JMAP
REGENTS BY DATE

The NY Algebra 2/Trigonometry Regents Exam Questions
from Spring, 2009 to January, 2016 Sorted by Date

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## fall09a2

1 The expression $(3 - 7i)^2$ is equivalent to
   1) $-40 + 0i$
   2) $-40 - 42i$
   3) $58 + 0i$
   4) $58 - 42i$

2 If $f(x) = \dfrac{1}{2}x - 3$ and $g(x) = 2x + 5$, what is the value
   of $(g \circ f)(4)$?
   1) -13
   2) 3.5
   3) 3
   4) 6

3 What are the values of θ in the interval
   $0° \le \theta < 360°$ that satisfy the equation
   $\tan\theta - \sqrt{3} = 0$?
   1) 60°, 240°
   2) 72°, 252°
   3) 72°, 108°, 252°, 288°
   4) 60°, 120°, 240°, 300°

4 A survey completed at a large university asked
   2,000 students to estimate the average number of
   hours they spend studying each week. Every tenth
   student entering the library was surveyed. The data
   showed that the mean number of hours that
   students spend studying was 15.7 per week. Which
   characteristic of the survey could create a bias in
   the results?
   1) the size of the sample
   2) the size of the population
   3) the method of analyzing the data
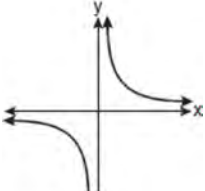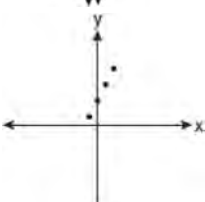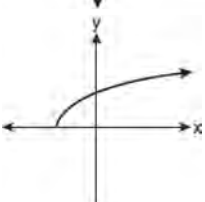   4) the method of choosing the students who were
       surveyed
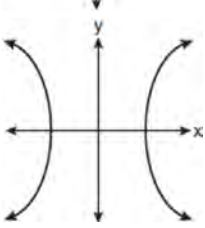
5 Which graph represents the solution set of
   $|6x - 7| \le 5$?

   1)

   2)

   3)

   4)
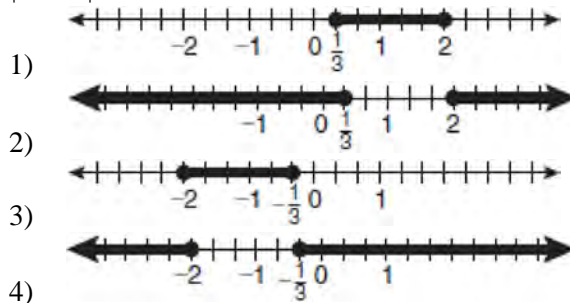
6 Which function is *not* one-to-one?
   1) $\{(0,1),(1,2),(2,3),(3,4)\}$
   2) $\{(0,0),(1,1),(2,2),(3,3)\}$
   3) $\{(0,1),(1,0),(2,3),(3,2)\}$
   4) $\{(0,1),(1,0),(2,0),(3,2)\}$

7 In $\triangle ABC$, m$\angle A = 120$, $b = 10$, and $c = 18$. What
   is the area of $\triangle ABC$ to the *nearest square inch*?
   1) 52
   2) 78
   3) 90
   4) 156

8 Which graph does *not* represent a function?

1)

2)

3)

4)

9 The expression $\log_8 64$ is equivalent to
1) 8
2) 2
3) $\dfrac{1}{2}$
4) $\dfrac{1}{8}$

10 The expression $\cos 4x \cos 3x + \sin 4x \sin 3x$ is equivalent to
1) $\sin x$
2) $\sin 7x$
3) $\cos x$
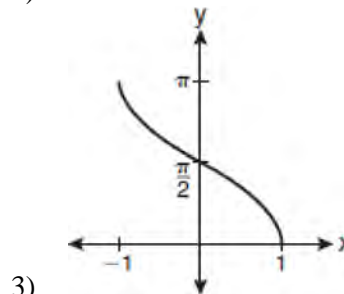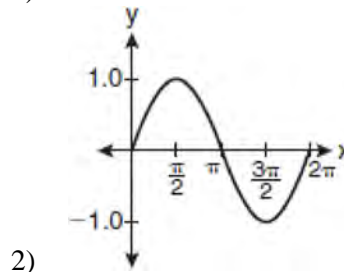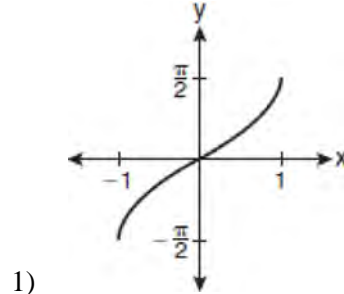4) $\cos 7x$

11 The value of the expression $2\displaystyle\sum_{n=0}^{2}(n^2+2^n)$ is
1) 12
2) 22
3) 24
4) 26

12 For which equation does the sum of the roots equal $\dfrac{3}{4}$ and the product of the roots equal -2?
1) $4x^2 - 8x + 3 = 0$
2) $4x^2 + 8x + 3 = 0$
3) $4x^2 - 3x - 8 = 0$
4) $4x^2 + 3x - 2 = 0$

13 Which graph represents the equation $y = \cos^{-1}x$?

1)

2)

3)

4)

2
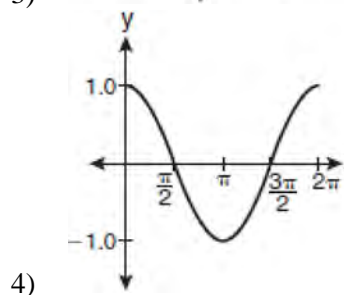
14 The expression $\dfrac{a^2 b^{-3}}{a^{-4} b^2}$ is equivalent to

1) $\dfrac{a^6}{b^5}$

2) $\dfrac{b^5}{a^6}$

3) $\dfrac{a^2}{b}$

4) $a^{-2} b^{-1}$

15 The lengths of 100 pipes have a normal distribution with a mean of 102.4 inches and a standard deviation of 0.2 inch. If one of the pipes measures exactly 102.1 inches, its length lies
1) below the 16th percentile
2) between the 50th and 84th percentiles
3) between the 16th and 50th percentiles
4) above the 84th percentile

16 If a function is defined by the equation $f(x) = 4^x$, which graph represents the inverse of this function?
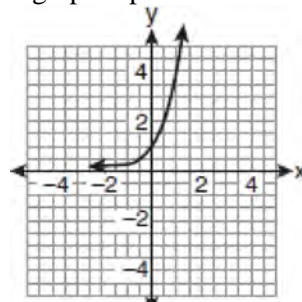
1)
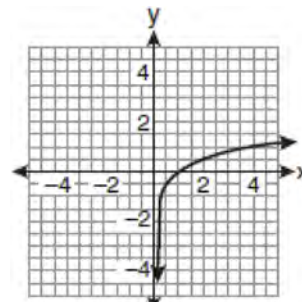
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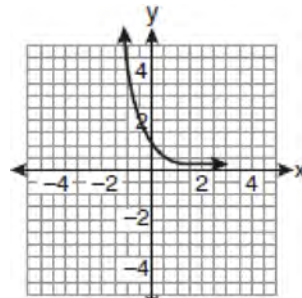
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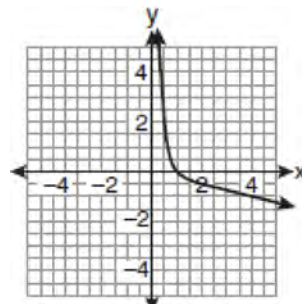
4)

17 Factored completely, the expression $6x - x^3 - x^2$ is equivalent to
1) $x(x + 3)(x - 2)$
2) $x(x - 3)(x + 2)$
3) $-x(x - 3)(x + 2)$
4) $-x(x + 3)(x - 2)$

3

18 The expression $4ab\sqrt{2b} - 3a\sqrt{18b^3} + 7ab\sqrt{6b}$ is equivalent to
1) $2ab\sqrt{6b}$
2) $16ab\sqrt{2b}$
3) $-5ab + 7ab\sqrt{6b}$
4) $-5ab\sqrt{2b} + 7ab\sqrt{6b}$

19 What is the fourth term in the expansion of $(3x - 2)^5$?
1) $-720x^2$
2) $-240x$
3) $720x^2$
4) $1,080x^3$

20 Written in simplest form, the expression $\dfrac{\dfrac{x}{4} - \dfrac{1}{x}}{\dfrac{1}{2x} + \dfrac{1}{4}}$ is equivalent to
1) $x - 1$
2) $x - 2$
3) $\dfrac{x - 2}{2}$
4) $\dfrac{x^2 - 4}{x + 2}$

21 What is the solution of the equation $2\log_4(5x) = 3$?
1) 6.4
2) 2.56
3) $\dfrac{9}{5}$
4) $\dfrac{8}{5}$

22 A circle has a radius of 4 inches. In inches, what is the length of the arc intercepted by a central angle of 2 radians?
1) 2π
2) 2
3) 8π
4) 8

23 What is the domain of the function $f(x) = \sqrt{x - 2} + 3$?
1) $(-\infty, \infty)$
2) $(2, \infty)$
3) $[2, \infty)$
4) $[3, \infty)$

24 The table below shows the first-quarter averages for Mr. Harper's statistics class.

Statistics Class Averages

Quarter Averages	Frequency
99	1
97	5
95	4
92	4
90	7
87	2
84	6
81	2
75	1
70	2
65	1

What is the population variance for this set of data?
1) 8.2
2) 8.3
3) 67.3
4) 69.3

25 Which formula can be used to determine the total number of different eight-letter arrangements that can be formed using the letters in the word *DEADLINE*?
1) $8!$
2) $\dfrac{8!}{4!}$
3) $\dfrac{8!}{2! + 2!}$
4) $\dfrac{8!}{2! \cdot 2!}$

26 The graph below shows the function f(x).
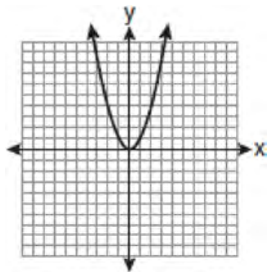
Which graph represents the function f(x + 2)?

1)

2)

3)

4)
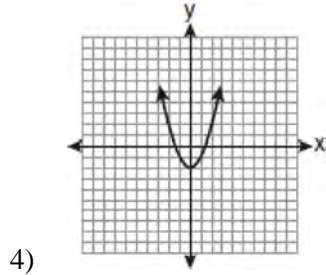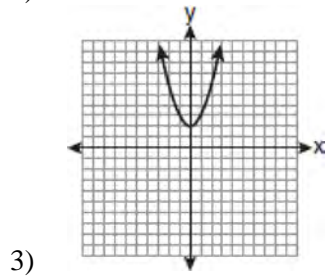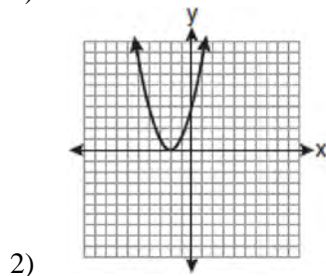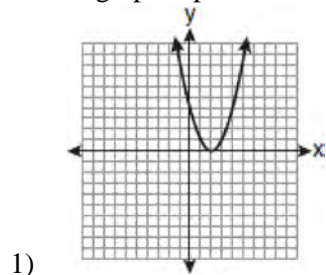
27 The equation $y - 2\sin\theta = 3$ may be rewritten as

1) $f(y) = 2\sin x + 3$
2) $f(y) = 2\sin\theta + 3$
3) $f(x) = 2\sin\theta + 3$
4) $f(\theta) = 2\sin\theta + 3$

28 Express $\dfrac{5}{3 - \sqrt{2}}$ with a rational denominator, in simplest radical form.

29 Write an equation of the circle shown in the graph below.
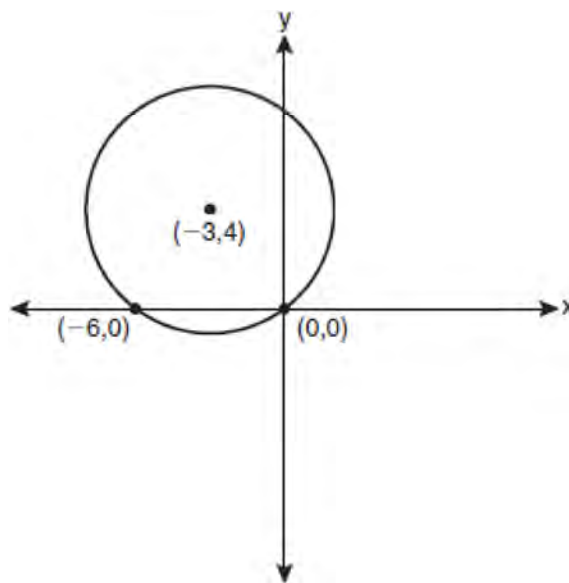
30 Solve for x: $\dfrac{4x}{x - 3} = 2 + \dfrac{12}{x - 3}$

31 Find, to the *nearest minute*, the angle whose measure is 3.45 radians.

32 Matt places $1,200 in an investment account earning an annual rate of 6.5%, compounded continuously. Using the formula $V = Pe^{rt}$, where V is the value of the account in t years, P is the principal initially invested, e is the base of a natural logarithm, and r is the rate of interest, determine the amount of money, to the *nearest cent*, that Matt will have in the account after 10 years.

33 If θ is an angle in standard position and its terminal side passes through the point $(-3, 2)$, find the exact value of $\csc \theta$.

34 Find the first four terms of the recursive sequence defined below.

$$a_1 = -3$$

$$a_n = a_{(n-1)} - n$$

35 A committee of 5 members is to be randomly selected from a group of 9 teachers and 20 students. Determine how many different committees can be formed if 2 members must be teachers and 3 members must be students.

36 Solve $2x^2 - 12x + 4 = 0$ by completing the square, expressing the result in simplest radical form.

37 Solve the equation $8x^3 + 4x^2 - 18x - 9 = 0$ algebraically for all values of x.

38 The table below shows the results of an experiment involving the growth of bacteria.

Time (x) (in minutes)	1	3	5	7	9	11
Number of Bacteria (y)	2	25	81	175	310	497

Write a power regression equation for this set of data, rounding all values to *three decimal places*. Using this equation, predict the bacteria's growth, to the *nearest integer*, after 15 minutes.

39 Two forces of 25 newtons and 85 newtons acting on a body form an angle of 55°. Find the magnitude of the resultant force, to the *nearest hundredth of a newton*. Find the measure, to the *nearest degree*, of the angle formed between the resultant and the larger force.

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1 What is the common difference of the arithmetic sequence $5, 8, 11, 14$?
   1) $\dfrac{8}{5}$
   2) -3
   3) 3
   4) 9

2 What is the number of degrees in an angle whose radian measure is $\dfrac{11\pi}{12}$?
   1) 150
   2) 165
   3) 330
   4) 518

3 If $a = 3$ and $b = -2$, what is the value of the expression $\dfrac{a^{-2}}{b^{-3}}$?
   1) $-\dfrac{9}{8}$
   2) -1
   3) $-\dfrac{8}{9}$
   4) $\dfrac{8}{9}$

4 Four points on the graph of the function f(x) are shown below.
   $$\{(0,1),(1,2),(2,4),(3,8)\}$$
   Which equation represents f(x)?
   1) f(x) = 2^x
   2) f(x) = $2x$
   3) f(x) = $x + 1$
   4) f(x) = $\log_2 x$

5 The graph of $y = $ f(x) is shown below.
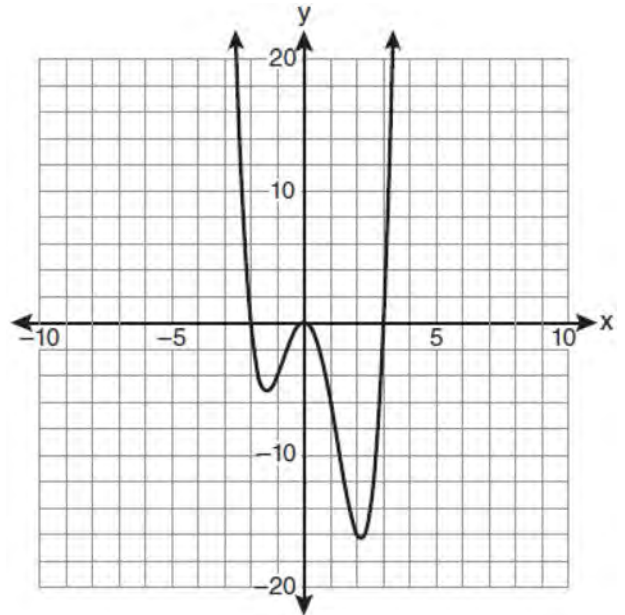
   Which set lists all the real solutions of f(x) = 0?
   1) $\{-3,2\}$
   2) $\{-2,3\}$
   3) $\{-3,0,2\}$
   4) $\{-2,0,3\}$

6 In simplest form, $\sqrt{-300}$ is equivalent to
   1) $3i\sqrt{10}$
   2) $5i\sqrt{12}$
   3) $10i\sqrt{3}$
   4) $12i\sqrt{5}$

7 Twenty different cameras will be assigned to several boxes. Three cameras will be randomly selected and assigned to box A. Which expression can be used to calculate the number of ways that three cameras can be assigned to box A?
   1) $20!$
   2) $\dfrac{20!}{3!}$
   3) $_{20}C_3$
   4) $_{20}P_3$

8 Factored completely, the expression
$12x^4 + 10x^3 - 12x^2$ is equivalent to
1) $x^2(4x + 6)(3x - 2)$
2) $2(2x^2 + 3x)(3x^2 - 2x)$
3) $2x^2(2x - 3)(3x + 2)$
4) $2x^2(2x + 3)(3x - 2)$

9 The solutions of the equation $y^2 - 3y = 9$ are
1) $\dfrac{3 \pm 3i\sqrt{3}}{2}$
2) $\dfrac{3 \pm 3i\sqrt{5}}{2}$
3) $\dfrac{-3 \pm 3\sqrt{5}}{2}$
4) $\dfrac{3 \pm 3\sqrt{5}}{2}$

10 The expression $2\log x - (3\log y + \log z)$ is equivalent to
1) $\log \dfrac{x^2}{y^3 z}$
2) $\log \dfrac{x^2 z}{y^3}$
3) $\log \dfrac{2x}{3yz}$
4) $\log \dfrac{2xz}{3y}$

11 The expression $(x^2 - 1)^{-\frac{2}{3}}$ is equivalent to
1) $\sqrt[3]{(x^2 - 1)^2}$
2) $\dfrac{1}{\sqrt[3]{(x^2 - 1)^2}}$
3) $\sqrt{(x^2 - 1)^3}$
4) $\dfrac{1}{\sqrt{(x^2 - 1)^3}}$

12 Which expression is equivalent to $\dfrac{\sqrt{3} + 5}{\sqrt{3} - 5}$?
1) $-\dfrac{14 + 5\sqrt{3}}{11}$
2) $-\dfrac{17 + 5\sqrt{3}}{11}$
3) $\dfrac{14 + 5\sqrt{3}}{14}$
4) $\dfrac{17 + 5\sqrt{3}}{14}$

13 Which relation is *not* a function?
1) $(x - 2)^2 + y^2 = 4$
2) $x^2 + 4x + y = 4$
3) $x + y = 4$
4) $xy = 4$

14 If $\angle A$ is acute and $\tan A = \dfrac{2}{3}$, then
1) $\cot A = \dfrac{2}{3}$
2) $\cot A = \dfrac{1}{3}$
3) $\cot(90° - A) = \dfrac{2}{3}$
4) $\cot(90° - A) = \dfrac{1}{3}$

15 The solution set of $4^{x^2 + 4x} = 2^{-6}$ is
1) $\{1, 3\}$
2) $\{-1, 3\}$
3) $\{-1, -3\}$
4) $\{1, -3\}$

16 The equation $x^2 + y^2 - 2x + 6y + 3 = 0$ is equivalent to
1) $(x - 1)^2 + (y + 3)^2 = -3$
2) $(x - 1)^2 + (y + 3)^2 = 7$
3) $(x + 1)^2 + (y + 3)^2 = 7$
4) $(x + 1)^2 + (y + 3)^2 = 10$

17 Which graph best represents the inequality
$y + 6 \geq x^2 - x$?
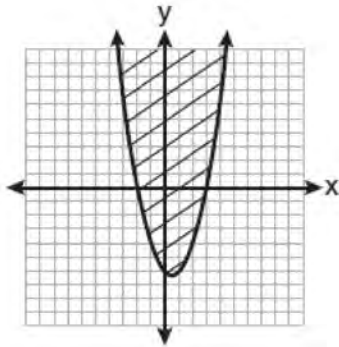
1)
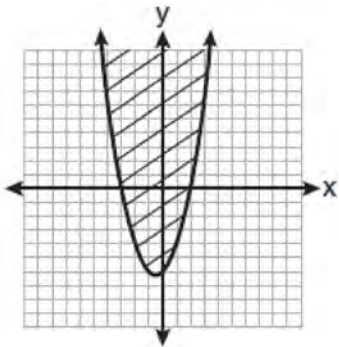
2)
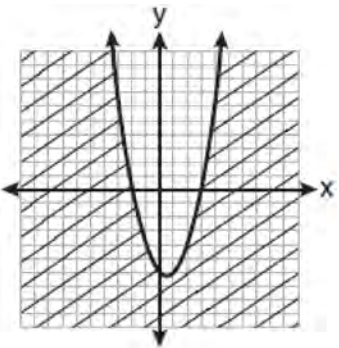
3)
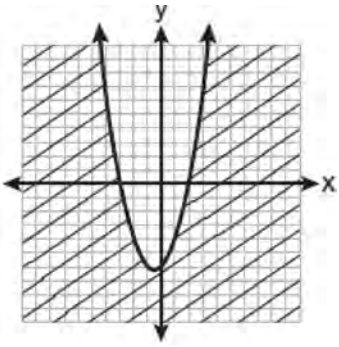
4)

18 The solution set of the equation $\sqrt{x+3} = 3 - x$ is
1) $\{1\}$
2) $\{0\}$
3) $\{1,6\}$
4) $\{2,3\}$

19 The product of i^7 and i^5 is equivalent to
1) 1
2) -1
3) i
4) $-i$

20 Which equation is represented by the graph below?
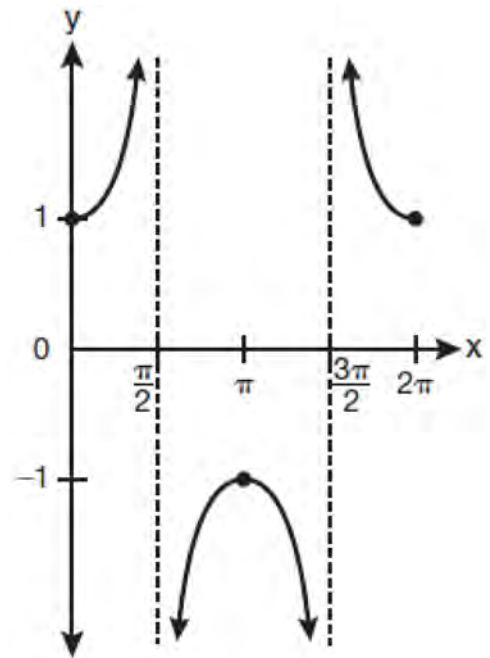
1) $y = \cot x$
2) $y = \csc x$
3) $y = \sec x$
4) $y = \tan x$

21 Which value of r represents data with a strong negative linear correlation between two variables?
1) -1.07
2) -0.89
3) -0.14
4) 0.92

3

22 The function $f(x) = \tan x$ is defined in such a way that $f^{-1}(x)$ is a function. What can be the domain of $f(x)$?
1) $\{x \mid 0 \le x \le \pi\}$
2) $\{x \mid 0 \le x \le 2\pi\}$
3) $\left\{x \mid -\dfrac{\pi}{2} < x < \dfrac{\pi}{2}\right\}$
4) $\left\{x \mid -\dfrac{\pi}{2} < x < \dfrac{3\pi}{2}\right\}$

23 In the diagram below of right triangle KTW, $KW = 6$, $KT = 5$, and $m\angle KTW = 90$.
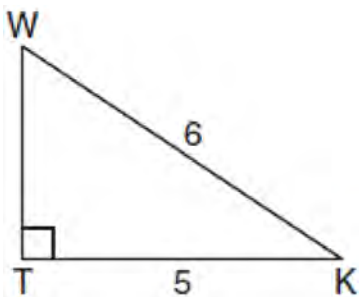
What is the measure of $\angle K$, to the *nearest minute*?
1) 33°33'
2) 33°34'
3) 33°55'
4) 33°56'

24 The expression $\cos^2 \theta - \cos 2\theta$ is equivalent to
1) $\sin^2 \theta$
2) $-\sin^2 \theta$
3) $\cos^2 \theta + 1$
4) $-\cos^2 \theta - 1$

25 Mrs. Hill asked her students to express the sum $1+3+5+7+9+\ldots+39$ using sigma notation. Four different student answers were given. Which student answer is correct?
1) $\displaystyle\sum_{k=1}^{20}(2k-1)$
2) $\displaystyle\sum_{k=2}^{40}(k-1)$
3) $\displaystyle\sum_{k=-1}^{37}(k+2)$
4) $\displaystyle\sum_{k=1}^{39}(2k-1)$

26 What is the formula for the nth term of the sequence $54, 18, 6, \ldots$?
1) $a_n = 6\left(\dfrac{1}{3}\right)^n$
2) $a_n = 6\left(\dfrac{1}{3}\right)^{n-1}$
3) $a_n = 54\left(\dfrac{1}{3}\right)^n$
4) $a_n = 54\left(\dfrac{1}{3}\right)^{n-1}$

27 What is the period of the function $y = \dfrac{1}{2}\sin\left(\dfrac{x}{3} - \pi\right)$?
1) $\dfrac{1}{2}$
2) $\dfrac{1}{3}$
3) $\dfrac{2}{3}\pi$
4) 6π

28 Use the discriminant to determine all values of k that would result in the equation $x^2 - kx + 4 = 0$ having equal roots.

29 The scores of one class on the Unit 2 mathematics test are shown in the table below.

Unit 2 Mathematics Test

Test Score	Frequency
96	1
92	2
84	5
80	3
76	6
72	3
68	2

Find the population standard deviation of these scores, to the *nearest tenth*.

30 Find the sum and product of the roots of the equation $5x^2 + 11x - 3 = 0$.

31 The graph of the equation $y = \left(\dfrac{1}{2}\right)^x$ has an asymptote. On the grid below, sketch the graph of $y = \left(\dfrac{1}{2}\right)^x$ and write the equation of this asymptote.
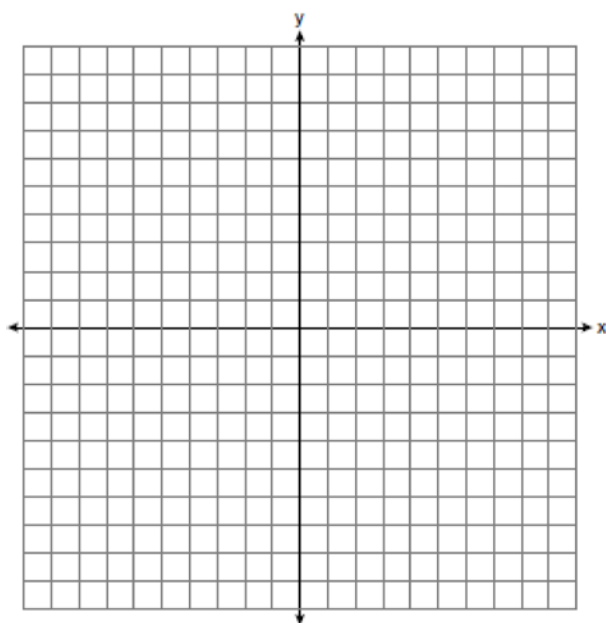
32 Express $5\sqrt{3x^3} - 2\sqrt{27x^3}$ in simplest radical form.

33 On the unit circle shown in the diagram below, sketch an angle, in standard position, whose degree measure is 240 and find the exact value of $\sin 240°$.
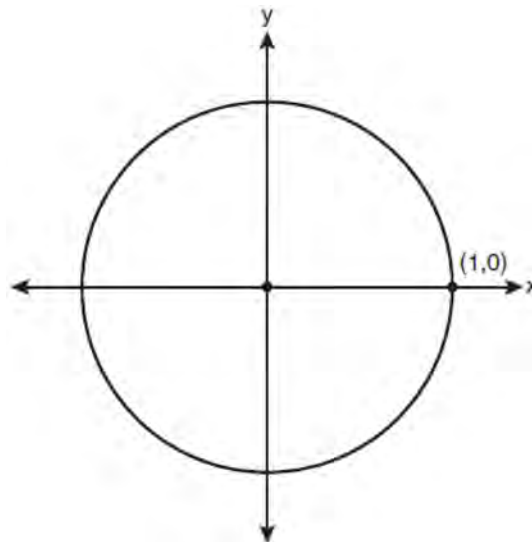
34 Two sides of a parallelogram are 24 feet and 30 feet. The measure of the angle between these sides is 57°. Find the area of the parallelogram, to the *nearest square foot*.

35 Express in simplest form: $\dfrac{\dfrac{1}{2} - \dfrac{4}{d}}{\dfrac{1}{d} + \dfrac{3}{2d}}$

36 The members of a men's club have a choice of wearing black or red vests to their club meetings. A study done over a period of many years determined that the percentage of black vests worn is 60%. If there are 10 men at a club meeting on a given night, what is the probability, to the *nearest thousandth*, that *at least* 8 of the vests worn will be black?

37 Find all values of θ in the interval $0° \le \theta < 360°$ that satisfy the equation $\sin 2\theta = \sin \theta$.

5

38 The letters of any word can be rearranged. Carol believes that the number of different 9-letter arrangements of the word "TENNESSEE" is greater than the number of different 7-letter arrangements of the word "VERMONT." Is she correct? Justify your answer.

39 In a triangle, two sides that measure 6 cm and 10 cm form an angle that measures 80°. Find, to the *nearest degree*, the measure of the smallest angle in the triangle.

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1 The product of $(3 + \sqrt{5})$ and $(3 - \sqrt{5})$ is
  1) $4 - 6\sqrt{5}$
  2) $14 - 6\sqrt{5}$
  3) 14
  4) 4

2 What is the radian measure of an angle whose measure is $-420°$?
  1) $-\dfrac{7\pi}{3}$
  2) $-\dfrac{7\pi}{6}$
  3) $\dfrac{7\pi}{6}$
  4) $\dfrac{7\pi}{3}$

3 What are the domain and the range of the function shown in the graph below?
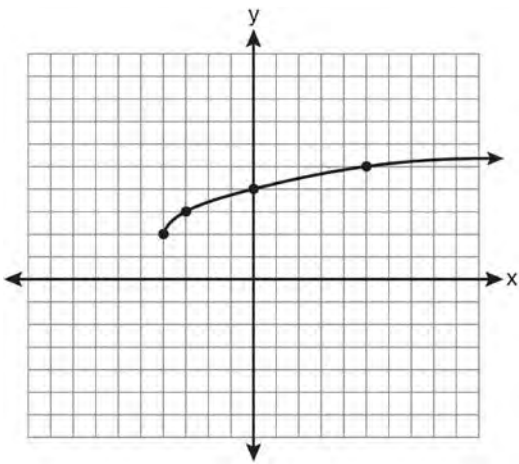
  1) $\{x|x > -4\}; \{y|y > 2\}$
  2) $\{x|x \geq -4\}; \{y|y \geq 2\}$
  3) $\{x|x > 2\}; \{y|y > -4\}$
  4) $\{x|x \geq 2\}; \{y|y \geq -4\}$

4 The expression $2i^2 + 3i^3$ is equivalent to
  1) $-2 - 3i$
  2) $2 - 3i$
  3) $-2 + 3i$
  4) $2 + 3i$

5 In which graph is θ coterminal with an angle of $-70°$?

  1)

  2)

  3)

  4)
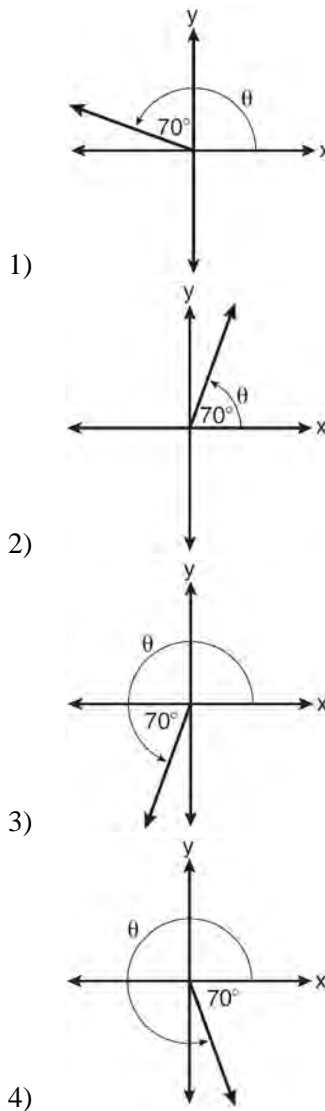
6 In $\triangle ABC$, $m\angle A = 74$, $a = 59.2$, and $c = 60.3$. What are the two possible values for $m\angle C$, to the *nearest tenth*?
  1) 73.7 and 106.3
  2) 73.7 and 163.7
  3) 78.3 and 101.7
  4) 78.3 and 168.3

7 What is the principal value of $\cos^{-1}\left(-\dfrac{\sqrt{3}}{2}\right)$?

1) $-30°$
2) $60°$
3) $150°$
4) $240°$

8 What is the value of x in the equation $9^{3x+1} = 27^{x+2}$?

1) 1
2) $\dfrac{1}{3}$
3) $\dfrac{1}{2}$
4) $\dfrac{4}{3}$

9 The roots of the equation $2x^2 + 7x - 3 = 0$ are

1) $-\dfrac{1}{2}$ and -3
2) $\dfrac{1}{2}$ and 3
3) $\dfrac{-7 \pm \sqrt{73}}{4}$
4) $\dfrac{7 \pm \sqrt{73}}{4}$

10 Which ratio represents $\csc A$ in the diagram below?
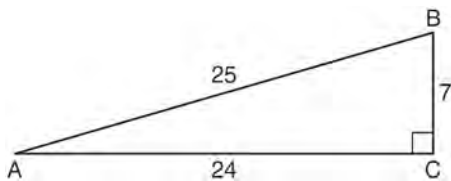
1) $\dfrac{25}{24}$
2) $\dfrac{25}{7}$
3) $\dfrac{24}{7}$
4) $\dfrac{7}{24}$

11 When simplified, the expression $\left(\dfrac{w^{-5}}{w^{-9}}\right)^{\frac{1}{2}}$ is equivalent to

1) w^{-7}
2) w^2
3) w^7
4) w^{14}

12 The principal would like to assemble a committee of 8 students from the 15-member student council. How many different committees can be chosen?

1) 120
2) 6,435
3) 32,432,400
4) 259,459,200

13 An amateur bowler calculated his bowling average for the season. If the data are normally distributed, about how many of his 50 games were within one standard deviation of the mean?

1) 14
2) 17
3) 34
4) 48

14 What is a formula for the nth term of sequence B shown below?
$$B = 10, 12, 14, 16, \ldots$$

1) $b_n = 8 + 2n$
2) $b_n = 10 + 2n$
3) $b_n = 10(2)^n$
4) $b_n = 10(2)^{n-1}$

15 Which values of x are in the solution set of the following system of equations?
$$y = 3x - 6$$
$$y = x^2 - x - 6$$

1) $0, -4$
2) $0, 4$
3) $6, -2$
4) $-6, 2$

16 The roots of the equation $9x^2 + 3x - 4 = 0$ are
1) imaginary
2) real, rational, and equal
3) real, rational, and unequal
4) real, irrational, and unequal

17 In $\triangle ABC$, $a = 3$, $b = 5$, and $c = 7$. What is m$\angle C$?
1) 22
2) 38
3) 60
4) 120

18 When $x^{-1} - 1$ is divided by $x - 1$, the quotient is
1) -1
2) $-\dfrac{1}{x}$
3) $\dfrac{1}{x^2}$
4) $\dfrac{1}{(x-1)^2}$

19 The fraction $\dfrac{3}{\sqrt{3a^2 b}}$ is equivalent to
1) $\dfrac{1}{a\sqrt{b}}$
2) $\dfrac{\sqrt{b}}{ab}$
3) $\dfrac{\sqrt{3b}}{ab}$
4) $\dfrac{\sqrt{3}}{a}$

20 Which graph represents a one-to-one function?
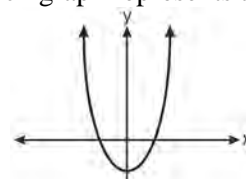
1)
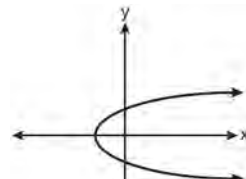
2)
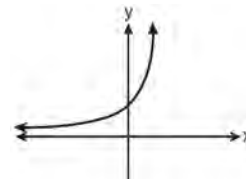
3)
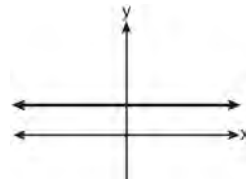
4)

21 The sides of a parallelogram measure 10 cm and 18 cm. One angle of the parallelogram measures 46 degrees. What is the area of the parallelogram, to the *nearest square centimeter*?
1) 65
2) 125
3) 129
4) 162

22 The minimum point on the graph of the equation $y = f(x)$ is $(-1, -3)$. What is the minimum point on the graph of the equation $y = f(x) + 5$?
1) $(-1, 2)$
2) $(-1, -8)$
3) $(4, -3)$
4) $(-6, -3)$

23 The graph of $y = x^3 - 4x^2 + x + 6$ is shown below.
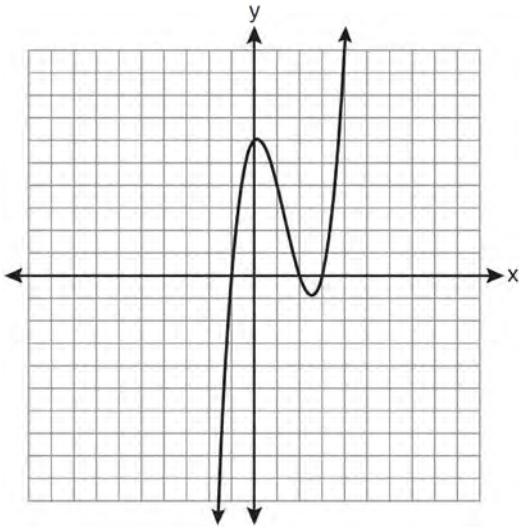
What is the product of the roots of the equation
$x^3 - 4x^2 + x + 6 = 0$?
1) −36
2) −6
3) 6
4) 4

24 What is the conjugate of $-2 + 3i$?
1) $-3 + 2i$
2) $-2 - 3i$
3) $2 - 3i$
4) $3 + 2i$

25 What is the common ratio of the geometric
sequence whose first term is 27 and fourth term is
64?
1) $\dfrac{3}{4}$
2) $\dfrac{64}{81}$
3) $\dfrac{4}{3}$
4) $\dfrac{37}{3}$

26 Which graph represents one complete cycle of the
equation $y = \sin 3\pi x$?
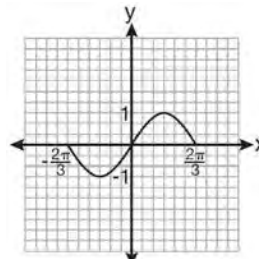
1)
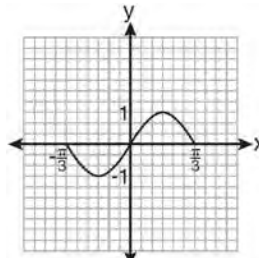
2)
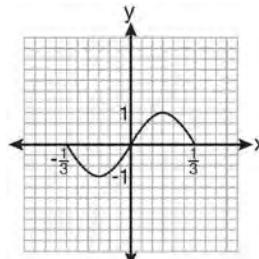
3)
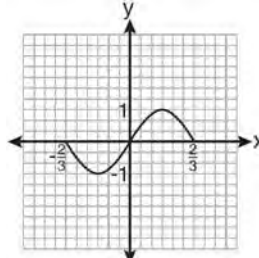
4)

27 Which two functions are inverse functions of each
other?
1) $f(x) = \sin x$ and $g(x) = \cos(x)$
2) $f(x) = 3 + 8x$ and $g(x) = 3 - 8x$
3) $f(x) = e^x$ and $g(x) = \ln x$
4) $f(x) = 2x - 4$ and $g(x) = -\dfrac{1}{2}x + 4$

28 Factor completely: $10ax^2 - 23ax - 5a$

29 Express the sum $7 + 14 + 21 + 28 + \ldots + 105$ using
sigma notation.

4

30 Howard collected fish eggs from a pond behind his house so he could determine whether sunlight had an effect on how many of the eggs hatched. After he collected the eggs, he divided them into two tanks. He put both tanks outside near the pond, and he covered one of the tanks with a box to block out all sunlight. State whether Howard's investigation was an example of a controlled experiment, an observation, or a survey. Justify your response.

31 The table below shows the number of new stores in a coffee shop chain that opened during the years 1986 through 1994.

Year	Number of New Stores
1986	14
1987	27
1988	48
1989	80
1990	110
1991	153
1992	261
1993	403
1994	681

Using $x = 1$ to represent the year 1986 and y to represent the number of new stores, write the exponential regression equation for these data. Round all values to the *nearest thousandth.*

32 Solve the equation $2\tan C - 3 = 3\tan C - 4$ algebraically for all values of C in the interval $0° \le C < 360°$.

33 A circle shown in the diagram below has a center of $(-5, 3)$ and passes through point $(-1, 7)$.
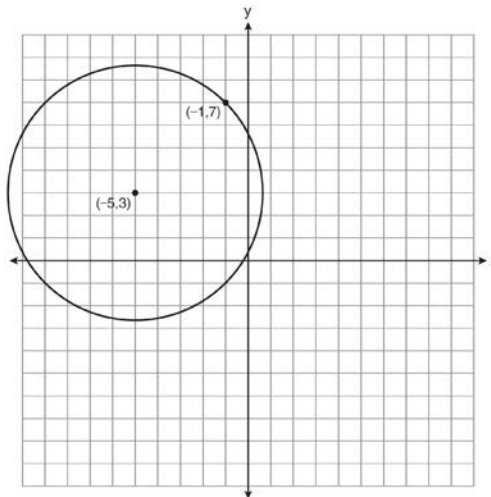
Write an equation that represents the circle.

34 Express $\left(\dfrac{2}{3} x - 1 \right)^2$ as a trinomial.

35 Find the total number of different twelve-letter arrangements that can be formed using the letters in the word *PENNSYLVANIA*.

36 Solve algebraically for x: $\dfrac{1}{x+3} - \dfrac{2}{3-x} = \dfrac{4}{x^2 - 9}$

37 If $\tan A = \dfrac{2}{3}$ and $\sin B = \dfrac{5}{\sqrt{41}}$ and angles A and B are in Quadrant I, find the value of $\tan(A + B)$.

38 A study shows that 35% of the fish caught in a local lake had high levels of mercury. Suppose that 10 fish were caught from this lake. Find, to the *nearest tenth of a percent,* the probability that *at least* 8 of the 10 fish caught did *not* contain high levels of mercury.

39 Solve algebraically for x: $\log_{x+3} \dfrac{x^3 + x - 2}{x} = 2$

5

0111a2

1 Which graph does *not* represent a function?
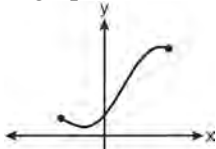
1)
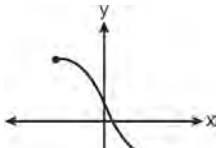
2)
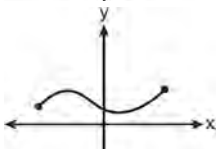
3)
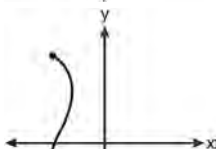
4)

2 The roots of the equation $x^2 - 10x + 25 = 0$ are
1) imaginary
2) real and irrational
3) real, rational, and equal
4) real, rational, and unequal

3 Which values of x are solutions of the equation $x^3 + x^2 - 2x = 0$?
1) $0, 1, 2$
2) $0, 1, -2$
3) $0, -1, 2$
4) $0, -1, -2$

4 In the diagram below of a unit circle, the ordered pair $\left(-\dfrac{\sqrt{2}}{2}, -\dfrac{\sqrt{2}}{2}\right)$ represents the point where the terminal side of θ intersects the unit circle.
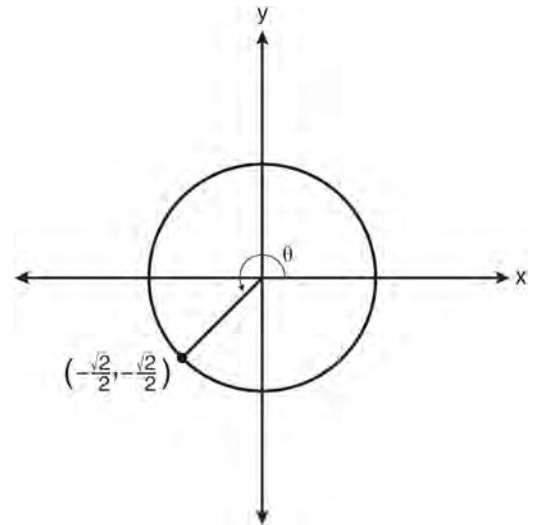
What is $m\angle\theta$?
1) 45
2) 135
3) 225
4) 240

5 What is the fifteenth term of the sequence $5, -10, 20, -40, 80, \ldots$?
1) $-163,840$
2) $-81,920$
3) $81,920$
4) $327,680$

1

6 What is the solution set of the equation $|4a + 6| - 4a = -10$?

1) $\varnothing$

2) $\{0\}$

3) $\left\{\dfrac{1}{2}\right\}$

4) $\left\{0, \dfrac{1}{2}\right\}$

7 If $\sin A = \dfrac{2}{3}$ where $0° < A < 90°$, what is the value of $\sin 2A$?

1) $\dfrac{2\sqrt{5}}{3}$

2) $\dfrac{2\sqrt{5}}{9}$

3) $\dfrac{4\sqrt{5}}{9}$

4) $-\dfrac{4\sqrt{5}}{9}$

8 A dartboard is shown in the diagram below. The two lines intersect at the center of the circle, and the central angle in sector 2 measures $\dfrac{2\pi}{3}$.
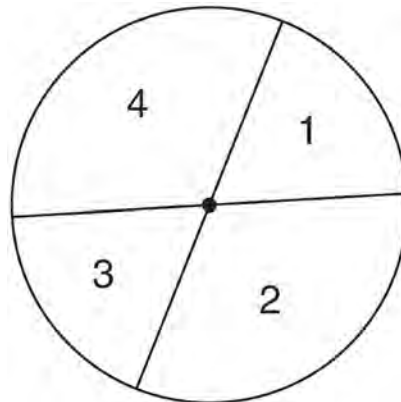
If darts thrown at this board are equally likely to land anywhere on the board, what is the probability that a dart that hits the board will land in either sector 1 or sector 3?

1) $\dfrac{1}{6}$

2) $\dfrac{1}{3}$

3) $\dfrac{1}{2}$

4) $\dfrac{2}{3}$

9 If $f(x) = x^2 - 5$ and $g(x) = 6x$, then $g(f(x))$ is equal to

1) $6x^3 - 30x$

2) $6x^2 - 30$

3) $36x^2 - 5$

4) $x^2 + 6x - 5$

10 Which arithmetic sequence has a common difference of 4?

1) $\{0, 4n, 8n, 12n, \dots\}$

2) $\{n, 4n, 16n, 64n, \dots\}$

3) $\{n+1, n+5, n+9, n+13, \dots\}$

4) $\{n+4, n+16, n+64, n+256, \dots\}$

11 The conjugate of $7 - 5i$ is
1) $-7 - 5i$
2) $-7 + 5i$
3) $7 - 5i$
4) $7 + 5i$

12 If $\sin^{-1}\left(\dfrac{5}{8}\right) = A$, then

1) $\sin A = \dfrac{5}{8}$

2) $\sin A = \dfrac{8}{5}$

3) $\cos A = \dfrac{5}{8}$

4) $\cos A = \dfrac{8}{5}$

13 How many distinct triangles can be formed if $m\angle A = 35$, $a = 10$, and $b = 13$?
1) 1
2) 2
3) 3
4) 0

14 When $\dfrac{3}{2}x^2 - \dfrac{1}{4}x - 4$ is subtracted from

$\dfrac{5}{2}x^2 - \dfrac{3}{4}x + 1$, the difference is

1) $-x^2 + \dfrac{1}{2}x - 5$

2) $x^2 - \dfrac{1}{2}x + 5$

3) $-x^2 - x - 3$

4) $x^2 - x - 3$

15 The solution set of the inequality $x^2 - 3x > 10$ is
1) $\{x \mid -2 < x < 5\}$
2) $\{x \mid 0 < x < 3\}$
3) $\{x \mid x < -2 \text{ or } x > 5\}$
4) $\{x \mid x < -5 \text{ or } x > 2\}$

16 If $x^2 + 2 = 6x$ is solved by completing the square, an intermediate step would be
1) $(x + 3)^2 = 7$
2) $(x - 3)^2 = 7$
3) $(x - 3)^2 = 11$
4) $(x - 6)^2 = 34$

17 Three marbles are to be drawn at random, without replacement, from a bag containing 15 red marbles, 10 blue marbles, and 5 white marbles. Which expression can be used to calculate the probability of drawing 2 red marbles and 1 white marble from the bag?

1) $\dfrac{{}_{15}C_2 \cdot {}_5C_1}{{}_{30}C_3}$

2) $\dfrac{{}_{15}P_2 \cdot {}_5P_1}{{}_{30}C_3}$

3) $\dfrac{{}_{15}C_2 \cdot {}_5C_1}{{}_{30}P_3}$

4) $\dfrac{{}_{15}P_2 \cdot {}_5P_1}{{}_{30}P_3}$

18 The expression $x^{-\frac{2}{5}}$ is equivalent to

1) $-\sqrt[2]{x^5}$

2) $-\sqrt[5]{x^2}$

3) $\dfrac{1}{\sqrt[2]{x^5}}$

4) $\dfrac{1}{\sqrt[5]{x^2}}$

19 On January 1, a share of a certain stock cost $180. Each month thereafter, the cost of a share of this stock decreased by one-third. If x represents the time, in months, and y represents the cost of the stock, in dollars, which graph best represents the cost of a share over the following 5 months?

1)

2)

3)

4)
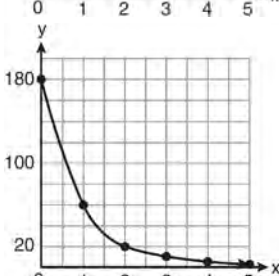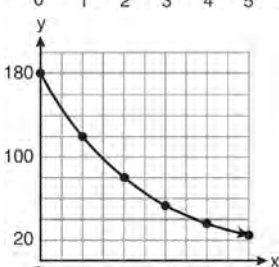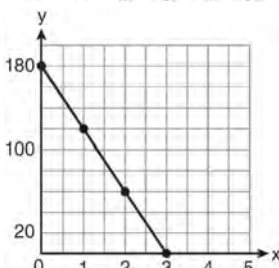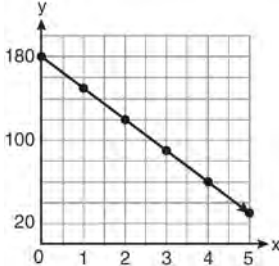
20 In the diagram below of right triangle JTM, $JT = 12$, $JM = 6$, and $m\angle JMT = 90$.
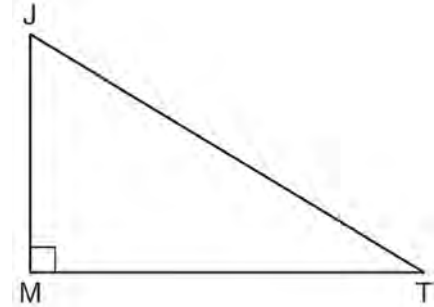
What is the value of $\cot J$?

1) $\dfrac{\sqrt{3}}{3}$

2) 2

3) $\sqrt{3}$

4) $\dfrac{2\sqrt{3}}{3}$

21 For which equation does the sum of the roots equal -3 and the product of the roots equal 2?

1) $x^2 + 2x - 3 = 0$
2) $x^2 - 3x + 2 = 0$
3) $2x^2 + 6x + 4 = 0$
4) $2x^2 - 6x + 4 = 0$

22 The expression $\dfrac{2x+4}{\sqrt{x+2}}$ is equivalent to

1) $\dfrac{(2x+4)\sqrt{x-2}}{x-2}$

2) $\dfrac{(2x+4)\sqrt{x-2}}{x-4}$

3) $2\sqrt{x-2}$

4) $2\sqrt{x+2}$

4

23 Which equation is sketched in the diagram below?
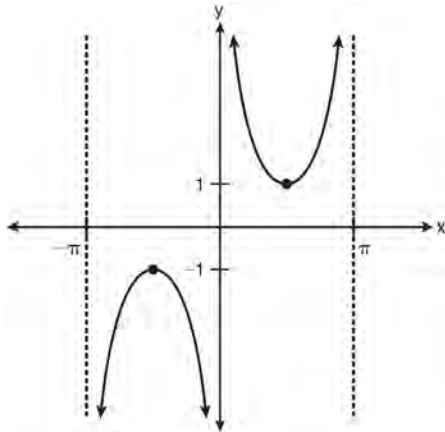
1) $y = \csc x$
2) $y = \sec x$
3) $y = \cot x$
4) $y = \tan x$

24 The expression $\log_5\left(\dfrac{1}{25}\right)$ is equivalent to

1) $\dfrac{1}{2}$
2) 2
3) $-\dfrac{1}{2}$
4) -2

25 A four-digit serial number is to be created from the digits 0 through 9. How many of these serial numbers can be created if 0 can *not* be the first digit, no digit may be repeated, and the last digit must be 5?

1) 448
2) 504
3) 2,240
4) 2,520

26 Which equation represents the circle shown in the graph below that passes through the point $(0,-1)$?
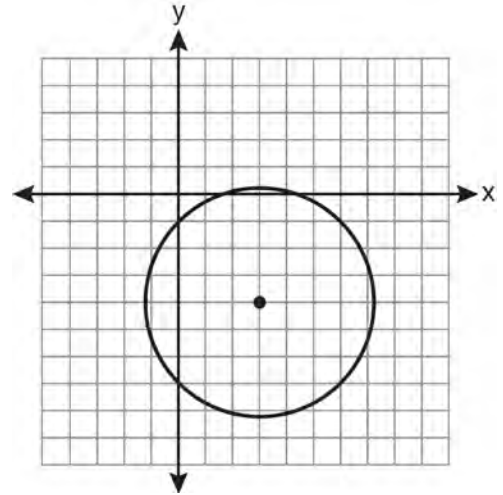
1) $(x-3)^2 + (y+4)^2 = 16$
2) $(x-3)^2 + (y+4)^2 = 18$
3) $(x+3)^2 + (y-4)^2 = 16$
4) $(x+3)^2 + (y-4)^2 = 18$

27 Which task is *not* a component of an observational study?
1) The researcher decides who will make up the sample.
2) The researcher analyzes the data received from the sample.
3) The researcher gathers data from the sample, using surveys or taking measurements.
4) The researcher divides the sample into two groups, with one group acting as a control group.

28 Solve algebraically for *x*: $16^{2x+3} = 64^{x+2}$

29 Find, to the *nearest tenth of a degree*, the angle whose measure is 2.5 radians.

5

30 For a given set of rectangles, the length is inversely proportional to the width. In one of these rectangles, the length is 12 and the width is 6. For this set of rectangles, calculate the width of a rectangle whose length is 9.

31 Evaluate: $10 + \sum_{n=1}^{5}(n^3 - 1)$

32 The graph below represents the function $y = f(x)$.
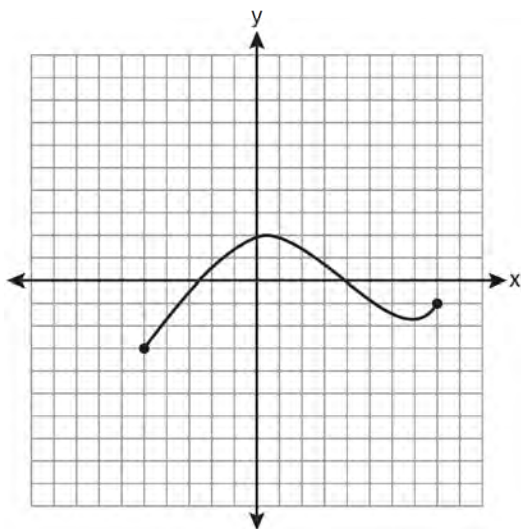
State the domain and range of this function.

33 Express $\dfrac{\sqrt{108x^5y^8}}{\sqrt{6xy^5}}$ in simplest radical form.

34 Assume that the ages of first-year college students are normally distributed with a mean of 19 years and standard deviation of 1 year. To the *nearest integer*, find the percentage of first-year college students who are between the ages of 18 years and 20 years, inclusive. To the *nearest integer*, find the percentage of first-year college students who are 20 years old or older.

35 Starting with $\sin^2 A + \cos^2 A = 1$, derive the formula $\tan^2 A + 1 = \sec^2 A$.

36 Write the binomial expansion of $(2x - 1)^5$ as a polynomial in simplest form.

37 In $\triangle ABC$, m$\angle A = 32$, $a = 12$, and $b = 10$. Find the measures of the missing angles and side of $\triangle ABC$. Round each measure to the *nearest tenth*.

38 The probability that the Stormville Sluggers will win a baseball game is $\frac{2}{3}$. Determine the probability, to the *nearest thousandth*, that the Stormville Sluggers will win *at least* 6 of their next 8 games.

39 The temperature, T, of a given cup of hot chocolate after it has been cooling for t minutes can best be modeled by the function below, where T_0 is the temperature of the room and k is a constant.
$$\ln(T - T_0) = -kt + 4.718$$
A cup of hot chocolate is placed in a room that has a temperature of 68°. After 3 minutes, the temperature of the hot chocolate is 150°. Compute the value of k to the nearest thousandth. [Only an algebraic solution can receive full credit.] Using this value of k, find the temperature, T, of this cup of hot chocolate if it has been sitting in this room for a total of 10 minutes. Express your answer to the *nearest degree*. [Only an algebraic solution can receive full credit.]

6

0611a2

1 A doctor wants to test the effectiveness of a new drug on her patients. She separates her sample of patients into two groups and administers the drug to only one of these groups. She then compares the results. Which type of study *best* describes this situation?
1) census
2) survey
3) observation
4) controlled experiment

2 If $f(x) = \dfrac{x}{x^2 - 16}$, what is the value of f(−10)?
1) $-\dfrac{5}{2}$
2) $-\dfrac{5}{42}$
3) $\dfrac{5}{58}$
4) $\dfrac{5}{18}$

3 An auditorium has 21 rows of seats. The first row has 18 seats, and each succeeding row has two more seats than the previous row. How many seats are in the auditorium?
1) 540
2) 567
3) 760
4) 798

4 Expressed as a function of a positive acute angle, cos(−305°) is equal to
1) −cos 55°
2) cos 55°
3) −sin 55°
4) sin 55°

5 The value of x in the equation $4^{2x+5} = 8^{3x}$ is
1) 1
2) 2
3) 5
4) −10

6 What is the value of x in the equation $\log_5 x = 4$?
1) 1.16
2) 20
3) 625
4) 1,024

7 The expression $\sqrt[4]{16x^2 y^7}$ is equivalent to
1) $2x^{\frac{1}{2}} y^{\frac{7}{4}}$
2) $2x^8 y^{28}$
3) $4x^{\frac{1}{2}} y^{\frac{7}{4}}$
4) $4x^8 y^{28}$

8 Which equation is represented by the graph below?
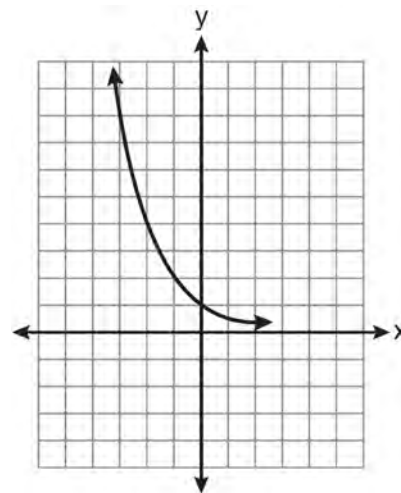
1) $y = 5^x$
2) $y = 0.5^x$
3) $y = 5^{-x}$
4) $y = 0.5^{-x}$

9 What is the fifteenth term of the geometric sequence $-\sqrt{5}, \sqrt{10}, -2\sqrt{5}, \ldots$?
1) $-128\sqrt{5}$
2) $128\sqrt{10}$
3) $-16384\sqrt{5}$
4) $16384\sqrt{10}$

10 In $\triangle ABC$, $a = 15$, $b = 14$, and $c = 13$, as shown in the diagram below. What is the m$\angle C$, to the *nearest degree*?
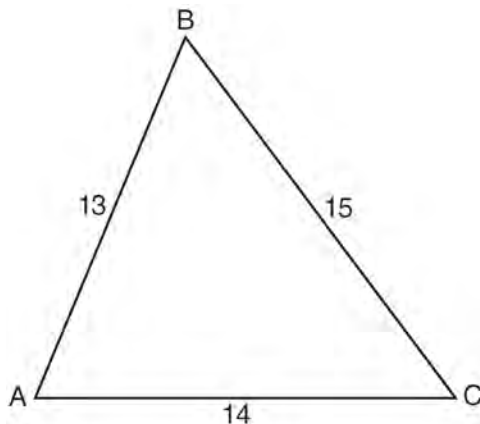
1) 53
2) 59
3) 67
4) 127

11 What is the period of the function $f(\theta) = -2\cos 3\theta$?
1) π
2) $\dfrac{2\pi}{3}$
3) $\dfrac{3\pi}{2}$
4) 2π

12 What is the range of $f(x) = (x+4)^2 + 7$?
1) $y \geq -4$
2) $y \geq 4$
3) $y = 7$
4) $y \geq 7$

13 Ms. Bell's mathematics class consists of 4 sophomores, 10 juniors, and 5 seniors. How many different ways can Ms. Bell create a four-member committee of juniors if each junior has an equal chance of being selected?
1) 210
2) 3,876
3) 5,040
4) 93,024

14 Which graph represents a relation that is *not* a function?

1)

2)

3)

4)
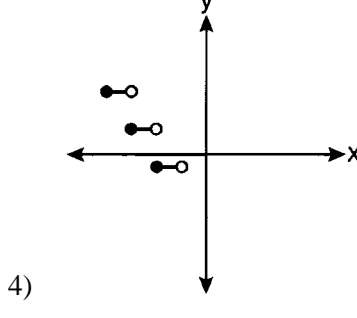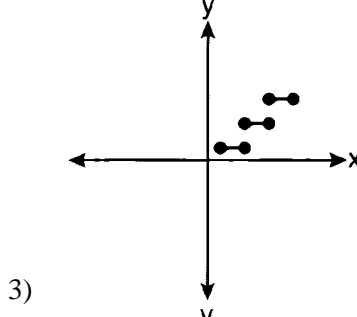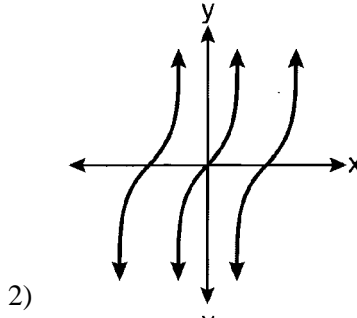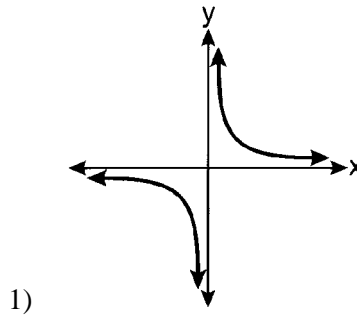
15 The value of $\tan 126°43'$ to the *nearest ten-thousandth* is
1) -1.3407
2) -1.3408
3) -1.3548
4) -1.3549

2

16 The expression $\dfrac{4}{5-\sqrt{13}}$ is equivalent to

1) $\dfrac{4\sqrt{13}}{5\sqrt{13}-13}$

2) $\dfrac{4(5-\sqrt{13})}{38}$

3) $\dfrac{5+\sqrt{13}}{3}$

4) $\dfrac{4(5+\sqrt{13})}{38}$

17 Akeem invests $25,000 in an account that pays 4.75% annual interest compounded continuously.

Using the formula $A = Pe^{rt}$, where A = the amount in the account after t years, P = principal invested, and r = the annual interest rate, how many years, to the *nearest tenth*, will it take for Akeem's investment to triple?

1) 10.0
2) 14.6
3) 23.1
4) 24.0

18 The value of the expression $\sum\limits_{r=3}^{5}(-r^2+r)$ is

1) −38
2) −12
3) 26
4) 62

19 Which graph shows $y = \cos^{-1}x$?
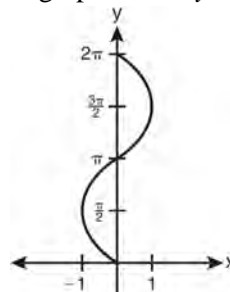
1)
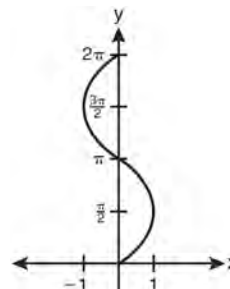
2)
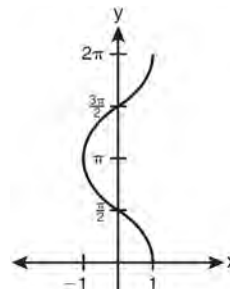
3)
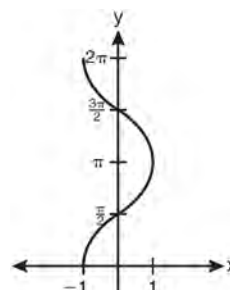
4)

20 If $r = \sqrt[3]{\dfrac{A^2 B}{C}}$, then $\log r$ can be represented by

1) $\dfrac{1}{6} \log A + \dfrac{1}{3} \log B - \log C$

2) $3(\log A^2 + \log B - \log C)$

3) $\dfrac{1}{3} \log(A^2 + B) - C$

4) $\dfrac{2}{3} \log A + \dfrac{1}{3} \log B - \dfrac{1}{3} \log C$

21 The solution set of $\sqrt{3x + 16} = x + 2$ is

1) $\{-3, 4\}$

2) $\{-4, 3\}$

3) $\{3\}$

4) $\{-4\}$

22 Brian correctly used a method of completing the square to solve the equation $x^2 + 7x - 11 = 0$. Brian's first step was to rewrite the equation as $x^2 + 7x = 11$. He then added a number to both sides of the equation. Which number did he add?

1) $\dfrac{7}{2}$

2) $\dfrac{49}{4}$

3) $\dfrac{49}{2}$

4) 49

23 The expression $\dfrac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta}$ is equivalent to

1) $\cos^2 \theta$

2) $\sin^2 \theta$

3) $\sec^2 \theta$

4) $\csc^2 \theta$

24 The number of minutes students took to complete a quiz is summarized in the table below.

Minutes	14	15	16	17	18	19	20
Number of Students	5	3	x	5	2	10	1

If the mean number of minutes was 17, which equation could be used to calculate the value of x?

1) $17 = \dfrac{119 + x}{x}$

2) $17 = \dfrac{119 + 16x}{x}$

3) $17 = \dfrac{446 + x}{26 + x}$

4) $17 = \dfrac{446 + 16x}{26 + x}$

25 What is the radian measure of the smaller angle formed by the hands of a clock at 7 o'clock?

1) $\dfrac{\pi}{2}$

2) $\dfrac{2\pi}{3}$

3) $\dfrac{5\pi}{6}$

4) $\dfrac{7\pi}{6}$

26 What is the coefficient of the fourth term in the expansion of $(a - 4b)^9$?

1) $-5,376$

2) -336

3) 336

4) $5,376$

4

27 Samantha constructs the scatter plot below from a set of data.
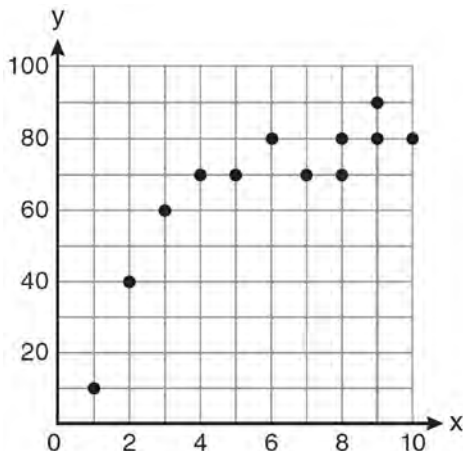
Based on her scatter plot, which regression model would be most appropriate?
1) exponential
2) linear
3) logarithmic
4) power

28 Express the product of $\left(\frac{1}{2}y^2 - \frac{1}{3}y\right)$ and $\left(12y + \frac{3}{5}\right)$ as a trinomial.

29 In a study of 82 video game players, the researchers found that the ages of these players were normally distributed, with a mean age of 17 years and a standard deviation of 3 years. Determine if there were 15 video game players in this study over the age of 20. Justify your answer.

30 Write a quadratic equation such that the sum of its roots is 6 and the product of its roots is −27.

31 Evaluate $e^{x \ln y}$ when $x = 3$ and $y = 2$.

32 If $f(x) = x^2 - 6$, find $f^{-1}(x)$.

33 Factor the expression $12t^8 - 75t^4$ completely.

34 Simplify the expression $\dfrac{3x^{-4}y^5}{(2x^3y^{-7})^{-2}}$ and write the answer using only positive exponents.

35 If $f(x) = x^2 - 6$ and $g(x) = 2^x - 1$, determine the value of $(g \circ f)(-3)$.

36 Express as a single fraction the exact value of $\sin 75°$.

37 Graph the inequality $-3|6 - x| < -15$ for x. Graph the solution on the line below.

38 The probability that a professional baseball player will get a hit is $\frac{1}{3}$. Calculate the exact probability that he will get *at least* 3 hits in 5 attempts.

39 Solve the following systems of equations algebraically: $5 = y - x$

$$4x^2 = -17x + y + 4$$

0112a2

1 The yearbook staff has designed a survey to learn student opinions on how the yearbook could be improved for this year. If they want to distribute this survey to 100 students and obtain the most reliable data, they should survey
1) every third student sent to the office
2) every third student to enter the library
3) every third student to enter the gym for the basketball game
4) every third student arriving at school in the morning

2 What is the sum of the first 19 terms of the sequence $3, 10, 17, 24, 31, \ldots$?
1) 1188
2) 1197
3) 1254
4) 1292

3 Which expression, when rounded to three decimal places, is equal to -1.155?
1) $\sec\left(\dfrac{5\pi}{6}\right)$
2) $\tan(49°20')$
3) $\sin\left(-\dfrac{3\pi}{5}\right)$
4) $\csc(-118°)$

4 If $f(x) = 4x - x^2$ and $g(x) = \dfrac{1}{x}$, then $(f \circ g)\left(\dfrac{1}{2}\right)$ is equal to
1) $\dfrac{4}{7}$
2) -2
3) $\dfrac{7}{2}$
4) 4

5 A population of rabbits doubles every 60 days according to the formula $P = 10(2)^{\frac{t}{60}}$, where P is the population of rabbits on day t. What is the value of t when the population is 320?
1) 240
2) 300
3) 660
4) 960

6 What is the product of $\left(\dfrac{x}{4} - \dfrac{1}{3}\right)$ and $\left(\dfrac{x}{4} + \dfrac{1}{3}\right)$?
1) $\dfrac{x^2}{8} - \dfrac{1}{9}$
2) $\dfrac{x^2}{16} - \dfrac{1}{9}$
3) $\dfrac{x^2}{8} - \dfrac{x}{6} - \dfrac{1}{9}$
4) $\dfrac{x^2}{16} - \dfrac{x}{6} - \dfrac{1}{9}$

7 Which is a graph of $y = \cot x$?

1)

2)

3)

4)
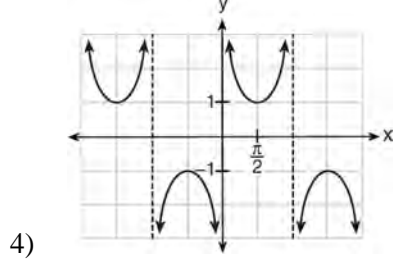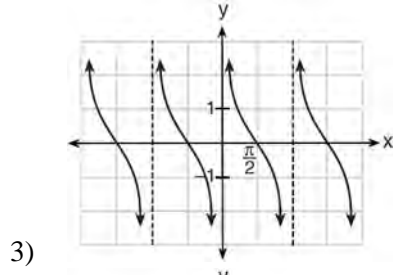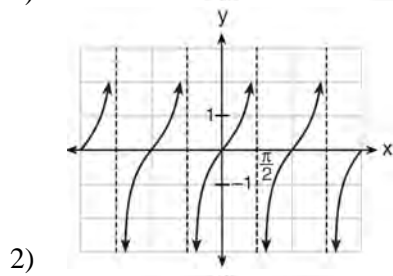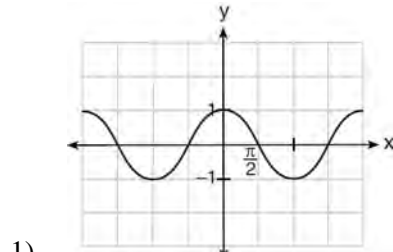
8 Which expression always equals 1?
1) $\cos^2 x - \sin^2 x$
2) $\cos^2 x + \sin^2 x$
3) $\cos x - \sin x$
4) $\cos x + \sin x$

9 What are the sum and product of the roots of the equation $6x^2 - 4x - 12 = 0$?
1) sum $= -\frac{2}{3}$; product $= -2$
2) sum $= \frac{2}{3}$; product $= -2$
3) sum $= -2$; product $= \frac{2}{3}$
4) sum $= -2$; product $= -\frac{2}{3}$

10 Given $\triangle ABC$ with $a = 9$, $b = 10$, and m$\angle B = 70$, what type of triangle can be drawn?
1) an acute triangle, only
2) an obtuse triangle, only
3) both an acute triangle and an obtuse triangle
4) neither an acute triangle nor an obtuse triangle

11 When $x^{-1} + 1$ is divided by $x + 1$, the quotient equals
1) 1
2) $\frac{1}{x}$
3) x
4) $-\frac{1}{x}$

12 If the amount of time students work in any given week is normally distributed with a mean of 10 hours per week and a standard deviation of 2 hours, what is the probability a student works between 8 and 11 hours per week?
1) 34.1%
2) 38.2%
3) 53.2%
4) 68.2%

13 What is the conjugate of $\frac{1}{2} + \frac{3}{2}i$?

1) $-\frac{1}{2} + \frac{3}{2}i$

2) $\frac{1}{2} - \frac{3}{2}i$

3) $\frac{3}{2} + \frac{1}{2}i$

4) $-\frac{1}{2} - \frac{3}{2}i$

14 Given angle A in Quadrant I with $\sin A = \frac{12}{13}$ and angle B in Quadrant II with $\cos B = -\frac{3}{5}$, what is the value of $\cos(A - B)$?

1) $\frac{33}{65}$

2) $-\frac{33}{65}$

3) $\frac{63}{65}$

4) $-\frac{63}{65}$

15 Which expression represents the third term in the expansion of $(2x^4 - y)^3$?

1) $-y^3$

2) $-6x^4 y^2$

3) $6x^4 y^2$

4) $2x^4 y^2$

16 What is the solution set of the equation $3x^5 - 48x = 0$?

1) $\{0, \pm 2\}$

2) $\{0, \pm 2, 3\}$

3) $\{0, \pm 2, \pm 2i\}$

4) $\{\pm 2, \pm 2i\}$

17 A sequence has the following terms: $a_1 = 4$, $a_2 = 10$, $a_3 = 25$, $a_4 = 62.5$. Which formula represents the nth term in the sequence?

1) $a_n = 4 + 2.5n$

2) $a_n = 4 + 2.5(n - 1)$

3) $a_n = 4(2.5)^n$

4) $a_n = 4(2.5)^{n-1}$

18 In parallelogram $BFLO$, $\overline{OL} = 3.8$, $LF = 7.4$, and $m\angle O = 126$. If diagonal $\overline{BL}$ is drawn, what is the area of $\triangle BLF$?

1) 11.4

2) 14.1

3) 22.7

4) 28.1

19 Which statement about the graph of the equation $y = e^x$ is *not* true?

1) It is asymptotic to the x-axis.

2) The domain is the set of all real numbers.

3) It lies in Quadrants I and II.

4) It passes through the point $(e, 1)$.

3

20 What is the number of degrees in an angle whose measure is 2 radians?

1) $\dfrac{360}{\pi}$

2) $\dfrac{\pi}{360}$

3) 360

4) 90

21 A spinner is divided into eight equal sections. Five sections are red and three are green. If the spinner is spun three times, what is the probability that it lands on red *exactly* twice?

1) $\dfrac{25}{64}$

2) $\dfrac{45}{512}$

3) $\dfrac{75}{512}$

4) $\dfrac{225}{512}$

22 What is the range of $f(x) = |x - 3| + 2$?

1) $\{x | x \geq 3\}$
2) $\{y | y \geq 2\}$
3) $\{x | x \in \text{real numbers}\}$
4) $\{y | y \in \text{real numbers}\}$

23 Which calculator output shows the strongest linear relationship between x and y?

1)
Lin Reg
$y = a + bx$
$a = 59.026$
$b = 6.767$
$r = .8643$

2)
Lin Reg
$y = a + bx$
$a = .7$
$b = 24.2$
$r = .8361$

3)
Lin Reg
$y = a + bx$
$a = 2.45$
$b = .95$
$r = .6022$

4)
Lin Reg
$y = a + bx$
$a = -2.9$
$b = 24.1$
$r = -.8924$

24 If $\log x^2 - \log 2a = \log 3a$, then $\log x$ expressed in terms of $\log a$ is equivalent to

1) $\dfrac{1}{2} \log 5a$

2) $\dfrac{1}{2} \log 6 + \log a$

3) $\log 6 + \log a$

4) $\log 6 + 2 \log a$

25 Which function is one-to-one?

1) $f(x) = |x|$
2) $f(x) = 2^x$
3) $f(x) = x^2$
4) $f(x) = \sin x$

26 If p varies inversely as q, and $p = 10$ when $q = \dfrac{3}{2}$,

what is the value of p when $q = \dfrac{3}{5}$?

1) 25
2) 15
3) 9
4) 4

27 Which equation is graphed in the diagram below?

(15,8)
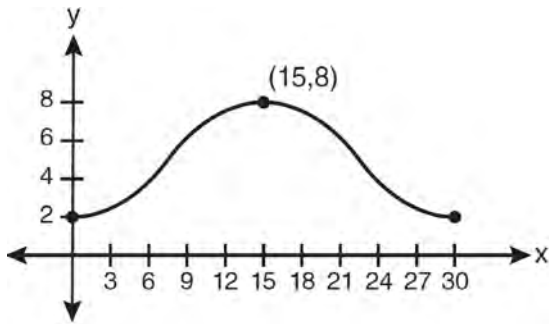
1) $y = 3\cos\left(\dfrac{\pi}{30}x\right) + 8$

2) $y = 3\cos\left(\dfrac{\pi}{15}x\right) + 5$

3) $y = -3\cos\left(\dfrac{\pi}{30}x\right) + 8$

4) $y = -3\cos\left(\dfrac{\pi}{15}x\right) + 5$

28 Find the solution of the inequality $x^2 - 4x > 5$, algebraically.

29 Solve algebraically for x: $4 - \sqrt{2x - 5} = 1$

30 Evaluate: $\displaystyle\sum_{n=1}^{3}(-n^4 - n)$

31 Express in simplest form: $\sqrt[3]{\dfrac{a^6 b^9}{-64}}$

32 A blood bank needs twenty people to help with a blood drive. Twenty-five people have volunteered. Find how many different groups of twenty can be formed from the twenty-five volunteers.

33 On the axes below, for $-2 \le x \le 2$, graph $y = 2^{x+1} - 3$.
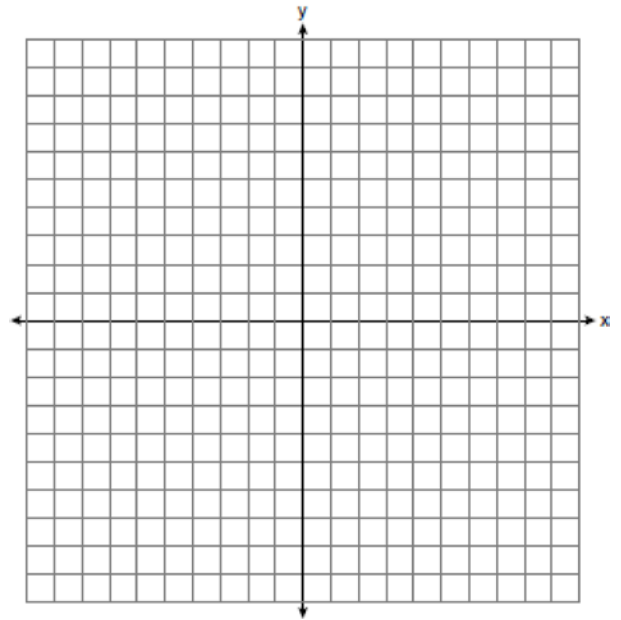
34 Write an equation of the circle shown in the diagram below.
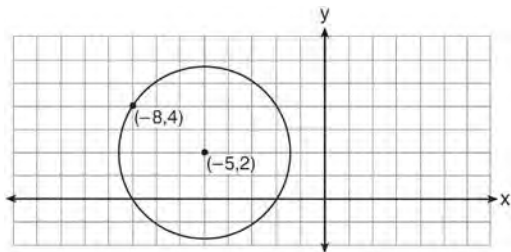
35 Express the exact value of $\csc 60°$, with a rational denominator.

36 The diagram below shows the plans for a cell phone tower. A guy wire attached to the top of the tower makes an angle of 65 degrees with the ground. From a point on the ground 100 feet from the end of the guy wire, the angle of elevation to the top of the tower is 32 degrees. Find the height of the tower, to the *nearest foot*.
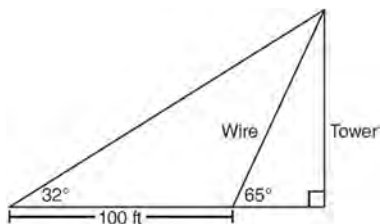
37 If $\log_4 x = 2.5$ and $\log_y 125 = -\frac{3}{2}$, find the numerical value of $\frac{x}{y}$, in simplest form.

38 A population of single-celled organisms was grown in a Petri dish over a period of 16 hours. The number of organisms at a given time is recorded in the table below.

Time, hrs (x)	Number of Organisms (y)
0	25
2	36
4	52
6	68
8	85
10	104
12	142
16	260

Determine the exponential regression equation model for these data, rounding all values to the *nearest ten-thousandth*. Using this equation, predict the number of single-celled organisms, to the *nearest whole number*, at the end of the 18th hour.

39 Perform the indicated operations and simplify completely:
$$\frac{x^3 - 3x^2 + 6x - 18}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} \div \frac{x^2 + 2x - 8}{16 - x^2}$$

6

0612a2

1 What is the product of $\left(\dfrac{2}{5} x - \dfrac{3}{4} y^2 \right)$ and

$\left(\dfrac{2}{5} x + \dfrac{3}{4} y^2 \right)$?

1) $\dfrac{4}{25} x^2 - \dfrac{9}{16} y^4$

2) $\dfrac{4}{25} x - \dfrac{9}{16} y^2$

3) $\dfrac{2}{5} x^2 - \dfrac{3}{4} y^4$

4) $\dfrac{4}{5} x$

2 What is the domain of the function shown below?
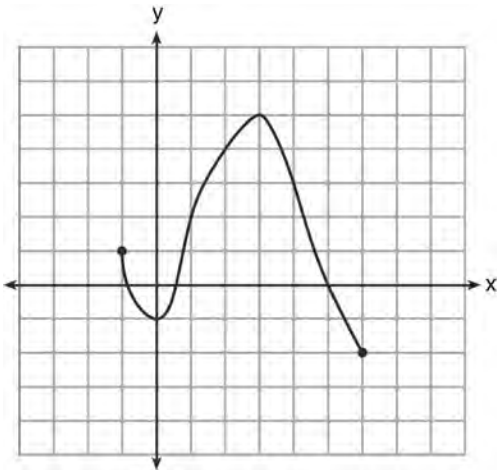
1) $-1 \le x \le 6$
2) $-1 \le y \le 6$
3) $-2 \le x \le 5$
4) $-2 \le y \le 5$

3 What is the solution set for $2\cos\theta - 1 = 0$ in the interval $0° \le \theta < 360°$?
1) $\{30°, 150°\}$
2) $\{60°, 120°\}$
3) $\{30°, 330°\}$
4) $\{60°, 300°\}$

4 The expression $\sqrt[3]{64a^{16}}$ is equivalent to
1) $8a^4$
2) $8a^8$
3) $4a^5 \sqrt[3]{a}$
4) $4a \sqrt[3]{a^5}$

5 Which summation represents
$5 + 7 + 9 + 11 + \ldots + 43$?

1) $\displaystyle\sum_{n=5}^{43} n$

2) $\displaystyle\sum_{n=1}^{20} (2n + 3)$

3) $\displaystyle\sum_{n=4}^{24} (2n - 3)$

4) $\displaystyle\sum_{n=3}^{23} (3n - 4)$

6 If $m\angle\theta = -50$, which diagram represents θ drawn in standard position?

1)

2)

3)

4)
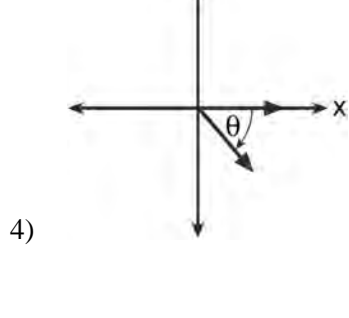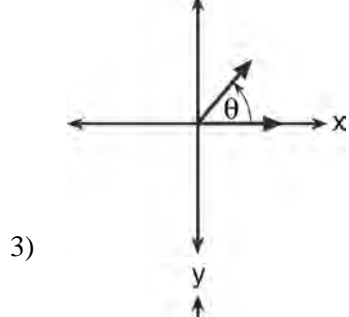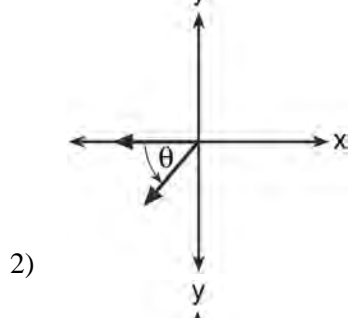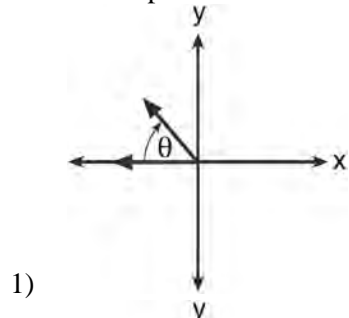
7 If $\log_b x = 3\log_b p - \left(2\log_b t + \dfrac{1}{2}\log_b r\right)$, then the value of x is

1) $\dfrac{p^3}{\sqrt{t^2 r}}$

2) $p^3 t^2 r^{\frac{1}{2}}$

3) $\dfrac{p^3 t^2}{\sqrt{r}}$

4) $\dfrac{p^3}{t^2\sqrt{r}}$

8 Which equation has roots with the sum equal to $\dfrac{9}{4}$ and the product equal to $\dfrac{3}{4}$?

1) $4x^2 + 9x + 3 = 0$
2) $4x^2 + 9x - 3 = 0$
3) $4x^2 - 9x + 3 = 0$
4) $4x^2 - 9x - 3 = 0$

9 Which graph represents the solution set of $\left|\dfrac{4x-5}{3}\right| > 1?$

1)

2)

3)

4)

2

10 Which expression is equivalent to $\dfrac{x^{-1}y^4}{3x^{-5}y^{-1}}$?

1) $\dfrac{x^4y^5}{3}$

2) $\dfrac{x^5y^4}{3}$

3) $3x^4y^5$

4) $\dfrac{y^4}{3x^5}$

11 Which graph represents the function $\log_2 x = y$?

1)

2)

3)

4)
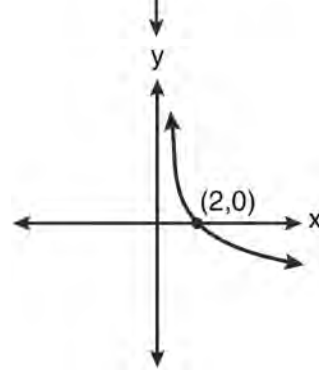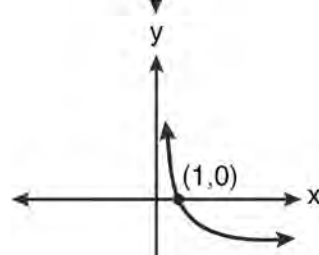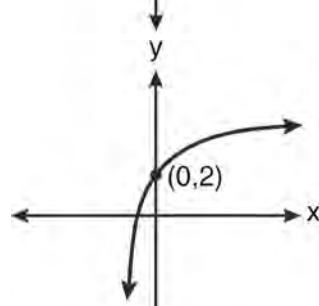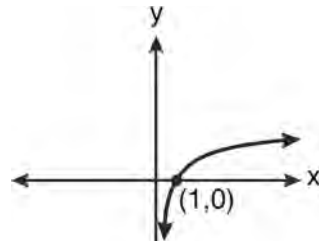
12 A circle is drawn to represent a pizza with a 12 inch diameter. The circle is cut into eight congruent pieces. What is the length of the outer edge of any one piece of this circle?

1) $\dfrac{3\pi}{4}$

2) π

3) $\dfrac{3\pi}{2}$

4) 3π

13 What is the solution set for the equation $\sqrt{5x+29} = x+3$?

1) $\{4\}$

2) $\{-5\}$

3) $\{4,5\}$

4) $\{-5,4\}$

14 When factored completely, $x^3 + 3x^2 - 4x - 12$ equals

1) $(x+2)(x-2)(x-3)$

2) $(x+2)(x-2)(x+3)$

3) $(x^2-4)(x+3)$

4) $(x^2-4)(x-3)$

15 What is the middle term in the expansion of $\left(\dfrac{x}{2} - 2y\right)^6$?

1) $20x^3y^3$

2) $-\dfrac{15}{4}x^4y^2$

3) $-20x^3y^3$

4) $\dfrac{15}{4}x^4y^2$

16 Which expression is equivalent to $(n \circ m \circ p)(x)$, given $m(x) = \sin x$, $n(x) = 3x$, and $p(x) = x^2$?

1) $\sin(3x)^2$

2) $3\sin x^2$

3) $\sin^2(3x)$

4) $3\sin^2 x$

17 The value of $\csc 138°23'$ rounded to four decimal places is

1) -1.3376

2) -1.3408

3) 1.5012

4) 1.5057

18 Which function is one-to-one?

1) $k(x) = x^2 + 2$

2) $g(x) = x^3 + 2$

3) $f(x) = |x| + 2$

4) $j(x) = x^4 + 2$

19 The conjugate of the complex expression $-5x + 4i$ is

1) $5x - 4i$

2) $5x + 4i$

3) $-5x - 4i$

4) $-5x + 4i$

20 What is a positive value of $\tan \dfrac{1}{2}x$, when $\sin x = 0.8$?

1) 0.5

2) 0.4

3) 0.33

4) 0.25

21 The table below displays the results of a survey regarding the number of pets each student in a class has. The average number of pets per student in this class is 2.

Number of Pets	0	1	2	3	4	5
Number of Students	4	6	10	0	k	2

What is the value of k for this table?

1) 9

2) 2

3) 8

4) 4

4

22 How many negative solutions to the equation
$2x^3 - 4x^2 + 3x - 1 = 0$ exist?
1) 1
2) 2
3) 3
4) 0

23 A study finds that 80% of the local high school students text while doing homework. Ten students are selected at random from the local high school. Which expression would be part of the process used to determine the probability that, *at most*, 7 of the 10 students text while doing homework?

1) $_{10}C_6 \left(\dfrac{4}{5} \right)^6 \left(\dfrac{1}{5} \right)^4$

2) $_{10}C_7 \left(\dfrac{4}{5} \right)^{10} \left(\dfrac{1}{5} \right)^7$

3) $_{10}C_8 \left(\dfrac{7}{10} \right)^{10} \left(\dfrac{3}{10} \right)^2$

4) $_{10}C_9 \left(\dfrac{7}{10} \right)^9 \left(\dfrac{3}{10} \right)^1$

24 In which interval of $f(x) = \cos(x)$ is the inverse also a function?

1) $-\dfrac{\pi}{2} < x < \dfrac{\pi}{2}$

2) $-\dfrac{\pi}{2} \le x \le \dfrac{\pi}{2}$

3) $0 \le x \le \pi$

4) $\dfrac{\pi}{2} \le x \le \dfrac{3\pi}{2}$

25 As shown in the table below, a person's target heart rate during exercise changes as the person gets older.

Age (years)	Target Heart Rate (beats per minute)
20	135
25	132
30	129
35	125
40	122
45	119
50	115

Which value represents the linear correlation coefficient, rounded to the *nearest thousandth*, between a person's age, in years, and that person's target heart rate, in beats per minute?
1) −0.999
2) −0.664
3) 0.998
4) 1.503

26 In $\triangle MNP$, $m = 6$ and $n = 10$. Two distinct triangles can be constructed if the measure of angle M is
1) 35
2) 40
3) 45
4) 50

27 If order does *not* matter, which selection of students would produce the most possible committees?
1) 5 out of 15
2) 5 out of 25
3) 20 out of 25
4) 15 out of 25

28 Determine the value of n in simplest form:
$i^{13} + i^{18} + i^{31} + n = 0$

29 The formula for continuously compounded interest is $A = Pe^{rt}$, where A is the amount of money in the account, P is the initial investment, r is the interest rate, and t is the time in years. Using the formula, determine, to the *nearest dollar*, the amount in the account after 8 years if $750 is invested at an annual rate of 3%.

30 Express $\cos\theta(\sec\theta - \cos\theta)$, in terms of $\sin\theta$.

31 A cup of soup is left on a countertop to cool. The table below gives the temperatures, in degrees Fahrenheit, of the soup recorded over a 10-minute period.

Time in Minutes (x)	0	2	4	6	8	10
Temperature in °F (y)	180.2	165.8	146.3	135.4	127.7	110.5

Write an exponential regression equation for the data, rounding all values to the *nearest thousandth.*

32 Find, to the *nearest tenth*, the radian measure of 216º.

33 Find the third term in the recursive sequence $a_{k+1} = 2a_k - 1$, where $a_1 = 3$.

34 The two sides and included angle of a parallelogram are 18, 22, and 60°. Find its exact area in simplest form.

35 Write an equation for the graph of the trigonometric function shown below.
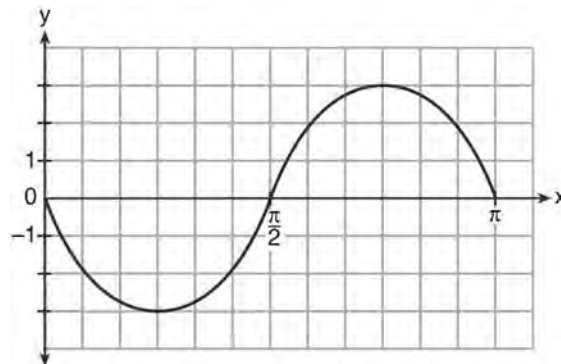
36 Express in simplest form: $\dfrac{\dfrac{4-x^2}{x^2+7x+12}}{\dfrac{2x-4}{x+3}}$

37 During a particular month, a local company surveyed all its employees to determine their travel times to work, in minutes. The data for all 15 employees are shown below.

$$\begin{array}{ccccc} 25 & 55 & 40 & 65 & 29 \\ 45 & 59 & 35 & 25 & 37 \\ 52 & 30 & 8 & 40 & 55 \end{array}$$

Determine the number of employees whose travel time is within one standard deviation of the mean.

38 The measures of the angles between the resultant and two applied forces are 60° and 45°, and the magnitude of the resultant is 27 pounds. Find, to the *nearest pound*, the magnitude of each applied force.

39 Solve algebraically for all values of x:

$$81^{x^3+2x^2} = 27^{\frac{5x}{3}}$$

6

0113a2

1 What is the equation of the graph shown below?
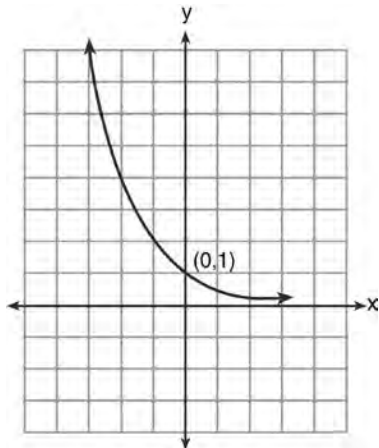
1) $y = 2^x$
2) $y = 2^{-x}$
3) $x = 2^y$
4) $x = 2^{-y}$

2 Which ordered pair is a solution of the system of equations shown below? $x + y = 5$

$$(x+3)^2 + (y-3)^2 = 53$$

1) $(2,3)$
2) $(5,0)$
3) $(-5,10)$
4) $(-4,9)$

3 The relationship between t, a student's test scores, and d, the student's success in college, is modeled by the equation $d = 0.48t + 75.2$. Based on this linear regression model, the correlation coefficient could be
1) between -1 and 0
2) between 0 and 1
3) equal to -1
4) equal to 0

4 What is the common ratio of the geometric sequence shown below?
$$-2, 4, -8, 16, \ldots$$
1) $-\dfrac{1}{2}$
2) 2
3) -2
4) -6

5 Given the relation $\{(8,2), (3,6), (7,5), (k,4)\}$, which value of k will result in the relation *not* being a function?
1) 1
2) 2
3) 3
4) 4

6 Which expression is equivalent to $\left(9x^2y^6 \right)^{-\frac{1}{2}}$?

1) $\dfrac{1}{3xy^3}$
2) $3xy^3$
3) $\dfrac{3}{xy^3}$
4) $\dfrac{xy^3}{3}$

7 In a certain high school, a survey revealed the mean amount of bottled water consumed by students each day was 153 bottles with a standard deviation of 22 bottles. Assuming the survey represented a normal distribution, what is the range of the number of bottled waters that approximately 68.2% of the students drink?
1) $131 - 164$
2) $131 - 175$
3) $142 - 164$
4) $142 - 175$

8 What is the fourth term in the binomial expansion $(x-2)^8$?

1) $448x^5$

2) $448x^4$

3) $-448x^5$

4) $-448x^4$

9 Which value of k satisfies the equation $8^{3k+4} = 4^{2k-1}$?

1) -1

2) $-\dfrac{9}{4}$

3) -2

4) $-\dfrac{14}{5}$

10 There are eight people in a tennis club. Which expression can be used to find the number of different ways they can place first, second, and third in a tournament?

1) $_8P_3$

2) $_8C_3$

3) $_8P_5$

4) $_8C_5$

11 If $\sin A = \dfrac{1}{3}$, what is the value of $\cos 2A$?

1) $-\dfrac{2}{3}$

2) $\dfrac{2}{3}$

3) $-\dfrac{7}{9}$

4) $\dfrac{7}{9}$

12 In the interval $0° \le x < 360°$, $\tan x$ is undefined when x equals

1) 0° and 90°

2) 90° and 180°

3) 180° and 270°

4) 90° and 270°

13 If $f(x) = \sqrt{9 - x^2}$, what are its domain and range?

1) domain: $\{x \mid -3 \le x \le 3\}$; range: $\{y \mid 0 \le y \le 3\}$

2) domain: $\{x \mid x \ne \pm 3\}$; range: $\{y \mid 0 \le y \le 3\}$

3) domain: $\{x \mid x \le -3 \text{ or } x \ge 3\}$; range: $\{y \mid y \ne 0\}$

4) domain: $\{x \mid x \ne 3\}$; range: $\{y \mid y \ge 0\}$

14 When $x^2 + 3x - 4$ is subtracted from $x^3 + 3x^2 - 2x$, the difference is

1) $x^3 + 2x^2 - 5x + 4$

2) $x^3 + 2x^2 + x - 4$

3) $-x^3 + 4x^2 + x - 4$

4) $-x^3 - 2x^2 + 5x + 4$

15 In the diagram below, the length of which line segment is equal to the exact value of $\sin \theta$?

1) $\overline{TO}$

2) $\overline{TS}$

3) $\overline{OR}$

4) $\overline{OS}$

2
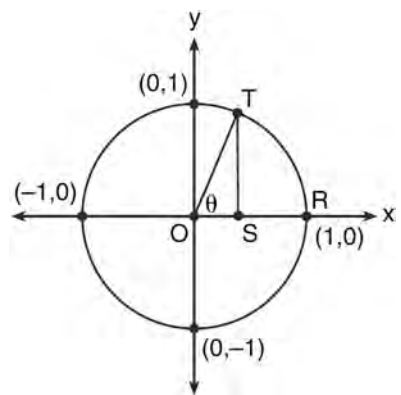
16 The area of triangle ABC is 42. If $AB = 8$ and $m\angle B = 61$, the length of $\overline{BC}$ is approximately
1) 5.1
2) 9.2
3) 12.0
4) 21.7

17 When factored completely, the expression $3x^3 - 5x^2 - 48x + 80$ is equivalent to
1) $(x^2 - 16)(3x - 5)$
2) $(x^2 + 16)(3x - 5)(3x + 5)$
3) $(x + 4)(x - 4)(3x - 5)$
4) $(x + 4)(x - 4)(3x - 5)(3x - 5)$

18 The value of $\sin(180 + x)$ is equivalent to
1) $-\sin x$
2) $-\sin(90 - x)$
3) $\sin x$
4) $\sin(90 - x)$

19 The sum of $\sqrt[3]{6a^4b^2}$ and $\sqrt[3]{162a^4b^2}$, expressed in simplest radical form, is
1) $\sqrt[6]{168a^8b^4}$
2) $2a^2b\sqrt[3]{21a^2b}$
3) $4a\sqrt[3]{6ab^2}$
4) $10a^2b\sqrt[3]{8}$

20 Which equation is represented by the graph below?
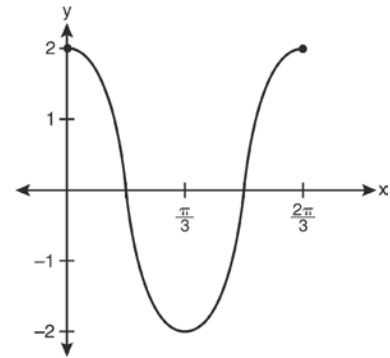
1) $y = 2\cos 3x$
2) $y = 2\sin 3x$
3) $y = 2\cos \dfrac{2\pi}{3}x$
4) $y = 2\sin \dfrac{2\pi}{3}x$

21 The quantities p and q vary inversely. If $p = 20$ when $q = -2$, and $p = x$ when $q = -2x + 2$, then x equals
1) -4 and 5
2) $\dfrac{20}{19}$
3) -5 and 4
4) $-\dfrac{1}{4}$

22 What is the solution set of the equation $-\sqrt{2}\sec x = 2$ when $0° \le x < 360°$?
1) $\{45°, 135°, 225°, 315°\}$
2) $\{45°, 315°\}$
3) $\{135°, 225°\}$
4) $\{225°, 315°\}$

3

23 The discriminant of a quadratic equation is 24.
The roots are
1) imaginary
2) real, rational, and equal
3) real, rational, and unequal
4) real, irrational, and unequal

24 How many different six-letter arrangements can be made using the letters of the word "TATTOO"?
1) 60
2) 90
3) 120
4) 720

25 Expressed in simplest form, $\dfrac{3y}{2y-6} + \dfrac{9}{6-2y}$ is equivalent to

1) $\dfrac{-6y^2 + 36y - 54}{(2y-6)(6-2y)}$

2) $\dfrac{3y-9}{2y-6}$

3) $\dfrac{3}{2}$

4) $-\dfrac{3}{2}$

26 If $\log 2 = a$ and $\log 3 = b$, the expression $\log \dfrac{9}{20}$ is equivalent to
1) $2b - a + 1$
2) $2b - a - 1$
3) $b^2 - a + 10$
4) $\dfrac{2b}{a+1}$

27 The expression $(x+i)^2 - (x-i)^2$ is equivalent to
1) 0
2) -2
3) $-2 + 4xi$
4) $4xi$

28 Determine the sum of the first twenty terms of the sequence whose first five terms are 5, 14, 23, 32, 41.

29 Determine the sum and the product of the roots of $3x^2 = 11x - 6$.

30 If $\sec(a + 15)° = \csc(2a)°$, find the smallest positive value of a, in degrees.

31 The heights, in inches, of 10 high school varsity basketball players are 78, 79, 79, 72, 75, 71, 74, 74, 83, and 71. Find the interquartile range of this data set.

32 Solve the equation $6x^2 - 2x - 3 = 0$ and express the answer in simplest radical form.

33 The number of bacteria present in a Petri dish can be modeled by the function $N = 50e^{3t}$, where N is the number of bacteria present in the Petri dish after t hours. Using this model, determine, to the *nearest hundredth*, the number of hours it will take for N to reach 30,700.

4

34 Determine the solution of the inequality $|3 - 2x| \geq 7$. [The use of the grid below is optional.]

37 The data collected by a biologist showing the growth of a colony of bacteria at the end of each hour are displayed in the table below.

Time, hour, (x)	Population (y)
0	250
1	330
2	580
3	800
4	1650
5	3000

Write an exponential regression equation to model these data. Round all values to the *nearest thousandth*. Assuming this trend continues, use this equation to estimate, to the nearest *ten*, the number of bacteria in the colony at the end of 7 hours.

35 Convert 3 radians to degrees and express the answer to the *nearest minute*.

36 Solve algebraically for all values of *x*:
$\log_{(x+4)}(17x - 4) = 2$

38 As shown in the diagram below, fire-tracking station *A* is 100 miles due west of fire-tracking station *B*. A forest fire is spotted at *F*, on a bearing 47° northeast of station *A* and 15° northeast of station *B*. Determine, to the *nearest tenth of a mile*, the distance the fire is from *both* station *A* and station *B*. [N represents due north.]
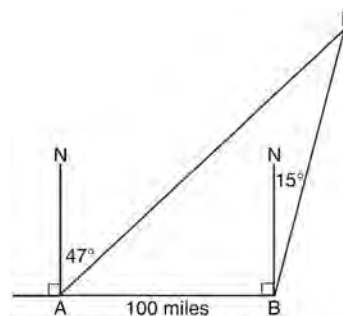
39 Solve algebraically for *x*:
$\sqrt{x^2 + x - 1} + 11x = 7x + 3$

5

0613a2

1 A market research firm needs to collect data on viewer preferences for local news programming in Buffalo. Which method of data collection is most appropriate?
1) census
2) survey
3) observation
4) controlled experiment

2 What is the number of degrees in an angle whose radian measure is $\dfrac{8\pi}{5}$?
1) 576
2) 288
3) 225
4) 113

3 Which diagram represents a relation that is both one-to-one and onto?

1)

2)

3)

4)
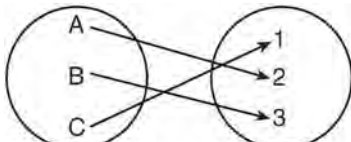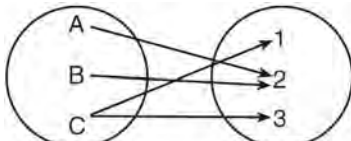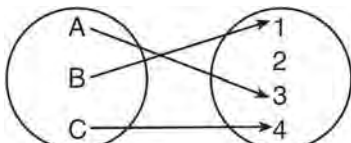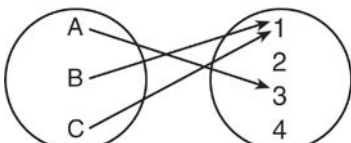
4 The sum of the first eight terms of the series $3 - 12 + 48 - 192 + \ldots$ is
1) $-13,107$
2) $-21,845$
3) $-39,321$
4) $-65,535$

5 The simplest form of $\dfrac{1 - \dfrac{4}{x}}{1 - \dfrac{2}{x} - \dfrac{8}{x^2}}$ is
1) $\dfrac{1}{2}$
2) $\dfrac{x}{x+2}$
3) $\dfrac{x}{3}$
4) $-\dfrac{x}{x-2}$

6 Which equation represents the graph below?
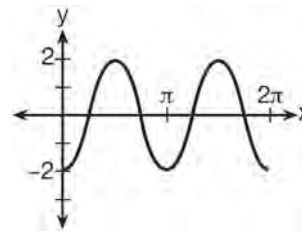
1) $y = -2\sin 2x$
2) $y = -2\sin \dfrac{1}{2}x$
3) $y = -2\cos 2x$
4) $y = -2\cos \dfrac{1}{2}x$

7 What is the graph of the solution set of $|2x - 1| > 5$?

1)

2)

3)

4)

8 What is the range of the function shown below?
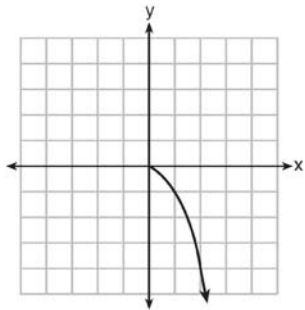
1) $x \le 0$
2) $x \ge 0$
3) $y \le 0$
4) $y \ge 0$

9 The expression $\sin(\theta + 90)°$ is equivalent to
1) $-\sin\theta$
2) $-\cos\theta$
3) $\sin\theta$
4) $\cos\theta$

10 The points $(2,3)$, $\left(4, \dfrac{3}{4}\right)$, and $(6,d)$ lie on the graph

of a function. If y is inversely proportional to the square of x, what is the value of d?
1) 1
2) $\dfrac{1}{3}$
3) 3
4) 27

11 In the right triangle shown below, what is the measure of angle S, to the *nearest minute*?
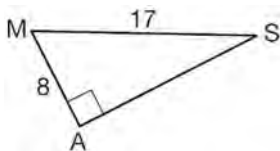
1) 28°1'
2) 28°4'
3) 61°56'
4) 61°93'

12 Which ordered pair is in the solution set of the system of equations shown below?
$$y^2 - x^2 + 32 = 0$$
$$3y - x = 0$$
1) $(2,6)$
2) $(3,1)$
3) $(-1,-3)$
4) $(-6,-2)$

13 Susie invests $500 in an account that is compounded continuously at an annual interest rate of 5%, according to the formula $A = Pe^{rt}$, where A is the amount accrued, P is the principal, r is the rate of interest, and t is the time, in years. Approximately how many years will it take for Susie's money to double?
1) 1.4
2) 6.0
3) 13.9
4) 14.7

14 If n is a negative integer, then which statement is always true?
1) $6n^{-2} < 4n^{-1}$
2) $\dfrac{n}{4} > -6n^{-1}$
3) $6n^{-1} < 4n^{-1}$
4) $4n^{-1} > (6n)^{-1}$

15 The expression $4 + \displaystyle\sum_{k=2}^{5} 3(k-x)$ is equal to
1) $58 - 4x$
2) $46 - 4x$
3) $58 - 12x$
4) $46 - 12x$

16 Which value of r represents data with a strong positive linear correlation between two variables?
1) 0.89
2) 0.34
3) 1.04
4) 0.01

17 Which problem involves evaluating $_6P_4$?
1) How many different four-digit ID numbers can be formed using 1, 2, 3, 4, 5, and 6 without repetition?
2) How many different subcommittees of four can be chosen from a committee having six members?
3) How many different outfits can be made using six shirts and four pairs of pants?
4) How many different ways can one boy and one girl be selected from a group of four boys and six girls?

18 Which equation is represented by the graph below?
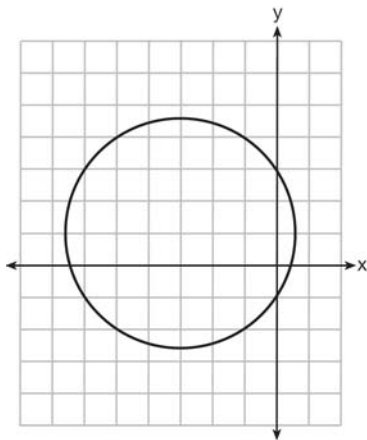
1) $(x-3)^2 + (y+1)^2 = 5$
2) $(x+3)^2 + (y-1)^2 = 5$
3) $(x-1)^2 + (y+3)^2 = 13$
4) $(x+3)^2 + (y-1)^2 = 13$

19 If $x = 3i$, $y = 2i$, and $z = m + i$, the expression xy^2z equals
1) $-12 - 12mi$
2) $-6 - 6mi$
3) $12 - 12mi$
4) $6 - 6mi$

20 An angle, P, drawn in standard position, terminates in Quadrant II if
1) $\cos P < 0$ and $\csc P < 0$
2) $\sin P > 0$ and $\cos P > 0$
3) $\csc P > 0$ and $\cot P < 0$
4) $\tan P < 0$ and $\sec P > 0$

21 The expression $\log 4m^2$ is equivalent to
1) $2(\log 4 + \log m)$
2) $2\log 4 + \log m$
3) $\log 4 + 2\log m$
4) $\log 16 + 2\log m$

22 In $\triangle PQR$, p equals
1) $\dfrac{r\sin P}{\sin Q}$
2) $\dfrac{r\sin P}{\sin R}$
3) $\dfrac{r\sin R}{\sin P}$
4) $\dfrac{q\sin R}{\sin Q}$

23 If $\tan\left(\text{Arc}\cos\dfrac{\sqrt{3}}{k}\right) = \dfrac{\sqrt{3}}{3}$, then k is
1) 1
2) 2
3) $\sqrt{2}$
4) $3\sqrt{2}$

24 Which expression is equivalent to $\dfrac{2x^{-2}y^{-2}}{4y^{-5}}$?
1) $\dfrac{y^3}{2x^2}$
2) $\dfrac{2y^3}{x^2}$
3) $\dfrac{2x^2}{y^3}$
4) $\dfrac{x^2}{2y^3}$

25 Expressed with a rational denominator and in simplest form, $\dfrac{x}{x - \sqrt{x}}$ is

1) $\dfrac{x^2 + x\sqrt{x}}{x^2 - x}$

2) $-\sqrt{x}$

3) $\dfrac{x + \sqrt{x}}{1 - x}$

4) $\dfrac{x + \sqrt{x}}{x - 1}$

26 What is the common ratio of the sequence $\dfrac{1}{64} a^5 b^3, -\dfrac{3}{32} a^3 b^4, \dfrac{9}{16} ab^5, \ldots$?

1) $-\dfrac{3b}{2a^2}$

2) $-\dfrac{6b}{a^2}$

3) $-\dfrac{3a^2}{b}$

4) $-\dfrac{6a^2}{b}$

27 In $\triangle KLM$, $KL = 20$, $LM = 13$, and m$\angle K = 40$. The measure of $\angle M$?
1) must be between 0° and 90°
2) must equal 90°
3) must be between 90° and 180°
4) is ambiguous

28 Determine the sum and the product of the roots of the equation $12x^2 + x - 6 = 0$.

29 Solve algebraically for x: $\log_{27}(2x - 1) = \dfrac{4}{3}$

30 Find the number of possible different 10-letter arrangements using the letters of the word "STATISTICS."

31 Express the product of cos 30° and sin 45° in simplest radical form.

32 Find, algebraically, the measure of the obtuse angle, to the *nearest degree*, that satisfies the equation $5 \csc \theta = 8$.

33 If g(x) = $\left(ax\sqrt{1 - x} \right)^2$, express g(10) in simplest form.

34 Express $\dfrac{\cot x \sin x}{\sec x}$ as a single trigonometric function, in simplest form, for all values of x for which it is defined.

35 On a multiple-choice test, Abby randomly guesses on all seven questions. Each question has four choices. Find the probability, to the *nearest thousandth*, that Abby gets *exactly* three questions correct.

36 Solve the equation below algebraically, and express the result in simplest radical form:
$$\frac{13}{x} = 10 - x$$

37 A ranch in the Australian Outback is shaped like triangle ACE, with m$\angle A = 42$, m$\angle E = 103$, and $AC = 15$ miles. Find the area of the ranch, to the *nearest square mile*.

38 Ten teams competed in a cheerleading competition at a local high school. Their scores were 29, 28, 39, 37, 45, 40, 41, 38, 37, and 48. How many scores are within one population standard deviation from the mean? For these data, what is the interquartile range?

39 Solve algebraically for all values of x:
$x^4 + 4x^3 + 4x^2 = -16x$

4

0114a2

1 What is the common difference in the sequence
$2a + 1, 4a + 4, 6a + 7, 8a + 10, \ldots$?
1) $2a + 3$
2) $-2a - 3$
3) $2a + 5$
4) $-2a + 5$

2 Which expression is equivalent to $\left(3x^2\right)^{-1}$?
1) $\dfrac{1}{3x^2}$
2) $-3x^2$
3) $\dfrac{1}{9x^2}$
4) $-9x^2$

3 If $g(x) = \dfrac{1}{2}x + 8$ and $h(x) = \dfrac{1}{2}x - 2$, what is the value of $g(h(-8))$?
1) 0
2) 9
3) 5
4) 4

4 The expression $\dfrac{1}{7 - \sqrt{11}}$ is equivalent to
1) $\dfrac{7 + \sqrt{11}}{38}$
2) $\dfrac{7 - \sqrt{11}}{38}$
3) $\dfrac{7 + \sqrt{11}}{60}$
4) $\dfrac{7 - \sqrt{11}}{60}$
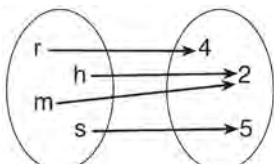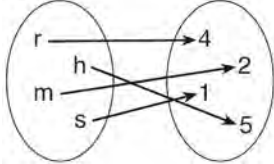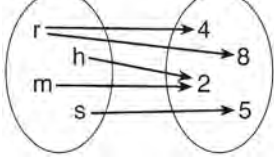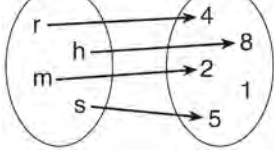
5 The expression $\dfrac{a + \dfrac{b}{c}}{d - \dfrac{b}{c}}$ is equivalent to
1) $\dfrac{c + 1}{d - 1}$
2) $\dfrac{a + b}{d - b}$
3) $\dfrac{ac + b}{cd - b}$
4) $\dfrac{ac + 1}{cd - 1}$

6 A school cafeteria has five different lunch periods. The cafeteria staff wants to find out which items on the menu are most popular, so they give every student in the first lunch period a list of questions to answer in order to collect data to represent the school. Which type of study does this represent?
1) observation
2) controlled experiment
3) population survey
4) sample survey

1

7 Which relation is both one-to-one and onto?

1)

2)

3)

4)

8 Max solves a quadratic equation by completing the square. He shows a correct step:
$$(x + 2)^2 = -9$$
What are the solutions to his equation?
1) $2 \pm 3i$
2) $-2 \pm 3i$
3) $3 \pm 2i$
4) $-3 \pm 2i$

9 Which expression represents the total number of different 11-letter arrangements that can be made using the letters in the word "MATHEMATICS"?
1) $\dfrac{11!}{3!}$
2) $\dfrac{11!}{2! + 2! + 2!}$
3) $\dfrac{11!}{8!}$
4) $\dfrac{11!}{2! \cdot 2! \cdot 2!}$

10 If $5000 is invested at a rate of 3% interest compounded quarterly, what is the value of the investment in 5 years? (Use the formula
$$A = P\left(1 + \frac{r}{n}\right)^{nt},$$
where A is the amount accrued, P is the principal, r is the interest rate, n is the number of times per year the money is compounded, and t is the length of time, in years.)
1) $5190.33
2) $5796.37
3) $5805.92
4) $5808.08

11 The roots of the equation $2x^2 + 4 = 9x$ are
1) real, rational, and equal
2) real, rational, and unequal
3) real, irrational, and unequal
4) imaginary

12 If d varies inversely as t, and $d = 20$ when $t = 2$, what is the value of t when $d = -5$?
1) 8
2) 2
3) −8
4) −2

13 If $\sin A = -\dfrac{7}{25}$ and $\angle A$ terminates in Quadrant IV, $\tan A$ equals
1) $-\dfrac{7}{25}$
2) $-\dfrac{7}{24}$
3) $-\dfrac{24}{7}$
4) $-\dfrac{24}{25}$

14 Which expression is equivalent to $\sum_{n=1}^{4}(a-n)^2$?

1) $2a^2 + 17$
2) $4a^2 + 30$
3) $2a^2 - 10a + 17$
4) $4a^2 - 20a + 30$

15 What are the coordinates of the center of a circle whose equation is $x^2 + y^2 - 16x + 6y + 53 = 0$?

1) $(-8,-3)$
2) $(-8,3)$
3) $(8,-3)$
4) $(8,3)$

16 For $y = \dfrac{3}{\sqrt{x-4}}$, what are the domain and range?

1) $\{x|x>4\}$ and $\{y|y>0\}$
2) $\{x|x\geq4\}$ and $\{y|y>0\}$
3) $\{x|x>4\}$ and $\{y|y\geq0\}$
4) $\{x|x\geq4\}$ and $\{y|y\geq0\}$

17 A math club has 30 boys and 20 girls. Which expression represents the total number of different 5-member teams, consisting of 3 boys and 2 girls, that can be formed?

1) $_{30}P_3 \cdot _{20}P_2$
2) $_{30}C_3 \cdot _{20}C_2$
3) $_{30}P_3 + _{20}P_2$
4) $_{30}C_3 + _{20}C_2$

18 What is the product of the roots of $x^2 - 4x + k = 0$ if one of the roots is 7?

1) 21
2) −11
3) −21
4) −77

19 In $\triangle DEF$, $d = 5$, $e = 8$, and m$\angle D = 32$. How many distinct triangles can be drawn given these measurements?

1) 1
2) 2
3) 3
4) 0

20 Liz has applied to a college that requires students to score in the top 6.7% on the mathematics portion of an aptitude test. The scores on the test are approximately normally distributed with a mean score of 576 and a standard deviation of 104. What is the minimum score Liz must earn to meet this requirement?

1) 680
2) 732
3) 740
4) 784

21 The expression $\left(\sqrt[3]{27x^2}\right)\left(\sqrt[3]{16x^4}\right)$ is equivalent to

1) $12x^2\sqrt[3]{2}$
2) $12x\sqrt[3]{2x}$
3) $6x\sqrt[3]{2x^2}$
4) $6x^2\sqrt[3]{2}$

3

22 Which sketch shows the inverse of $y = a^x$, where $a > 1$?

1)

2)

3)

4)
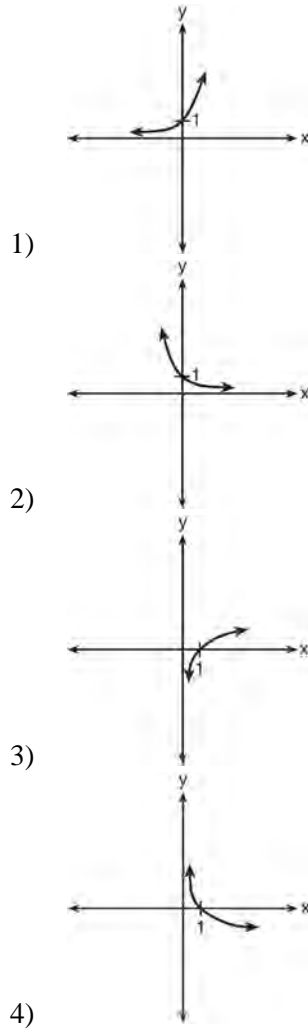
23 The expression $\dfrac{x^2 + 9x - 22}{x^2 - 121} \div (2 - x)$ is equivalent to

1) $x - 11$

2) $\dfrac{1}{x - 11}$

3) $11 - x$

4) $\dfrac{1}{11 - x}$

24 Which graph represents the solution set of $\dfrac{x + 16}{x - 2} \le 7$?

1)

2)

3)

4)
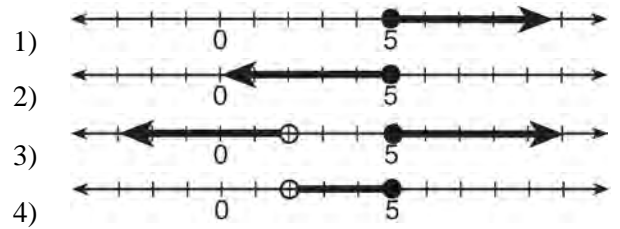
25 Which equation represents a graph that has a period of 4π?

1) $y = 3\sin\dfrac{1}{2}x$

2) $y = 3\sin 2x$

3) $y = 3\sin\dfrac{1}{4}x$

4) $y = 3\sin 4x$

26 The expression $x^2(x + 2) - (x + 2)$ is equivalent to

1) x^2

2) $x^2 - 1$

3) $x^3 + 2x^2 - x + 2$

4) $(x + 1)(x - 1)(x + 2)$

27 Approximately how many degrees does five radians equal?

1) 286

2) 900

3) $\dfrac{\pi}{36}$

4) 5π

28 Show that $\sec\theta\sin\theta\cot\theta = 1$ is an identity.

4

29 Find, to the *nearest tenth of a square foot*, the area of a rhombus that has a side of 6 feet and an angle of 50°.

30 The following is a list of the individual points scored by all twelve members of the Webster High School basketball team at a recent game:

2 2 3 4 6 7 9 10 10 11 12 14

Find the interquartile range for this set of data.

31 Determine algebraically the x-coordinate of all points where the graphs of $xy = 10$ and $y = x + 3$ intersect.

32 Solve $|-4x + 5| < 13$ algebraically for x.

33 Express $4xi + 5yi^8 + 6xi^3 + 2yi^4$ in simplest $a + bi$ form.

34 In an arithmetic sequence, $a_4 = 19$ and $a_7 = 31$. Determine a formula for a_n, the nth term of this sequence.

35 Circle O shown below has a radius of 12 centimeters. To the *nearest tenth of a centimeter*, determine the length of the arc, x, subtended by an angle of 83°50'.
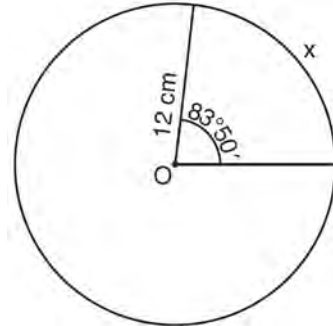
36 Solve algebraically for all exact values of x in the interval $0 \le x < 2\pi$: $2\sin^2 x + 5\sin x = 3$

37 Because Sam's backyard gets very little sunlight, the probability that a geranium planted there will flower is 0.28. Sam planted five geraniums. Determine the probability, to the *nearest thousandth*, that *at least* four geraniums will flower.

38 Two sides of a parallelogram measure 27 cm and 32 cm. The included angle measures 48°. Find the length of the longer diagonal of the parallelogram, to the *nearest centimeter*.

39 Solve algebraically for all values of x:
$\log_{(x+3)}(2x + 3) + \log_{(x+3)}(x + 5) = 2$

5

0614a2

1 Which survey is *least* likely to contain bias?
   1) surveying a sample of people leaving a movie theater to determine which flavor of ice cream is the most popular
   2) surveying the members of a football team to determine the most watched TV sport
   3) surveying a sample of people leaving a library to determine the average number of books a person reads in a year
   4) surveying a sample of people leaving a gym to determine the average number of hours a person exercises per week

2 The expression $(2a)^{-4}$ is equivalent to
   1) $-8a^4$
   2) $\dfrac{16}{a^4}$
   3) $-\dfrac{2}{a^4}$
   4) $\dfrac{1}{16a^4}$

3 Two sides of a triangular-shaped sandbox measure 22 feet and 13 feet. If the angle between these two sides measures 55°, what is the area of the sandbox, to the *nearest square foot*?
   1) 82
   2) 117
   3) 143
   4) 234

4 Expressed in simplest form, $\sqrt{-18} - \sqrt{-32}$ is
   1) $-\sqrt{2}$
   2) $-7\sqrt{2}$
   3) $-i\sqrt{2}$
   4) $7i\sqrt{2}$

5 Theresa is comparing the graphs of $y = 2^x$ and $y = 5^x$. Which statement is true?
   1) The *y*-intercept of $y = 2^x$ is $(0,2)$, and the *y*-intercept of $y = 5^x$ is $(0,5)$.
   2) Both graphs have a *y*-intercept of $(0,1)$, and $y = 2^x$ is steeper for $x > 0$.
   3) Both graphs have a *y*-intercept of $(0,1)$, and $y = 5^x$ is steeper for $x > 0$.
   4) Neither graph has a *y*-intercept.

6 The solution set of the equation $\sqrt{2x-4} = x - 2$ is
   1) $\{-2,-4\}$
   2) $\{2,4\}$
   3) $\{4\}$
   4) $\{\ \}$

7 The expression $\left(2 - 3\sqrt{x}\right)^2$ is equivalent to
   1) $4 - 9x$
   2) $4 - 3x$
   3) $4 - 12\sqrt{x} + 9x$
   4) $4 - 12\sqrt{x} + 6x$

8 Which step can be used when solving $x^2 - 6x - 25 = 0$ by completing the square?
   1) $x^2 - 6x + 9 = 25 + 9$
   2) $x^2 - 6x - 9 = 25 - 9$
   3) $x^2 - 6x + 36 = 25 + 36$
   4) $x^2 - 6x - 36 = 25 - 36$

9 Which graph represents a function?
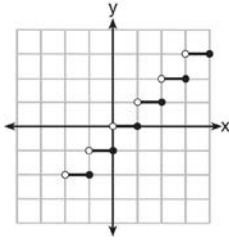
1)
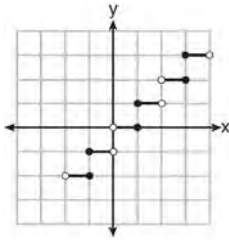
2)
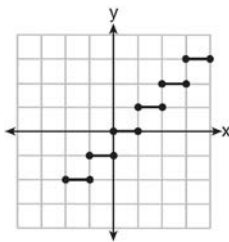
3)
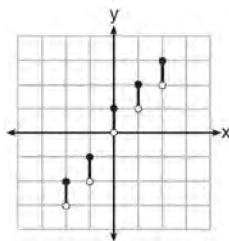
4)

10 The expression $\dfrac{\cot x}{\csc x}$ is equivalent to

1) $\sin x$
2) $\cos x$
3) $\tan x$
4) $\sec x$

11 What is the common difference of the arithmetic sequence below?
$$-7x, -4x, -x, 2x, 5x, \ldots$$
1) -3
2) $-3x$
3) 3
4) $3x$

12 If $\sin \theta < 0$ and $\cot \theta > 0$, in which quadrant does the terminal side of angle θ lie?
1) I
2) II
3) III
4) IV

13 What is the period of the graph $y = \dfrac{1}{2} \sin 6x$?

1) $\dfrac{\pi}{6}$

2) $\dfrac{\pi}{3}$

3) $\dfrac{\pi}{2}$

4) 6π

14 What is the product of the roots of the quadratic equation $2x^2 - 7x = 5$?
1) 5
2) $\dfrac{5}{2}$
3) -5
4) $-\dfrac{5}{2}$

15 What is the equation of the circle passing through the point $(6, 5)$ and centered at $(3, -4)$?
1) $(x - 6)^2 + (y - 5)^2 = 82$
2) $(x - 6)^2 + (y - 5)^2 = 90$
3) $(x - 3)^2 + (y + 4)^2 = 82$
4) $(x - 3)^2 + (y + 4)^2 = 90$

16 The formula to determine continuously compounded interest is $A = Pe^{rt}$, where A is the amount of money in the account, P is the initial investment, r is the interest rate, and t is the time, in years. Which equation could be used to determine the value of an account with an $18,000 initial investment, at an interest rate of 1.25% for 24 months?

1) $A = 18,000e^{1.25 \cdot 2}$

2) $A = 18,000e^{1.25 \cdot 24}$

3) $A = 18,000e^{0.0125 \cdot 2}$

4) $A = 18,000e^{0.0125 \cdot 24}$

17 What is the solution set of the equation
$$\frac{30}{x^2 - 9} + 1 = \frac{5}{x - 3}?$$
1) $\{2, 3\}$
2) $\{2\}$
3) $\{3\}$
4) $\{ \}$

18 The graph below shows the average price of gasoline, in dollars, for the years 1997 to 2007.
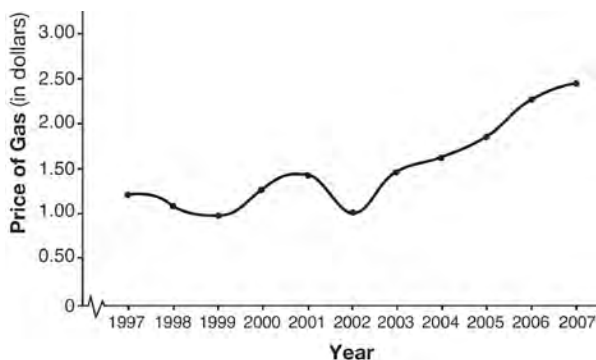
What is the approximate range of this graph?
1) $1997 \le x \le 2007$
2) $1999 \le x \le 2007$
3) $0.97 \le y \le 2.38$
4) $1.27 \le y \le 2.38$

19 If $f(x) = 2x^2 - 3x + 1$ and $g(x) = x + 5$, what is $f(g(x))$?

1) $2x^2 + 17x + 36$
2) $2x^2 + 17x + 66$
3) $2x^2 - 3x + 6$
4) $2x^2 - 3x + 36$

20 A jogger ran $\frac{1}{3}$ mile on day 1, and $\frac{2}{3}$ mile on day 2, and $1\frac{1}{3}$ miles on day 3, and $2\frac{2}{3}$ miles on day 4, and this pattern continued for 3 more days. Which expression represents the total distance the jogger ran?

1) $\displaystyle\sum_{d=1}^{7} \frac{1}{3}(2)^{d-1}$

2) $\displaystyle\sum_{d=1}^{7} \frac{1}{3}(2)^{d}$

3) $\displaystyle\sum_{d=1}^{7} 2\left(\frac{1}{3}\right)^{d-1}$

4) $\displaystyle\sum_{d=1}^{7} 2\left(\frac{1}{3}\right)^{d}$

21 If $\sin x = \sin y = a$ and $\cos x = \cos y = b$, then $\cos(x - y)$ is

1) $b^2 - a^2$
2) $b^2 + a^2$
3) $2b - 2a$
4) $2b + 2a$

22 A school math team consists of three juniors and five seniors. How many different groups can be formed that consist of one junior and two seniors?
1) 13
2) 15
3) 30
4) 60

23 For which value of k will the roots of the equation $2x^2 - 5x + k = 0$ be real and rational numbers?
1) 1
2) −5
3) 0
4) 4

24 A cliff diver on a Caribbean island jumps from a height of 105 feet, with an initial upward velocity of 5 feet per second. An equation that models the height, h(t), above the water, in feet, of the diver in time elapsed, t, in seconds, is h(t) = $-16t^2 + 5t + 105$. How many seconds, to the *nearest hundredth*, does it take the diver to fall 45 feet below his starting point?
1) 1.45
2) 1.84
3) 2.10
4) 2.72

25 The number of possible different 12-letter arrangements of the letters in the word "TRIGONOMETRY" is represented by
1) $\dfrac{12!}{3!}$
2) $\dfrac{12!}{6!}$
3) $\dfrac{{}_{12}P_{12}}{8}$
4) $\dfrac{{}_{12}P_{12}}{6!}$

26 If $2x^3 = y$, then $\log y$ equals
1) $\log(2x) + \log 3$
2) $3\log(2x)$
3) $3\log 2 + 3\log x$
4) $\log 2 + 3\log x$

27 Which statement regarding the inverse function is true?
1) A domain of $y = \sin^{-1}x$ is $[0, 2\pi]$.
2) The range of $y = \sin^{-1}x$ is $[-1, 1]$.
3) A domain of $y = \cos^{-1}x$ is $(-\infty, \infty)$.
4) The range of $y = \cos^{-1}x$ is $[0, \pi]$.

28 In a certain school, the heights of the population of girls are normally distributed, with a mean of 63 inches and a standard deviation of 2 inches. If there are 450 girls in the school, determine how many of the girls are *shorter than* 60 inches. Round the answer to the *nearest integer*.

29 The table below shows the concentration of ozone in Earth's atmosphere at different altitudes. Write the exponential regression equation that models these data, rounding *all* values to the *nearest thousandth*.

Concentration of Ozone

Altitude (x)	Ozone Units (y)
0	0.7
5	0.6
10	1.1
15	3.0
20	4.9

30 Solve $|2x - 3| > 5$ algebraically.

4

31 Convert 2.5 radians to degrees, and express the answer to the *nearest minute*.

32 Multiply $x + yi$ by its conjugate, and express the product in simplest form.

33 Solve algebraically for x: $\log_{5x-1} 4 = \dfrac{1}{3}$

34 Solve $\sec x - \sqrt{2} = 0$ algebraically for all values of x in $0° \le x < 360°$.

35 The function $f(x)$ is graphed on the set of axes below. On the same set of axes, graph $f(x + 1) + 2$.
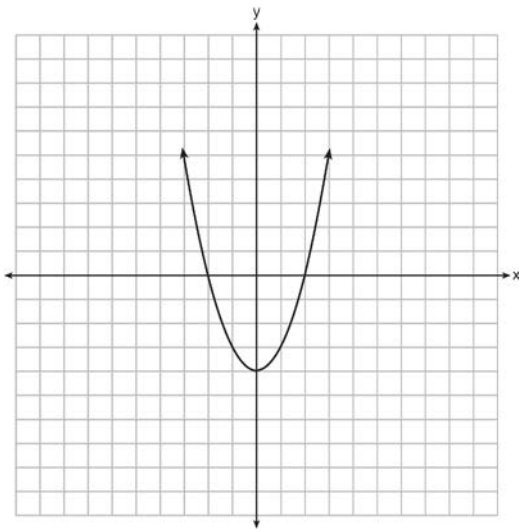
36 Express in simplest terms: $\dfrac{1 + \dfrac{3}{x}}{1 - \dfrac{5}{x} - \dfrac{24}{x^2}}$

37 Solve $x^3 + 5x^2 = 4x + 20$ algebraically.

38 Whenever Sara rents a movie, the probability that it is a horror movie is 0.57. Of the next five movies she rents, determine the probability, to the *nearest hundredth*, that *no more than* two of these rentals are horror movies.

39 Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the *nearest pound*. Using this answer, find the measure of the angle formed between the resultant and the *smaller* force, to the *nearest degree*.

0115a2

1 In $\triangle FGH$, $f = 6$, $g = 9$, and $m\angle H = 57$. Which statement can be used to determine the numerical value of h?

1) $h^2 = 6^2 + 9^2 - 2(9)(h)\cos 57°$

2) $h^2 = 6^2 + 9^2 - 2(6)(9)\cos 57°$

3) $6^2 = 9^2 + h^2 - 2(9)(h)\cos 57°$

4) $9^2 = 6^2 + h^2 - 2(6)(h)\cos 57°$

2 The table of values below can be modeled by which equation?

x	y
-2	5
-1	4
0	3
1	4
2	5

1) $f(x) = |x + 3|$

2) $f(x) = |x| + 3$

3) $f(y) = |y + 3|$

4) $f(y) = |y| + 3$

3 The equation $\log_a x = y$ where $x > 0$ and $a > 1$ is equivalent to

1) $x^y = a$

2) $y^a = x$

3) $a^y = x$

4) $a^x = y$

4 Which expression is equivalent to the sum of the sequence $6, 12, 20, 30$?

1) $\sum\limits_{n=4}^{7} 2^n - 10$

2) $\sum\limits_{n=3}^{6} \frac{2n^2}{3}$

3) $\sum\limits_{n=2}^{5} 5n - 4$

4) $\sum\limits_{n=2}^{5} n^2 + n$

5 An investment is earning 5% interest compounded quarterly. The equation represents the total amount of money, A, where P is the original investment, r is the interest rate, t is the number of years, and n represents the number of times per year the money earns interest. Which graph could represent this investment over at least 50 years?

1)

2)

3)

4)
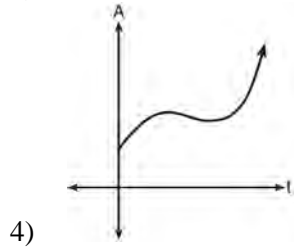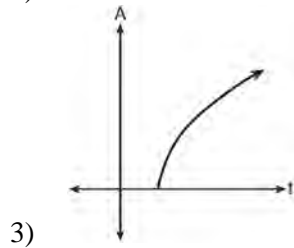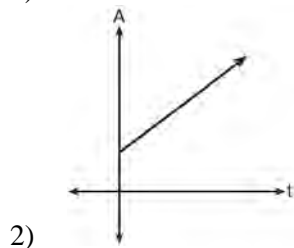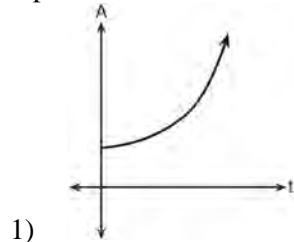
6 Which equation has real, rational, and unequal roots?

1) $x^2 + 10x + 25 = 0$
2) $x^2 - 5x + 4 = 0$
3) $x^2 - 3x + 1 = 0$
4) $x^2 - 2x + 5 = 0$

7 Which statement is true about the graphs of f and g shown below?
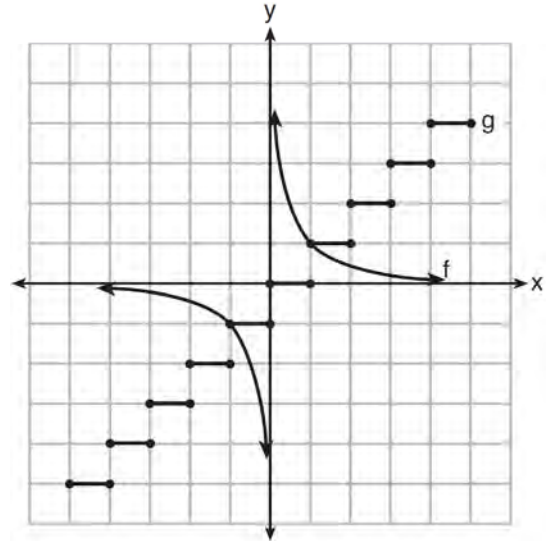
1) f is a relation and g is a function.
2) f is a function and g is a relation.
3) Both f and g are functions.
4) Neither f nor g is a function.

8 The common ratio of the sequence $-\dfrac{1}{2}, \dfrac{3}{4}, -\dfrac{9}{8}$ is

1) $-\dfrac{3}{2}$
2) $-\dfrac{2}{3}$
3) $-\dfrac{1}{2}$
4) $-\dfrac{1}{4}$

9 How many different ways can teams of four members be formed from a class of 20 students?
1) 5
2) 80
3) 4,845
4) 116,280

10 If $\sin A = \dfrac{3}{8}$, what is the value of $\cos 2A$?

1) $-\dfrac{9}{64}$

2) $\dfrac{1}{4}$

3) $\dfrac{23}{32}$

4) $\dfrac{55}{64}$

11 When factored completely, the expression $x^3 - 2x^2 - 9x + 18$ is equivalent to
1) $(x^2 - 9)(x - 2)$
2) $(x - 2)(x - 3)(x + 3)$
3) $(x - 2)^2(x - 3)(x + 3)$
4) $(x - 3)^2(x - 2)$

12 When $-3 - 2i$ is multiplied by its conjugate, the result is
1) -13
2) -5
3) 5
4) 13

13 A circle with center O and passing through the origin is graphed below.
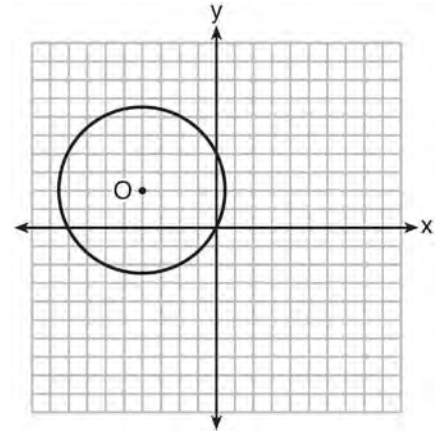
What is the equation of circle O?
1) $x^2 + y^2 = 2\sqrt{5}$
2) $x^2 + y^2 = 20$
3) $(x + 4)^2 + (y - 2)^2 = 2\sqrt{5}$
4) $(x + 4)^2 + (y - 2)^2 = 20$

14 Which expression is equivalent to $(5^{-2}a^3b^{-4})^{-1}$?

1) $\dfrac{10b^4}{a^3}$

2) $\dfrac{25b^4}{a^3}$

3) $\dfrac{a^3}{25b^4}$

4) $\dfrac{a^2}{125b^5}$

3

15 Which trigonometric expression does *not* simplify to 1?
1) $\sin^2 x(1 + \cot^2 x)$
2) $\sec^2 x(1 - \sin^2 x)$
3) $\cos^2 x(\tan^2 x - 1)$
4) $\cot^2 x(\sec^2 x - 1)$

16 What is the product of $\sqrt[3]{4a^2b^4}$ and $\sqrt[3]{16a^3b^2}$?
1) $4ab^2 \sqrt[3]{a^2}$
2) $4a^2b^3 \sqrt[3]{a}$
3) $8ab^2 \sqrt[3]{a^2}$
4) $8a^2b^3 \sqrt[3]{a}$

17 What is the product of the roots of $4x^2 - 5x = 3$?
1) $\dfrac{3}{4}$
2) $\dfrac{5}{4}$
3) $-\dfrac{3}{4}$
4) $-\dfrac{5}{4}$

18 How many different 11-letter arrangements are possible using the letters in the word "ARRANGEMENT"?
1) 2,494,800
2) 4,989,600
3) 19,958,400
4) 39,916,800

19 What is the third term in the expansion of $(2x - 3)^5$?
1) $720x^3$
2) $180x^3$
3) $-540x^2$
4) $-1080x^2$

20 Angle θ is in standard position and $(-4, 0)$ is a point on the terminal side of θ. What is the value of $\sec \theta$?
1) -4
2) -1
3) 0
4) undefined

21 The domain of $f(x) = -\dfrac{3}{\sqrt{2 - x}}$ is the set of all real numbers
1) greater than 2
2) less than 2
3) except 2
4) between -2 and 2

22 Which equation could be used to solve $\dfrac{5}{x - 3} - \dfrac{2}{x} = 1$?
1) $x^2 - 6x - 3 = 0$
2) $x^2 - 6x + 3 = 0$
3) $x^2 - 6x - 6 = 0$
4) $x^2 - 6x + 6 = 0$

23 How many distinct triangles can be constructed if
$m\angle A = 30$, side $a = \sqrt{34}$, and side $b = 12$?
1) one acute triangle
2) one obtuse triangle
3) two triangles
4) none

26 A wheel has a radius of 18 inches. Which distance, to the *nearest inch*, does the wheel travel when it rotates through an angle of $\dfrac{2\pi}{5}$ radians?
1) 45
2) 23
3) 13
4) 11

24 The expression $\left(\dfrac{3}{2}x + 1\right)\left(\dfrac{3}{2}x - 1\right) - \left(\dfrac{3}{2}x - 1\right)^2$
is equivalent to
1) 0
2) $-3x$
3) $\dfrac{3}{4}x - 2$
4) $3x - 2$

27 If $f(x) = 4x^2 - x + 1$, then $f(a + 1)$ equals
1) $4a^2 - a + 6$
2) $4a^2 - a + 4$
3) $4a^2 + 7a + 6$
4) $4a^2 + 7a + 4$

25 The table below shows five numbers and their frequency of occurrence.

Number	Frequency
5	9
7	5
8	8
12	8
14	8

The interquartile range for these data is
1) 7
2) 5
3) 7 to 12
4) 6 to 13

28 If p and q vary inversely and p is 25 when q is 6, determine q when p is equal to 30.

29 Express in simplest form: $\dfrac{\dfrac{36 - x^2}{(x + 6)^2}}{\dfrac{x - 3}{x^2 + 3x - 18}}$

30 Solve $e^{4x} = 12$ algebraically for x, rounded to the *nearest hundredth*.

31 Determine, to the *nearest minute*, the degree measure of an angle of $\dfrac{5}{11}\pi$ radians.

5

32 The probability of Ashley being the catcher in a softball game is $\frac{2}{5}$. Calculate the exact probability that she will be the catcher in *exactly* five of the next six games.

33 If x is a real number, express $2xi(i - 4i^2)$ in simplest $a + bi$ form.

34 On a test that has a normal distribution of scores, a score of 57 falls one standard deviation below the mean, and a score of 81 is two standard deviations above the mean. Determine the mean score of this test.

35 The area of a parallelogram is 594, and the lengths of its sides are 32 and 46. Determine, to the *nearest tenth of a degree*, the measure of the acute angle of the parallelogram.

36 The table below shows the amount of a decaying radioactive substance that remained for selected years after 1990.

Years After 1990 (x)	0	2	5	9	14	17	19
Amount (y)	750	451	219	84	25	12	8

Write an exponential regression equation for this set of data, rounding all values to the *nearest thousandth*. Using this equation, determine the amount of the substance that remained in 2002, to the *nearest integer*.

37 Use the recursive sequence defined below to express the next three terms as fractions reduced to lowest terms.

$$a_1 = 2$$

$$a_n = 3\left(a_{n-1}\right)^{-2}$$

38 The periodic graph below can be represented by the trigonometric equation $y = a\cos bx + c$ where a, b, and c are real numbers.
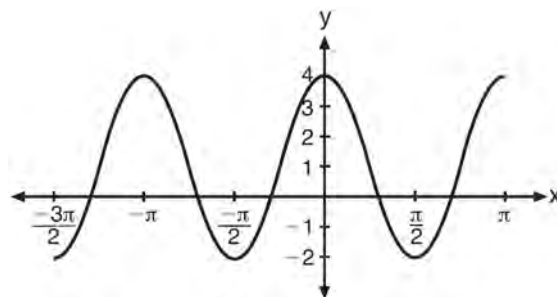
State the values of a, b, and c, and write an equation for the graph.

39 A homeowner wants to increase the size of a rectangular deck that now measures 14 feet by 22 feet. The building code allows for a deck to have a maximum area of 800 square feet. If the length and width are increased by the same number of feet, find the maximum number of whole feet each dimension can be increased and *not* exceed the building code. [Only an algebraic solution can receive full credit.]

6

0615a2

1 Which list of ordered pairs does *not* represent a one-to-one function?
 1) $(1,-1),(2,0),(3,1),(4,2)$
 2) $(1,2),(2,3),(3,4),(4,6)$
 3) $(1,3),(2,4),(3,3),(4,1)$
 4) $(1,5),(2,4),(3,1),(4,0)$

2 The terminal side of an angle measuring $\frac{4\pi}{5}$ radians lies in Quadrant
 1) I
 2) II
 3) III
 4) IV

3 If $f(x) = 2x^2 + 1$ and $g(x) = 3x - 2$, what is the value of $f(g(-2))$?
 1) -127
 2) -23
 3) 25
 4) 129

4 The expression $\sqrt[3]{27a^3} \cdot \sqrt[4]{16b^8}$ is equivalent to
 1) $6ab^2$
 2) $6ab^4$
 3) $12ab^2$
 4) $12ab^4$

5 If $x^2 = 12x - 7$ is solved by completing the square, one of the steps in the process is
 1) $(x-6)^2 = -43$
 2) $(x+6)^2 = -43$
 3) $(x-6)^2 = 29$
 4) $(x+6)^2 = 29$

6 Which expression is equivalent to $\frac{x^{-1}y^2}{x^2y^{-4}}$?
 1) $\frac{x}{y^2}$
 2) $\frac{x^3}{y^6}$
 3) $\frac{y^2}{x}$
 4) $\frac{y^6}{x^3}$

7 What is the solution of the inequality $9 - x^2 < 0$?
 1) $\{x|-3 < x < 3\}$
 2) $\{x|x > 3 \text{ or } x < -3\}$
 3) $\{x|x > 3\}$
 4) $\{x|x < -3\}$

8 What is the area of a parallelogram that has sides measuring 8 cm and 12 cm and includes an angle of 120°?
 1) $24\sqrt{3}$
 2) $48\sqrt{3}$
 3) $83\sqrt{3}$
 4) $96\sqrt{3}$

9 The expression $\frac{5}{4-\sqrt{11}}$ is equivalent to
 1) $4 + \sqrt{11}$
 2) $\frac{20 + 5\sqrt{11}}{27}$
 3) $4 - \sqrt{11}$
 4) $\frac{20 - 5\sqrt{11}}{27}$

1

10 Given y varies inversely as x, when y is multiplied by $\frac{1}{2}$, then x is multiplied by

1) $\frac{1}{2}$

2) 2

3) $-\frac{1}{2}$

4) -2

11 What is the total number of different nine-letter arrangements that can be formed using the letters in the word "TENNESSEE"?
1) 3,780
2) 15,120
3) 45,360
4) 362,880

12 What is the fourth term of the sequence defined by

$a_1 = 3xy^5$

$a_n = \left(\dfrac{2x}{y}\right)a_{n-1}$?

1) $12x^3y^3$
2) $24x^2y^4$
3) $24x^4y^2$
4) $48x^5y$

13 What is the solution set of $|x - 2| = 3x + 10$?
1) $\{\ \}$
2) $\{-2\}$
3) $\{-6\}$
4) $\{-2, -6\}$

14 By law, a wheelchair service ramp may be inclined no more than $4.76°$. If the base of a ramp begins 15 feet from the base of a public building, which equation could be used to determine the maximum height, h, of the ramp where it reaches the building's entrance?

1) $\sin 4.76° = \dfrac{h}{15}$

2) $\sin 4.76° = \dfrac{15}{h}$

3) $\tan 4.76° = \dfrac{h}{15}$

4) $\tan 4.76° = \dfrac{15}{h}$

15 When $\frac{7}{8}x^2 - \frac{3}{4}x$ is subtracted from

$\frac{5}{8}x^2 - \frac{1}{4}x + 2$, the difference is

1) $-\frac{1}{4}x^2 - x + 2$

2) $\frac{1}{4}x^2 - x + 2$

3) $-\frac{1}{4}x^2 + \frac{1}{2}x + 2$

4) $\frac{1}{4}x^2 - \frac{1}{2}x - 2$

16 Which transformation of $y = f(x)$ moves the graph 7 units to the left and 3 units down?
1) $y = f(x + 7) - 3$
2) $y = f(x + 7) + 3$
3) $y = f(x - 7) - 3$
4) $y = f(x - 7) + 3$

17 If $\log x = 2\log a + \log b$, then x equals
1) a^2b
2) $2ab$
3) $a^2 + b$
4) $2a + b$

18 Which value is in the domain of the function graphed below, but is *not* in its range?
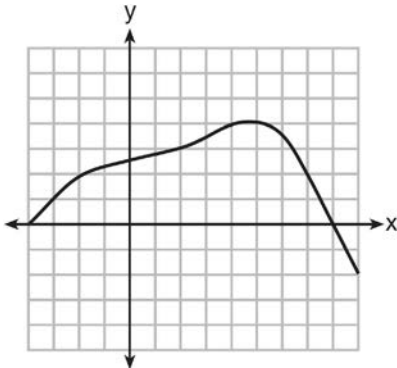
1) 0
2) 2
3) 3
4) 7

19 How many full cycles of the function $y = 3\sin 2x$ appear in π radians?

1) 1
2) 2
3) 3
4) 4

20 A theater has 35 seats in the first row. Each row has four more seats than the row before it. Which expression represents the number of seats in the nth row?

1) $35 + (n + 4)$
2) $35 + (4n)$
3) $35 + (n + 1)(4)$
4) $35 + (n - 1)(4)$

21 What is the inverse of the function $f(x) = \log_4 x$?

1) $f^{-1}(x) = x^4$
2) $f^{-1}(x) = 4^x$
3) $f^{-1}(x) = \log_x 4$
4) $f^{-1}(x) = -\log_x 4$

22 The expression $\dfrac{1 + \cos 2A}{\sin 2A}$ is equivalent to

1) $\cot A$
2) $\tan A$
3) $\sec A$
4) $1 + \cot 2A$

23 A video-streaming service can choose from six half-hour shows and four one-hour shows. Which expression could be used to calculate the number of different ways the service can choose four half-hour shows and two one-hour shows?

1) $_6P_4 \cdot _4P_2$
2) $_6P_4 + _4P_2$
3) $_6C_4 \cdot _4C_2$
4) $_6C_4 + _4C_2$

24 The roots of $3x^2 + x = 14$ are

1) imaginary
2) real, rational, and equal
3) real, rational, and unequal
4) real, irrational, and unequal

25 Circle O has a radius of 2 units. An angle with a measure of $\dfrac{\pi}{6}$ radians is in standard position. If the terminal side of the angle intersects the circle at point B, what are the coordinates of B?

1) $\left(\dfrac{\sqrt{3}}{2}, \dfrac{1}{2} \right)$
2) $\left(\sqrt{3}, 1 \right)$
3) $\left(\dfrac{1}{2}, \dfrac{\sqrt{3}}{2} \right)$
4) $\left(1, \sqrt{3} \right)$

26 What is the value of $\displaystyle\sum_{x=0}^{2}(3-2a)^x$?

1) $4a^2 - 2a + 12$

2) $4a^2 - 2a + 13$

3) $4a^2 - 14a + 12$

4) $4a^2 - 14a + 13$

27 A population, p(x), of wild turkeys in a certain area is represented by the function $p(x) = 17(1.15)^{2x}$, where x is the number of years since 2010. How many more turkeys will be in the population for the year 2015 than 2010?

1) 46

2) 49

3) 51

4) 68

28 Solve algebraically for x: $5^{4x} = 125^{x-1}$

29 In triangle ABC, determine the number of distinct triangles that can be formed if m$\angle A = 85$, side $a = 8$, and side $c = 2$. Justify your answer.

30 The probability that Kay and Joseph Dowling will have a redheaded child is 1 out of 4. If the Dowlings plan to have three children, what is the *exact* probability that only one child will have red hair?

31 If $\log_{(x+1)} 64 = 3$, find the value of x.

32 Factor completely: $x^3 - 6x^2 - 25x + 150$

33 Express $xi^8 - yi^6$ in simplest form.

34 Given the equation $3x^2 + 2x + k = 0$, state the sum and product of the roots.

35 Determine which set of data given below has the stronger linear relationship between x and y. Justify your choice.

Set A

x	1	2	3	4	5	6
y	24	30	36	51	70	86

Set B

x	1	2	3	4	5	6
y	81	64	49	36	25	16

36 Find the measure of the smallest angle, to the *nearest degree*, of a triangle whose sides measure 28, 47, and 34.

37 Solve algebraically for x: $\dfrac{3}{x} + \dfrac{x}{x+2} = -\dfrac{2}{x+2}$

38 The table below shows the final examination scores for Mr. Spear's class last year.

Test Score	Frequency
72	1
76	1
79	4
83	5
85	7
88	5
94	3

Find the population standard deviation based on these data, to the *nearest hundredth*. Determine the number of students whose scores are within one population standard deviation of the mean.

39 In the interval $0° \le \theta < 360°$, solve the equation $5\cos\theta = 2\sec\theta - 3$ algebraically for all values of θ, to the *nearest tenth of a degree*.

4

0815a2

1 What are the zeros of the polynomial function graphed below?
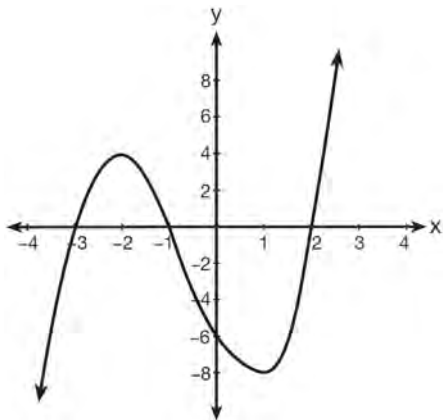
1) $\{-3,-1,2\}$
2) $\{3,1,-2\}$
3) $\{4,-8\}$
4) $\{-6\}$

2 A study compared the number of years of education a person received and that person's average yearly salary. It was determined that the relationship between these two quantities was linear and the correlation coefficient was 0.91. Which conclusion can be made based on the findings of this study?
1) There was a weak relationship.
2) There was a strong relationship.
3) There was no relationship.
4) There was an unpredictable relationship.

3 What is the value of $4x^{\frac{1}{2}}+x^{0}+x^{-\frac{1}{4}}$ when $x = 16$?
1) $7\dfrac{1}{2}$
2) $9\dfrac{1}{2}$
3) $16\dfrac{1}{2}$
4) $17\dfrac{1}{2}$

4 The expression $\sqrt[4]{81x^2y^5}$ is equivalent to
1) $3x^{\frac{1}{2}}y^{\frac{5}{4}}$
2) $3x^{\frac{1}{2}}y^{\frac{4}{5}}$
3) $9xy^{\frac{5}{2}}$
4) $9xy^{\frac{2}{5}}$

5 The exact value of csc 120° is
1) $\dfrac{2\sqrt{3}}{3}$
2) 2
3) $-\dfrac{2\sqrt{3}}{3}$
4) -2

6 Which statement about the equation $3x^2 + 9x - 12 = 0$ is true?
1) The product of the roots is −12.
2) The product of the roots is −4.
3) The sum of the roots is 3.
4) The sum of the roots is −9.

7 A scholarship committee rewards the school's top math students. The amount of money each winner receives is inversely proportional to the number of scholarship recipients. If there are three winners, they each receive $400. If there are eight winners, how much money will each winner receive?
1) $1067
2) $400
3) $240
4) $150

8 What is the value of $\tan\left(\text{Arc}\cos\dfrac{15}{17}\right)$?

1) $\dfrac{8}{15}$

2) $\dfrac{8}{17}$

3) $\dfrac{15}{8}$

4) $\dfrac{17}{8}$

9 The table below displays the number of siblings of each of the 20 students in a class.

Number of Siblings	Frequency
0	2
1	5
2	7
3	4
4	2

What is the population standard deviation, to the *nearest hundredth*, for this group?
1) 1.11
2) 1.12
3) 1.14
4) 1.15

10 An arithmetic sequence has a first term of 10 and a sixth term of 40. What is the 20th term of this sequence?
1) 105
2) 110
3) 124
4) 130

11 Yusef deposits $50 into a savings account that pays 3.25% interest compounded quarterly. The amount, A, in his account can be determined by the formula $A = P\left(1 + \dfrac{r}{n}\right)^{nt}$, where P is the initial amount invested, r is the interest rate, n is the number of times per year the money is compounded, and t is the number of years for which the money is invested. What will his investment be worth in 12 years if he makes no other deposits or withdrawals?
1) $55.10
2) $73.73
3) $232.11
4) $619.74

12 How many distinct ways can the eleven letters in the word "TALLAHASSEE" be arranged?
1) 831,600
2) 1,663,200
3) 3,326,400
4) 5,702,400

13 A customer will select three different toppings for a supreme pizza. If there are nine different toppings to choose from, how many different supreme pizzas can be made?
1) 12
2) 27
3) 84
4) 504

14 Which values of x in the interval $0° \le x < 360°$ satisfy the equation $2\sin^2 x + \sin x - 1 = 0$?
1) $\{30°, 270°\}$
2) $\{30°, 150°, 270°\}$
3) $\{90°, 210°, 330°\}$
4) $\{90°, 210°, 270°, 330°\}$

15 Expressed as a function of a positive acute angle, $\sin 230°$ is equal to
1) $-\sin 40°$
2) $-\sin 50°$
3) $\sin 40°$
4) $\sin 50°$

16 Which equation represents a circle with its center at $(2,-3)$ and that passes through the point $(6,2)$?
1) $(x-2)^2 + (y+3)^2 = \sqrt{41}$
2) $(x+2)^2 + (y-3)^2 = \sqrt{41}$
3) $(x-2)^2 + (y+3)^2 = 41$
4) $(x+2)^2 + (y-3)^2 = 41$

17 What is the domain of the function $g(x) = 3^x - 1$?
1) $(-\infty, 3]$
2) $(-\infty, 3)$
3) $(-\infty, \infty)$
4) $(-1, \infty)$

18 The expression $\dfrac{3 - \sqrt{8}}{\sqrt{3}}$ is equivalent to
1) $\dfrac{\sqrt{3} - 2\sqrt{6}}{\sqrt{3}}$
2) $-\sqrt{3} + \dfrac{2}{3}\sqrt{6}$
3) $\dfrac{3 - \sqrt{24}}{3}$
4) $\sqrt{3} - \dfrac{2}{3}\sqrt{6}$

19 What is the period of the graph of the equation $y = \dfrac{1}{3}\sin 2x$?
1) $\dfrac{1}{3}$
2) 2
3) π
4) 6π

20 The first four terms of the sequence defined by $a_1 = \dfrac{1}{2}$ and $a_{n+1} = 1 - a_n$ are
1) $\dfrac{1}{2}, \dfrac{1}{2}, \dfrac{1}{2}, \dfrac{1}{2}$
2) $\dfrac{1}{2}, 1, 1\dfrac{1}{2}, 2$
3) $\dfrac{1}{2}, \dfrac{1}{4}, \dfrac{1}{8}, \dfrac{1}{16}$
4) $\dfrac{1}{2}, 1\dfrac{1}{2}, 2\dfrac{1}{2}, 3\dfrac{1}{2}$

21 The scores on a standardized exam have a mean of 82 and a standard deviation of 3.6. Assuming a normal distribution, a student's score of 91 would rank
1) below the 75th percentile
2) between the 75th and 85th percentiles
3) between the 85th and 95th percentiles
4) above the 95th percentile

22 If $\cos\theta = \dfrac{3}{4}$, then what is $\cos 2\theta$?
1) $\dfrac{1}{8}$
2) $\dfrac{9}{16}$
3) $-\dfrac{1}{8}$
4) $\dfrac{3}{2}$

23 If $m = \{(-1,1),(1,1),(-2,4),(2,4),(-3,9),(3,9)\}$, which statement is true?
1) m and its inverse are both functions.
2) m is a function and its inverse is not a function.
3) m is not a function and its inverse is a function.
4) Neither m nor its inverse is a function.

24 The expression $\sqrt{-180x^{16}}$ is equivalent to
1) $-6x^4\sqrt{5}$
2) $-6x^8\sqrt{5}$
3) $6x^4 i\sqrt{5}$
4) $6x^8 i\sqrt{5}$

25 The ninth term of the expansion of $(3x + 2y)^{15}$ is

   1) $\quad _{15}C_9(3x)^6(2y)^9$

   2) $\quad _{15}C_9(3x)^9(2y)^6$

   3) $\quad _{15}C_8(3x)^7(2y)^8$

   4) $\quad _{15}C_8(3x)^8(2y)^7$

26 Six people met at a dinner party, and each person shook hands once with everyone there. Which expression represents the total number of handshakes?

   1) $6!$

   2) $6! \cdot 2!$

   3) $\dfrac{6!}{2!}$

   4) $\dfrac{6!}{4! \cdot 2!}$

27 Which value of k will make $x^2 - \dfrac{1}{4}x + k$ a perfect square trinomial?

   1) $\dfrac{1}{64}$

   2) $\dfrac{1}{16}$

   3) $\dfrac{1}{8}$

   4) $\dfrac{1}{4}$

28 Determine, to the *nearest minute*, the number of degrees in an angle whose measure is 2.5 radians.

29 Solve for x: $\dfrac{1}{16} = 2^{3x-1}$

30 If $f(x) = x^2 - x$ and $g(x) = x + 1$, determine $f(g(x))$ in simplest form.

31 The probability of winning a game is $\dfrac{2}{3}$.

Determine the probability, expressed as a fraction, of winning *exactly* four games if seven games are played.

32 In a circle, an arc length of 6.6 is intercepted by a central angle of $\dfrac{2}{3}$ radians. Determine the length of the radius.

33 Show that $\dfrac{\sec^2 x - 1}{\sec^2 x}$ is equivalent to $\sin^2 x$.

34 Solve algebraically for the exact values of x:
$$\dfrac{5x}{2} = \dfrac{1}{x} + \dfrac{x}{4}$$

35 Simplify: $\displaystyle\sum_{a=1}^{4}\left(x - a^2\right)$.

36 In a triangle, two sides that measure 8 centimeters and 11 centimeters form an angle that measures 82°. To the *nearest tenth of a degree*, determine the measure of the *smallest* angle in the triangle.

37 Solve the equation $2x^3 - x^2 - 8x + 4 = 0$ algebraically for all values of x.

38 Solve algebraically for x: $|3x - 5| - x < 17$

39 Solve algebraically, to the *nearest hundredth*, for all values of x:
$$\log_2(x^2 - 7x + 12) - \log_2(2x - 10) = 3$$

0116a2

1 A survey is to be conducted in a small upstate village to determine whether or not local residents should fund construction of a skateboard park by raising taxes. Which segment of the population would provide the most unbiased responses?
1) a club of local skateboard enthusiasts
2) senior citizens living on fixed incomes
3) a group opposed to any increase in taxes
4) every tenth person 18 years of age or older walking down Main St.

2 Which angle does *not* terminate in Quadrant IV when drawn on a unit circle in standard position?
1) $-300°$
2) $-50°$
3) $280°$
4) $1030°$

3 The expression $\dfrac{\dfrac{1}{x} + \dfrac{3}{y}}{\dfrac{2}{xy}}$ is equivalent to

1) $\dfrac{3}{2}$

2) $\dfrac{3x + y}{2xy}$

3) $\dfrac{3xy}{2}$

4) $\dfrac{3x + y}{2}$

4 Which relation does *not* represent a function?

1) Domain   Range

2) Domain   Range

3) Domain   Range

4) Domain   Range

1
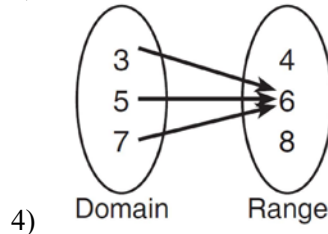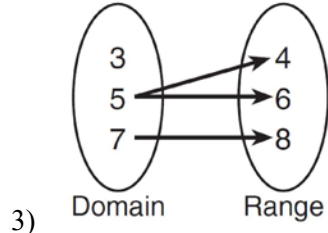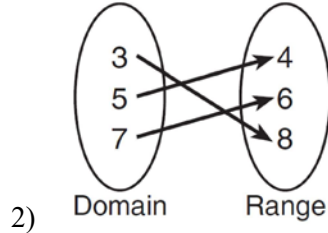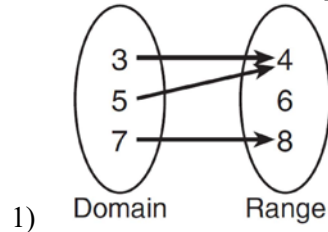
5 In the diagram below, the spinner is divided into eight equal regions.

Which expression represents the probability of the spinner landing on *B exactly* three times in five spins?

1) $_8C_3\left(\dfrac{1}{5}\right)^3\left(\dfrac{4}{5}\right)^5$

2) $_8C_3\left(\dfrac{1}{5}\right)^5\left(\dfrac{4}{5}\right)^3$

3) $_5C_3\left(\dfrac{1}{8}\right)^2\left(\dfrac{7}{8}\right)^3$

4) $_5C_3\left(\dfrac{1}{8}\right)^3\left(\dfrac{7}{8}\right)^2$

6 The expression $\sqrt[3]{27a^{-6}b^3c^2}$ is equivalent to

1) $\dfrac{3bc^{\frac{2}{3}}}{a^2}$

2) $\dfrac{3b^9c^6}{a^{18}}$

3) $\dfrac{3b^6c^5}{a^3}$

4) $\dfrac{3b\sqrt[3]{3c^2}}{a^2}$

7 The amount of money in an account can be determined by the formula $A = Pe^{rt}$, where P is the initial investment, r is the annual interest rate, and t is the number of years the money was invested. What is the value of a \$5000 investment after 18 years, if it was invested at 4% interest compounded continuously?

1) \$9367.30
2) \$9869.39
3) \$10,129.08
4) \$10,272.17

8 What is $\dfrac{x}{x-1} - \dfrac{1}{2-2x}$ expressed as a single fraction?

1) $\dfrac{x+1}{x-1}$

2) $\dfrac{2x-1}{2-2x}$

3) $\dfrac{2x+1}{2(x-1)}$

4) $\dfrac{2x-1}{2(x-1)}$

9 What is the total number of points of intersection of the graphs of the equations $2x^2 - y^2 = 8$ and $y = x + 2$?

1) 1
2) 2
3) 3
4) 0

2
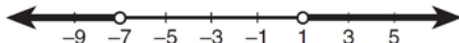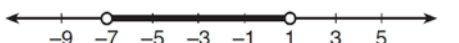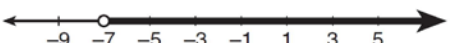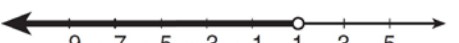
10 Given the sequence: $x, (x+y), (x+2y), \ldots$
Which expression can be used to determine the common difference of this sequence?
1) $x - (x+y)$
2) $(x+2y) - (x+y)$
3) $\dfrac{x}{(x+y)}$
4) $\dfrac{(x+2y)}{(x+y)}$

11 In a circle with a diameter of 24 cm, a central angle of $\dfrac{4\pi}{3}$ radians intercepts an arc. The length of the arc, in centimeters, is
1) 8π
2) 9π
3) 16π
4) 32π

12 Which graph is the solution to the inequality $4|2x+6| - 5 < 27$?
1) ![number line from -9 to 5]
2) ![number line from -9 to 5]
3) ![number line from -9 to 5]
4) ![number line from -9 to 5]

13 What is the sum of the roots of the equation $-3x^2 + 6x - 2 = 0$?
1) $\dfrac{2}{3}$
2) 2
3) $-\dfrac{2}{3}$
4) -2

14 The scores of 1000 students on a standardized test were normally distributed with a mean of 50 and a standard deviation of 5. What is the expected number of students who had scores greater than 60?
1) 1.7
2) 23
3) 46
4) 304

15 If $T = \dfrac{10x^2}{y}$, then $\log T$ is equivalent to
1) $(1 + 2\log x) - \log y$
2) $\log(1 + 2x) - \log y$
3) $(1 - 2\log x) + \log y$
4) $2(1 - \log x) + \log y$

16 Which statement regarding correlation is *not* true?
1) The closer the absolute value of the correlation coefficient is to one, the closer the data conform to a line.
2) A correlation coefficient measures the strength of the linear relationship between two variables.
3) A negative correlation coefficient indicates that there is a weak relationship between two variables.
4) A relation for which most of the data fall close to a line is considered strong.

17 What is the value of $\displaystyle\sum_{n=1}^{3} \cos\dfrac{n\pi}{2}$?
1) 1
2) -1
3) 0
4) $-\dfrac{1}{2}$

18 The roots of the equation $4(x^2 - 1) = -3x$ are
1) imaginary
2) real, rational, equal
3) real, rational, unequal
4) real, irrational, unequal

19 If $f(x) = 2x^2 - 3x + 4$, then $f(x+3)$ is equal to
1) $2x^2 - 3x + 7$
2) $2x^2 - 3x + 13$
3) $2x^2 + 9x + 13$
4) $2x^2 + 9x + 25$

20 The expression $x(3i^2)^3 + 2xi^{12}$ is equivalent to
1) $2x + 27xi$
2) $-7x$
3) $-25x$
4) $-29x$

21 If the terminal side of angle θ passes through point $(-3,-4)$, what is the value of $\sec \theta$?
1) $\dfrac{5}{3}$
2) $-\dfrac{5}{3}$
3) $\dfrac{5}{4}$
4) $-\dfrac{5}{4}$

22 When the inverse of $\tan \theta$ is sketched, its domain is
1) $-1 \le \theta \le 1$
2) $-\dfrac{\pi}{2} \le \theta \le \dfrac{\pi}{2}$
3) $0 \le \theta \le \pi$
4) $-\infty < \theta < \infty$

23 What is the third term of the recursive sequence below?
$$a_1 = -6$$
$$a_n = \frac{1}{2} a_{n-1} - n$$
1) $-\dfrac{11}{2}$
2) $-\dfrac{5}{2}$
3) $-\dfrac{1}{2}$
4) -4

24 What is the equation of a circle with its center at $(0,-2)$ and passing through the point $(3,-5)$?
1) $x^2 + (y+2)^2 = 9$
2) $(x+2)^2 + y^2 = 9$
3) $x^2 + (y+2)^2 = 18$
4) $(x+2)^2 + y^2 = 18$

25 If angles A and B are complementary, then $\sec B$ equals
1) $\csc(90° - B)$
2) $\csc(B - 90°)$
3) $\cos(B - 90°)$
4) $\cos(90° - B)$

26 The legs of a right triangle are represented by $x + \sqrt{2}$ and $x - \sqrt{2}$. The length of the hypotenuse of the right triangle is represented by

1) $\sqrt{2x^2 + 4}$
2) $2x^2 + 4$
3) $x\sqrt{2} + 2$
4) $\sqrt{x^2 - 2}$

27 What are the amplitude and the period of the graph represented by the equation $y = -3\cos\dfrac{\theta}{3}$?

1) amplitude: -3; period: $\dfrac{\pi}{3}$
2) amplitude: -3; period: 6π
3) amplitude: 3; period: $\dfrac{\pi}{3}$
4) amplitude: 3; period: 6π

28 Solve algebraically for x: $\sqrt{2x + 1} + 4 = 8$

29 Factor completely: $x^3 + 3x^2 + 2x + 6$

30 Solve algebraically for the *exact* value of x:
$\log_8 16 = x + 1$

31 Determine how many eleven-letter arrangements can be formed from the word "CATTARAUGUS."

32 Express $-130°$ in radian measure, to the *nearest hundredth*.

33 Determine the area, to the *nearest integer*, of $\triangle SRO$ shown below.
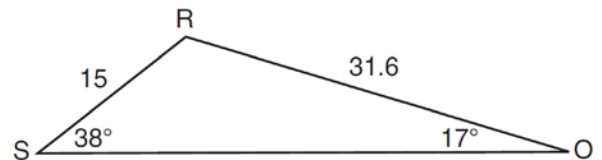
34 Prove that the equation shown below is an identity for all values for which the functions are defined:
$\csc\theta \cdot \sin^2\theta \cdot \cot\theta = \cos\theta$

35 Find the difference when $\dfrac{4}{3}x^3 - \dfrac{5}{8}x^2 + \dfrac{7}{9}x$ is subtracted from $2x^3 + \dfrac{3}{4}x^2 - \dfrac{2}{9}$.

36 Find the exact roots of $x^2 + 10x - 8 = 0$ by completing the square.

5

37 The table below gives the relationship between x and y.

x	1	2	3	4	5
y	4.2	33.5	113.1	268.1	523.6

Use exponential regression to find an equation for y as a function of x, rounding all values to the *nearest hundredth*. Using this equation, predict the value of x if y is 426.21, rounding to the *nearest tenth*. [Only an algebraic solution can receive full credit.]

38 Solve the equation $\cos 2x = \cos x$ algebraically for all values of x in the interval $0° \leq x < 360°$.

39 Given: $DC = 10$, $AG = 15$, $BE = 6$, $FE = 10$, $m\angle ABG = 40$, $m\angle GBD = 90$, $m\angle C < 90$, $\overline{BE} \cong \overline{ED}$, and $\overline{GF} \cong \overline{FB}$
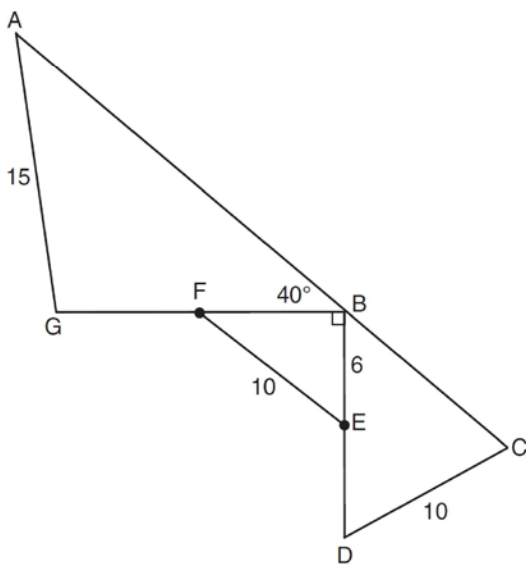
Find $m\angle A$ to the *nearest tenth*. Find BC to the *nearest tenth*.

fall09a2
Answer Section

1 ANS: 2
$(3 - 7i)(3 - 7i) = 9 - 21i - 21i + 49i^2 = 9 - 42i - 49 = -40 - 42i$

PTS: 2   REF: fall0901a2   STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers

2 ANS: 3
$f(4) = \dfrac{1}{2}(4) - 3 = -1.$ $g(-1) = 2(-1) + 5 = 3$

PTS: 2   REF: fall0902a2   STA: A2.A.42   TOP: Compositions of Functions
KEY: numbers

3 ANS: 1

$\tan \theta - \sqrt{3} = 0$.

$\tan \theta = \sqrt{3}$

$\theta = \tan^{-1} \sqrt{3}$

$\theta = 60, 240$
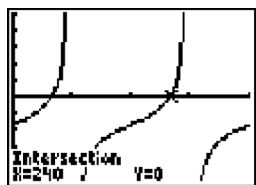
PTS: 2   REF: fall0903a2   STA: A2.A.68   TOP: Trigonometric Equations
KEY: basic

4 ANS: 4
Students entering the library are more likely to spend more time studying, creating bias.

PTS: 2   REF: fall0904a2   STA: A2.S.2   TOP: Analysis of Data

5 ANS: 1
$6x - 7 \le 5$ $6x - 7 \ge -5$

$6x \le 12$ $6x \ge 2$

$x \le 2$ $x \ge \dfrac{1}{3}$

PTS: 2   REF: fall0905a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph

6 ANS: 4
(4) fails the horizontal line test. Not every element of the range corresponds to only one element of the domain.

PTS: 2   REF: fall0906a2   STA: A2.A.43   TOP: Defining Functions

7 ANS: 2

$$K = \frac{1}{2}(10)(18)\sin 120 = 45\sqrt{3} \approx 78$$

 PTS: 2   REF: fall0907a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
 KEY: basic
8 ANS: 4   PTS: 2   REF: fall0908a2   STA: A2.A.38
 TOP: Defining Functions   KEY: graphs
9 ANS: 2

$$8^2 = 64$$

 PTS: 2   REF: fall0909a2   STA: A2.A.18   TOP: Evaluating Logarithmic Expressions
10 ANS: 3   PTS: 2   REF: fall0910a2   STA: A2.A.76
 TOP: Angle Sum and Difference Identities   KEY: simplifying
11 ANS: 3

n	0	1	2	Σ
$n^2 + 2^n$	$0^2 + 2^0 = 1$	$1^2 + 2^2 = 3$	$2^2 + 2^2 = 8$	12

$$2 \times 12 = 24$$

 PTS: 2   REF: fall0911a2   STA: A2.N.10   TOP: Sigma Notation
 KEY: basic
12 ANS: 3

$$S = \frac{-b}{a} = \frac{-(-3)}{4} = \frac{3}{4}.\ P = \frac{c}{a} = \frac{-8}{4} = -2$$

 PTS: 2   REF: fall0912a2   STA: A2.A.21   TOP: Roots of Quadratics
 KEY: basic
13 ANS: 3   PTS: 2   REF: fall0913a2   STA: A2.A.65
 TOP: Graphing Trigonometric Functions
14 ANS: 1   PTS: 2   REF: fall0914a2   STA: A2.A.9
 TOP: Negative and Fractional Exponents
15 ANS: 1
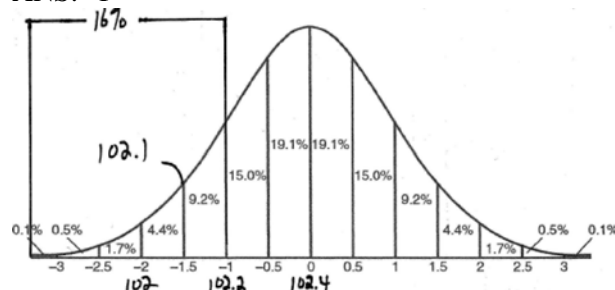
 PTS: 2   REF: fall0915a2   STA: A2.S.5   TOP: Normal Distributions
 KEY: interval

16 ANS: 2

$f^{-1}(x) = \log_4 x$

PTS: 2   REF: fall0916a2   STA: A2.A.54   TOP: Graphing Logarithmic Functions

17 ANS: 4

$6x - x^3 - x^2 = -x(x^2 + x - 6) = -x(x + 3)(x - 2)$

PTS: 2   REF: fall0917a2   STA: A2.A.7   TOP: Factoring Polynomials
KEY: single variable

18 ANS: 4

$4ab\sqrt{2b} - 3a\sqrt{9b^2}\sqrt{2b} + 7ab\sqrt{6b} = 4ab\sqrt{2b} - 9ab\sqrt{2b} + 7ab\sqrt{6b} = -5ab\sqrt{2b} + 7ab\sqrt{6b}$

PTS: 2   REF: fall0918a2   STA: A2.A.14   TOP: Operations with Radicals
KEY: with variables | index = 2

19 ANS: 1

${}_5C_3(3x)^2(-2)^3 = 10 \cdot 9x^2 \cdot -8 = -720x^2$

PTS: 2   REF: fall0919a2   STA: A2.A.36   TOP: Binomial Expansions

20 ANS: 2

$$\frac{\dfrac{x}{4} - \dfrac{1}{x}}{\dfrac{1}{2x} + \dfrac{1}{4}} = \frac{\dfrac{x^2 - 4}{4x}}{\dfrac{2x + 4}{8x}} = \frac{(x + 2)(x - 2)}{4x} \times \frac{8x}{2(x + 2)} = x - 2$$

PTS: 2   REF: fall0920a2   STA: A2.A.17   TOP: Complex Fractions

21 ANS: 4

$2\log_4(5x) = 3$

$\log_4(5x) = \dfrac{3}{2}$

$5x = 4^{\frac{3}{2}}$

$5x = 8$

$x = \dfrac{8}{5}$

PTS: 2   REF: fall0921a2   STA: A2.A.28   TOP: Logarithmic Equations
KEY: advanced

22 ANS: 4

$s = \theta r = 2 \cdot 4 = 8$

PTS: 2   REF: fall0922a2   STA: A2.A.61   TOP: Arc Length
KEY: arc length

23 ANS: 3   PTS: 2   REF: fall0923a2   STA: A2.A.39
TOP: Domain and Range   KEY: real domain

24 ANS: 3

PTS: 2 REF: fall0924a2 STA: A2.S.4 TOP: Dispersion
KEY: variance

25 ANS: 4 PTS: 2 REF: fall0925a2 STA: A2.S.10
TOP: Permutations

26 ANS: 2 PTS: 2 REF: fall0926a2 STA: A2.A.46
TOP: Transformations with Functions and Relations

27 ANS: 4

$y - 2\sin\theta = 3$

$y = 2\sin\theta + 3$

$f(\theta) = 2\sin\theta + 3$

PTS: 2 REF: fall0927a2 STA: A2.A.40 TOP: Functional Notation

28 ANS:

$$\frac{5(3+\sqrt{2})}{7}. \quad \frac{5}{3-\sqrt{2}} \times \frac{3+\sqrt{2}}{3+\sqrt{2}} = \frac{5(3+\sqrt{2})}{9-2} = \frac{5(3+\sqrt{2})}{7}$$

PTS: 2 REF: fall0928a2 STA: A2.N.5 TOP: Rationalizing Denominators

29 ANS:

$(x+3)^2 + (y-4)^2 = 25$

PTS: 2 REF: fall0929a2 STA: A2.A.49 TOP: Writing Equations of Circles

30 ANS:

no solution. $\quad \dfrac{4x}{x-3} = 2 + \dfrac{12}{x-3}$

$$\frac{4x-12}{x-3} = 2$$

$$\frac{4(x-3)}{x-3} = 2$$

$$4 \neq 2$$

PTS: 2 REF: fall0930a2 STA: A2.A.23 TOP: Solving Rationals
KEY: rational solutions

31 ANS:

```
3.45*180/π
        197.6704393
Ans▶DMS
     197°40'13.582"
■
```

197°40'. $3.45 \times \dfrac{180}{\pi} \approx 197°40'$.

PTS: 2   REF: fall0931a2   STA: A2.M.2   TOP: Radian Measure
KEY: degrees

32 ANS:

```
1200e^(.065*10)
        2298.648995
■
```

2,298.65.

PTS: 2   REF: fall0932a2   STA: A2.A.12   TOP: Evaluating Exponential Expressions

33 ANS:

$\dfrac{\sqrt{13}}{2}$. $\sin \theta = \dfrac{y}{\sqrt{x^2 + y^2}} = \dfrac{2}{\sqrt{(-3)^2 + 2^2}} = \dfrac{2}{\sqrt{13}}$. $\csc \theta = \dfrac{\sqrt{13}}{2}$.

PTS: 2   REF: fall0933a2   STA: A2.A.62   TOP: Determining Trigonometric Functions

34 ANS:
$-3, -5, -8, -12$

PTS: 2   REF: fall0934a2   STA: A2.A.33   TOP: Recursive Sequences

35 ANS:

```
9 nCr 2*20 nCr 3
              41040
```

41,040.

PTS: 2   REF: fall0935a2   STA: A2.S.12   TOP: Sample Space

36 ANS:

$3 \pm \sqrt{7}$. $2x^2 - 12x + 4 = 0$

$x^2 - 6x + 2 = 0$

$x^2 - 6x = -2$

$x^2 - 6x + 9 = -2 + 9$

$(x - 3)^2 = 7$

$x - 3 = \pm \sqrt{7}$

$x = 3 \pm \sqrt{7}$

PTS: 4   REF: fall0936a2   STA: A2.A.24   TOP: Completing the Square

37 ANS:

$\pm\dfrac{3}{2}, -\dfrac{1}{2}$. $8x^3 + 4x^2 - 18x - 9 = 0$

$4x^2(2x + 1) - 9(2x + 1) = 0$

$(4x^2 - 9)(2x + 1) = 0$

$4x^2 - 9 = 0 \text{ or } 2x + 1 = 0$

$(2x + 3)(2x - 3) = 0 \quad x = -\dfrac{1}{2}$

$x = \pm\dfrac{3}{2}$

PTS: 4   REF: fall0937a2   STA: A2.A.26   TOP: Solving Polynomial Equations

38 ANS:

$y = 2.001x^{2.298}$, 1,009. $y = 2.001(15)^{2.298} \approx 1009$

PTS: 4   REF: fall0938a2   STA: A2.S.7   TOP: Power Regression

39 ANS:

101.43, 12.

$r^2 = 25^2 + 85^2 - 2(25)(85)\cos 125.$

$r^2 \approx 10287.7$
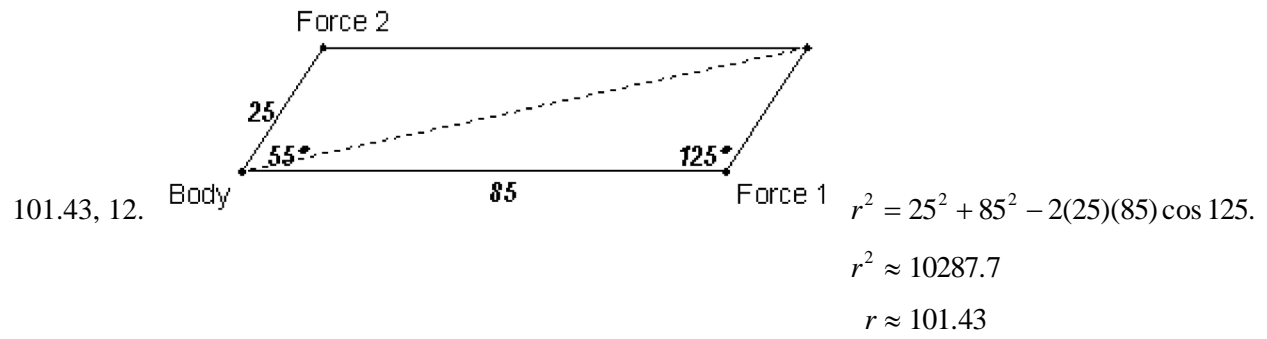
$r \approx 101.43$

$$\frac{2.5}{\sin x} = \frac{101.43}{\sin 125}$$

$x \approx 12$

PTS: 6   REF: fall0939a2   STA: A2.A.73   TOP: Vectors

0610a2
Answer Section

1 ANS: 3   PTS: 2   REF: 061001a2   STA: A2.A.30
   TOP: Sequences
2 ANS: 2
   $$\frac{11\pi}{12} \cdot \frac{180}{\pi} = 165$$

   PTS: 2   REF: 061002a2   STA: A2.M.2   TOP: Radian Measure
   KEY: degrees
3 ANS: 3

   $$\frac{3^{-2}}{(-2)^{-3}} = \frac{\frac{1}{9}}{-\frac{1}{8}} = -\frac{8}{9}$$

   PTS: 2   REF: 061003a2   STA: A2.N.1   TOP: Negative and Fractional Exponents
4 ANS: 1   PTS: 2   REF: 061004a2   STA: A2.A.52
   TOP: Identifying the Equation of a Graph
5 ANS: 4   PTS: 2   REF: 061005a2   STA: A2.A.50
   TOP: Solving Polynomial Equations
6 ANS: 3
   $$\sqrt{-300} = \sqrt{100}\sqrt{-1}\sqrt{3}$$

   PTS: 2   REF: 061006a2   STA: A2.N.6   TOP: Square Roots of Negative Numbers
7 ANS: 3   PTS: 2   REF: 061007a2   STA: A2.S.9
   TOP: Differentiating Permutations and Combinations
8 ANS: 4
   $$12x^4 + 10x^3 - 12x^2 = 2x^2(6x^2 + 5x - 6) = 2x^2(2x + 3)(3x - 2)$$

   PTS: 2   REF: 061008a2   STA: A2.A.7   TOP: Factoring Polynomials
   KEY: single variable
9 ANS: 4
   $$\frac{3 \pm \sqrt{(-3)^2 - 4(1)(-9)}}{2(1)} = \frac{3 \pm \sqrt{45}}{2} = \frac{3 \pm 3\sqrt{5}}{2}$$

   PTS: 2   REF: 061009a2   STA: A2.A.25   TOP: Quadratic Formula
10 ANS: 1

   $$2\log x - (3\log y + \log z) = \log x^2 - \log y^3 - \log z = \log \frac{x^2}{y^3 z}$$

   PTS: 2   REF: 061010a2   STA: A2.A.19   TOP: Properties of Logarithms
11 ANS: 2   PTS: 2   REF: 061011a2   STA: A2.A.10
   TOP: Fractional Exponents as Radicals

12 ANS: 1

$$\frac{\sqrt{3}+5}{\sqrt{3}-5} \cdot \frac{\sqrt{3}+5}{\sqrt{3}+5} = \frac{3+5\sqrt{3}+5\sqrt{3}+25}{3-25} = \frac{28+10\sqrt{3}}{-22} = -\frac{14+5\sqrt{3}}{11}$$

PTS: 2　　　REF: 061012a2　　STA: A2.N.5　　TOP: Rationalizing Denominators

13 ANS: 1　　　PTS: 2　　　REF: 061013a2　　STA: A2.A.38
TOP: Defining Functions

14 ANS: 3

Cofunctions tangent and cotangent are complementary

PTS: 2　　　REF: 061014a2　　STA: A2.A.58　　TOP: Cofunction Trigonometric Relationships

15 ANS: 3

$$4^{x^2+4x} = 2^{-6}. \qquad 2x^2 + 8x = -6$$

$$(2^2)^{x^2+4x} = 2^{-6} \qquad 2x^2 + 8x + 6 = 0$$

$$2^{2x^2+8x} = 2^{-6} \qquad x^2 + 4x + 3 = 0$$

$$(x+3)(x+1) = 0$$

$$x = -3 \ x = -1$$

PTS: 2　　　REF: 061015a2　　STA: A2.A.27　　TOP: Exponential Equations
KEY: common base shown

16 ANS: 2

$$x^2 - 2x + y^2 + 6y = -3$$

$$x^2 - 2x + 1 + y^2 + 6y + 9 = -3 + 1 + 9$$

$$(x-1)^2 + (y+3)^2 = 7$$

PTS: 2　　　REF: 061016a2　　STA: A2.A.47　　TOP: Equations of Circles

17 ANS: 1

$$y \geq x^2 - x - 6$$

$$y \geq (x-3)(x+2)$$

PTS: 2　　　REF: 061017a2　　STA: A2.A.4　　TOP: Quadratic Inequalities
KEY: two variables

18 ANS: 1　　　PTS: 2　　　REF: 061018a2　　STA: A2.A.22
TOP: Solving Radicals　　　　KEY: extraneous solutions

19 ANS: 1　　　PTS: 2　　　REF: 061019a2　　STA: A2.N.7
TOP: Imaginary Numbers

20 ANS: 3
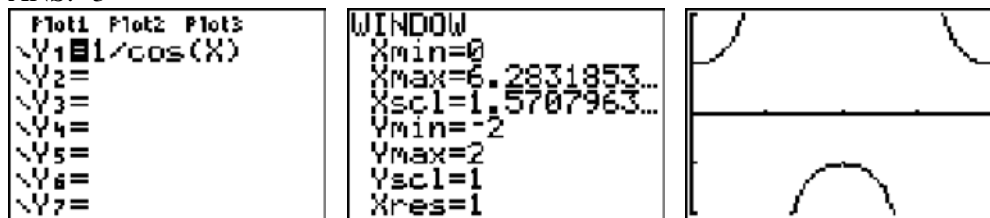
PTS: 2   REF: 061020a2   STA: A2.A.71   TOP: Graphing Trigonometric Functions
21 ANS: 2   PTS: 2   REF: 061021a2   STA: A2.S.8
    TOP: Correlation Coefficient
22 ANS: 3   PTS: 2   REF: 061022a2   STA: A2.A.63
    TOP: Domain and Range
23 ANS: 1
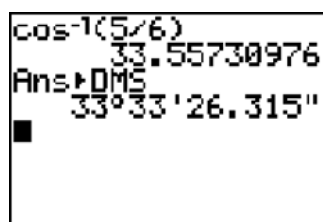
$\cos K = \dfrac{5}{6}$

$K = \cos^{-1} \dfrac{5}{6}$

$K \approx 33°33'$

PTS: 2   REF: 061023a2   STA: A2.A.55   TOP: Trigonometric Ratios
24 ANS: 1

$\cos^2 \theta - \cos 2\theta = \cos^2 \theta - (\cos^2 \theta - \sin^2 \theta) = \sin^2 \theta$

PTS: 2   REF: 061024a2   STA: A2.A.77   TOP: Double Angle Identities
    KEY: simplifying
25 ANS: 1   PTS: 2   REF: 061025a2   STA: A2.A.34
    TOP: Sigma Notation
26 ANS: 4   PTS: 2   REF: 061026a2   STA: A2.A.29
    TOP: Sequences
27 ANS: 4

$\dfrac{2\pi}{b} = \dfrac{2\pi}{\frac{1}{3}} = 6\pi$

PTS: 2   REF: 061027a2   STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions   KEY: period

28 ANS:

$$b^2 - 4ac = 0$$

$$k^2 - 4(1)(4) = 0$$

$$k^2 - 16 = 0$$

$$(k + 4)(k - 4) = 0$$

$$k = \pm 4$$

PTS: 2 REF: 061028a2 STA: A2.A.2 TOP: Using the Discriminant
KEY: determine equation given nature of roots

29 ANS:
7.4

PTS: 2 REF: 061029a2 STA: A2.S.4 TOP: Dispersion
KEY: basic, group frequency distributions

30 ANS:
Sum $\dfrac{-b}{a} = -\dfrac{11}{5}$. Product $\dfrac{c}{a} = -\dfrac{3}{5}$

PTS: 2 REF: 061030a2 STA: A2.A.20 TOP: Roots of Quadratics

31 ANS:

$y = 0$
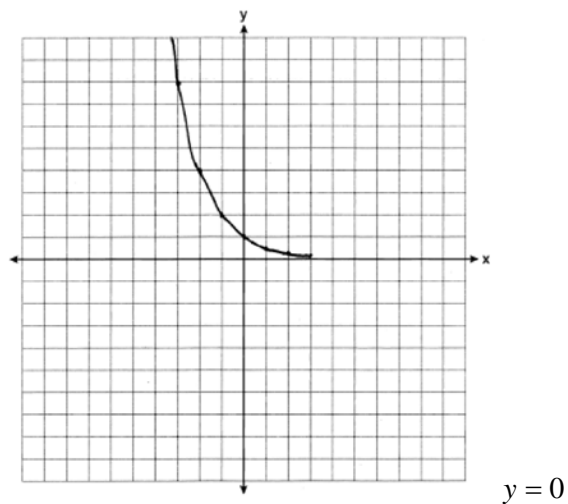
PTS: 2 REF: 061031a2 STA: A2.A.53 TOP: Graphing Exponential Functions

32 ANS:
$$5\sqrt{3x^3} - 2\sqrt{27x^3} = 5\sqrt{x^2}\sqrt{3x} - 2\sqrt{9x^2}\sqrt{3x} = 5x\sqrt{3x} - 6x\sqrt{3x} = -x\sqrt{3x}$$

PTS: 2 REF: 061032a2 STA: A2.N.2 TOP: Operations with Radicals

33 ANS:
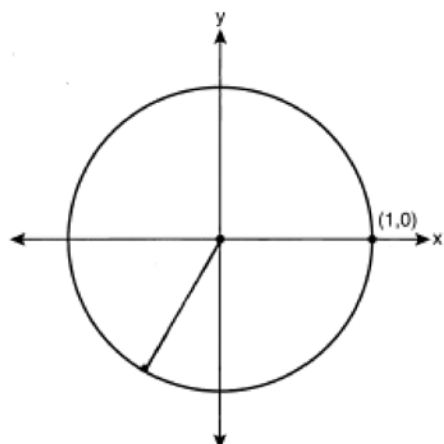
$$-\frac{\sqrt{3}}{2}$$

PTS: 2   REF: 061033a2   STA: A2.A.60   TOP: Unit Circle

34 ANS:

$K = ab\sin C = 24 \cdot 30\sin 57 \approx 604$

PTS: 2   REF: 061034a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
KEY: parallelograms

35 ANS:

$$\frac{\dfrac{1}{2} - \dfrac{4}{d}}{\dfrac{1}{d} + \dfrac{3}{2d}} = \frac{\dfrac{d-8}{2d}}{\dfrac{2d+3d}{2d^2}} = \frac{d-8}{2d} \times \frac{2d^2}{5d} = \frac{d-8}{5}$$

PTS: 2   REF: 061035a2   STA: A2.A.17   TOP: Complex Fractions

36 ANS:

0.167. $_{10}C_8 \cdot 0.6^8 \cdot 0.4^2 + {}_{10}C_9 \cdot 0.6^9 \cdot 0.4^1 + {}_{10}C_{10} \cdot 0.6^{10} \cdot 0.4^0 \approx 0.167$

PTS: 4   REF: 061036a2   STA: A2.S.15   TOP: Binomial Probability
KEY: at least or at most

37 ANS:

0, 60, 180, 300. $\quad \sin 2\theta = \sin \theta$

$$\sin 2\theta - \sin \theta = 0$$

$$2\sin \theta \cos \theta - \sin \theta = 0$$

$$\sin \theta (2\cos \theta - 1) = 0$$

$$\sin \theta = 0 \quad 2\cos \theta - 1 = 0$$

$$\theta = 0,180 \quad \cos \theta = \frac{1}{2}$$

$$\theta = 60,300$$

PTS: 4　　　　REF: 061037a2　　STA: A2.A.68　　TOP: Trigonometric Equations
KEY: double angle identities

38 ANS:

No. TENNESSEE: $\dfrac{_9P_9}{4! \cdot 2! \cdot 2!} = \dfrac{362,880}{96} = 3,780.$ VERMONT: $_7P_7 = 5,040$

PTS: 4　　　　REF: 061038a2　　STA: A2.S.10　　TOP: Permutations

39 ANS:

33. $a = \sqrt{10^2 + 6^2 - 2(10)(6)\cos 80} \approx 10.7.$ $\angle C$ is opposite the shortest side. $\dfrac{6}{\sin C} = \dfrac{10.7}{\sin 80}$

$$C \approx 33$$

PTS: 6　　　　REF: 061039a2　　STA: A2.A.73　　TOP: Law of Cosines
KEY: advanced

0810a2
Answer Section

1   ANS: 4
$(3 + \sqrt{5})(3 - \sqrt{5}) = 9 - \sqrt{25} = 4$

   PTS: 2   REF: 081001a2   STA: A2.N.4   TOP: Operations with Irrational Expressions
   KEY: without variables | index = 2
2   ANS: 1
$-420\left(\dfrac{\pi}{180}\right) = -\dfrac{7\pi}{3}$

   PTS: 2   REF: 081002a2   STA: A2.M.2   TOP: Radian Measure
   KEY: radians
3   ANS: 2   PTS: 2   REF: 081003a2   STA: A2.A.51
   TOP: Domain and Range
4   ANS: 1
$2i^2 + 3i^3 = 2(-1) + 3(-i) = -2 - 3i$

   PTS: 2   REF: 081004a2   STA: A2.N.7   TOP: Imaginary Numbers
5   ANS: 4   PTS: 2   REF: 081005a2   STA: A2.A.60
   TOP: Unit Circle
6   ANS: 3
$\dfrac{59.2}{\sin 74} = \dfrac{60.3}{\sin C}$ $180 - 78.3 = 101.7$

   $C \approx 78.3$

   PTS: 2   REF: 081006a2   STA: A2.A.75   TOP: Law of Sines - The Ambiguous Case
7   ANS: 3   PTS: 2   REF: 081007a2   STA: A2.A.64
   TOP: Using Inverse Trigonometric Functions   KEY: basic
8   ANS: 4
   $9^{3x+1} = 27^{x+2}$.

   $(3^2)^{3x+1} = (3^3)^{x+2}$

   $3^{6x+2} = 3^{3x+6}$

   $6x + 2 = 3x + 6$

   $3x = 4$

   $x = \dfrac{4}{3}$

   PTS: 2   REF: 081008a2   STA: A2.A.27   TOP: Exponential Equations
   KEY: common base not shown

9 ANS: 3

$$\frac{-7 \pm \sqrt{7^2 - 4(2)(-3)}}{2(2)} = \frac{-7 \pm \sqrt{73}}{4}$$

PTS: 2   REF: 081009a2   STA: A2.A.25   TOP: Quadratic Formula

10 ANS: 2   PTS: 2   REF: 081010a2   STA: A2.A.55
TOP: Trigonometric Ratios

11 ANS: 2

$$\left(\frac{w^{-5}}{w^{-9}} \right)^{\frac{1}{2}} = (w^4)^{\frac{1}{2}} = w^2$$

PTS: 2   REF: 081011a2   STA: A2.A.8   TOP: Negative and Fractional Exponents

12 ANS: 2
$_{15}C_8 = 6,435$

PTS: 2   REF: 081012a2   STA: A2.S.11   TOP: Combinations

13 ANS: 3
$68\% \times 50 = 34$

PTS: 2   REF: 081013a2   STA: A2.S.5   TOP: Normal Distributions
KEY: predict

14 ANS: 1
common difference is 2. $b_n = x + 2n$

$$10 = x + 2(1)$$
$$8 = x$$

PTS: 2   REF: 081014a2   STA: A2.A.29   TOP: Sequences

15 ANS: 2
$x^2 - x - 6 = 3x - 6$

$x^2 - 4x = 0$

$x(x - 4) = 0$

$x = 0, 4$

PTS: 2   REF: 081015a2   STA: A2.A.3   TOP: Quadratic-Linear Systems
KEY: equations

16 ANS: 4
$b^2 - 4ac = 3^2 - 4(9)(-4) = 9 + 144 = 153$

PTS: 2   REF: 081016a2   STA: A2.A.2   TOP: Using the Discriminant
KEY: determine nature of roots given equation

17 ANS: 4

$$7^2 = 3^2 + 5^2 - 2(3)(5)\cos A$$

$$49 = 34 - 30\cos A$$

$$15 = -30\cos A$$

$$-\frac{1}{2} = \cos A$$

$$120 = A$$

PTS: 2　　　　　REF: 081017a2　　STA: A2.A.73　　　TOP: Law of Cosines
KEY: angle, without calculator

18 ANS: 2

$$\frac{x^{-1} - 1}{x - 1} = \frac{\frac{1}{x} - 1}{x - 1} = \frac{\frac{1 - x}{x}}{x - 1} = \frac{\frac{-(x - 1)}{x}}{x - 1} = -\frac{1}{x}$$

PTS: 2　　　　　REF: 081018a2　　STA: A2.A.9　　　TOP: Negative Exponents

19 ANS: 3

$$\frac{3}{\sqrt{3a^2 b}} = \frac{3}{a\sqrt{3b}} \cdot \frac{\sqrt{3b}}{\sqrt{3b}} = \frac{3\sqrt{3b}}{3ab} = \frac{\sqrt{3b}}{ab}$$

PTS: 2　　　　　REF: 081019a2　　STA: A2.A.15　　　TOP: Rationalizing Denominators
KEY: index = 2

20 ANS: 3
(1) and (4) fail the horizontal line test and are not one-to-one. Not every element of the range corresponds to only one element of the domain. (2) fails the vertical line test and is not a function. Not every element of the domain corresponds to only one element of the range.

PTS: 2　　　　　REF: 081020a2　　STA: A2.A.43　　　TOP: Defining Functions

21 ANS: 3
$K = (10)(18)\sin 46 \approx 129$

PTS: 2　　　　　REF: 081021a2　　STA: A2.A.74　　　TOP: Using Trigonometry to Find Area
KEY: parallelograms

22 ANS: 1　　　　PTS: 2　　　　REF: 081022a2　　STA: A2.A.46
TOP: Transformations with Functions and Relations

23 ANS: 2
The roots are $-1, 2, 3$.

PTS: 2　　　　　REF: 081023a2　　STA: A2.A.50　　　TOP: Solving Polynomial Equations

24 ANS: 2　　　　PTS: 2　　　　REF: 081024a2　　STA: A2.N.8
TOP: Conjugates of Complex Numbers

25 ANS: 3

$27r^{4-1} = 64$

$$r^3 = \frac{64}{27}$$

$$r = \frac{4}{3}$$

PTS: 2 REF: 081025a2 STA: A2.A.31 TOP: Sequences

26 ANS: 3

$\text{period} = \frac{2\pi}{b} = \frac{2\pi}{3\pi} = \frac{2}{3}$

PTS: 2 REF: 081026a2 STA: A2.A.70 TOP: Graphing Trigonometric Functions
KEY: recognize

27 ANS: 3 PTS: 2 REF: 081027a2 STA: A2.A.44
TOP: Inverse of Functions KEY: equations

28 ANS:

$10ax^2 - 23ax - 5a = a(10x^2 - 23x - 5) = a(5x + 1)(2x - 5)$

PTS: 2 REF: 081028a2 STA: A2.A.7 TOP: Factoring Polynomials
KEY: multiple variables

29 ANS:

$$\sum_{n=1}^{15} 7n$$

PTS: 2 REF: 081029a2 STA: A2.A.34 TOP: Sigma Notation

30 ANS:
Controlled experiment because Howard is comparing the results obtained from an experimental sample against a control sample.

PTS: 2 REF: 081030a2 STA: A2.S.1 TOP: Analysis of Data

31 ANS:

$y = 10.596(1.586)^x$

PTS: 2 REF: 081031a2 STA: A2.S.7 TOP: Exponential Regression

32 ANS:
45, 225 $2\tan C - 3 = 3\tan C - 4$

$1 = \tan C$

$\tan^{-1} 1 = C$

$C = 45, 225$

PTS: 2 REF: 081032a2 STA: A2.A.68 TOP: Trigonometric Equations
KEY: basic

33 ANS:

$(x + 5)^2 + (y - 3)^2 = 32$

PTS: 2 REF: 081033a2 STA: A2.A.49 TOP: Writing Equations of Circles

34 ANS:

$\frac{4}{9} x^2 - \frac{4}{3} x + 1.$ $\left(\frac{2}{3} x - 1 \right)^2 = \left(\frac{2}{3} x - 1 \right)\left(\frac{2}{3} x - 1 \right) = \frac{4}{9} x^2 - \frac{2}{3} x - \frac{2}{3} x + 1 = \frac{4}{9} x^2 - \frac{4}{3} x + 1$

PTS: 2 REF: 081034a2 STA: A2.N.3 TOP: Operations with Polynomials

35 ANS:

$39{,}916{,}800.$ $\frac{{}_{12}P_{12}}{3! \cdot 2!} = \frac{479{,}001{,}600}{12} = 39{,}916{,}800$

PTS: 2 REF: 081035a2 STA: A2.S.10 TOP: Permutations

36 ANS:

$\frac{1}{3}$ $\frac{1}{x+3} - \frac{2}{3-x} = \frac{4}{x^2 - 9}$

$\frac{1}{x+3} + \frac{2}{x-3} = \frac{4}{x^2 - 9}$

$\frac{x - 3 + 2(x+3)}{(x+3)(x-3)} = \frac{4}{(x+3)(x-3)}$

$x - 3 + 2x + 6 = 4$

$3x = 1$

$x = \frac{1}{3}$

PTS: 4 REF: 081036a2 STA: A2.A.23 TOP: Solving Rationals
KEY: rational solutions

37 ANS:

$$\frac{23}{2} \qquad \cos^2 B + \sin^2 B = 1 \qquad \tan B = \frac{\sin B}{\cos B} = \frac{\dfrac{5}{\sqrt{41}}}{\dfrac{4}{\sqrt{41}}} = \frac{5}{4}$$

$$\cos^2 B + \left(\frac{5}{\sqrt{41}}\right)^2 = 1$$

$$\cos^2 B + \frac{25}{41} = \frac{41}{41}$$

$$\cos^2 B = \frac{16}{41}$$

$$\cos B = \frac{4}{\sqrt{41}}$$

$$\tan(A + B) = \frac{\dfrac{2}{3} + \dfrac{5}{4}}{1 - \left(\dfrac{2}{3}\right)\left(\dfrac{5}{4}\right)} = \frac{\dfrac{8 + 15}{12}}{\dfrac{12}{12} - \dfrac{10}{12}} = \frac{\dfrac{23}{12}}{\dfrac{2}{12}} = \frac{23}{2}$$

PTS: 4   REF: 081037a2   STA: A2.A.76   TOP: Angle Sum and Difference Identities
KEY: evaluating

38 ANS:

26.2%. $_{10}C_8 \cdot 0.65^8 \cdot 0.35^2 + {}_{10}C_9 \cdot 0.65^9 \cdot 0.35^1 + {}_{10}C_{10} \cdot 0.65^{10} \cdot 0.35^0 \approx 0.262$

PTS: 4   REF: 081038a2   STA: A2.S.15   TOP: Binomial Probability
KEY: at least or at most

39 ANS:

$$x = -\frac{1}{3}, -1 \qquad \log_{x+3} \frac{x^3 + x - 2}{x} = 2$$

$$\frac{x^3 + x - 2}{x} = (x + 3)^2$$

$$\frac{x^3 + x - 2}{x} = x^2 + 6x + 9$$

$$x^3 + x - 2 = x^3 + 6x^2 + 9x$$

$$0 = 6x^2 + 8x + 2$$

$$0 = 3x^2 + 4x + 1$$

$$0 = (3x + 1)(x + 1)$$

$$x = -\frac{1}{3}, -1$$

PTS: 6   REF: 081039a2   STA: A2.A.28   TOP: Logarithmic Equations
KEY: basic

0111a2
Answer Section

1 ANS: 4   PTS: 2   REF: 011101a2   STA: A2.A.38
   TOP: Defining Functions   KEY: graphs
2 ANS: 3
   $b^2 - 4ac = (-10)^2 - 4(1)(25) = 100 - 100 = 0$

   PTS: 2   REF: 011102a2   STA: A2.A.2   TOP: Using the Discriminant
   KEY: determine nature of roots given equation
3 ANS: 2
   $x^3 + x^2 - 2x = 0$

   $x(x^2 + x - 2) = 0$

   $x(x + 2)(x - 1) = 0$

   $x = 0, -2, 1$

   PTS: 2   REF: 011103a2   STA: A2.A.26   TOP: Solving Polynomial Equations
4 ANS: 3   PTS: 2   REF: 011104a2   STA: A2.A.64
   TOP: Using Inverse Trigonometric Functions   KEY: unit circle
5 ANS: 3
   $a_n = 5(-2)^{n-1}$

   $a_{15} = 5(-2)^{15-1} = 81,920$

   PTS: 2   REF: 011105a2   STA: A2.A.32   TOP: Sequences
6 ANS: 1

   $4a + 6 = 4a - 10.$ $4a + 6 = -4a + 10.$ $\left| 4\left(\frac{1}{2}\right) + 6 \right| - 4\left(\frac{1}{2}\right) = -10$

   $\quad\quad 6 \neq -10 \quad\quad\quad\quad 8a = 4$

   $\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad 8 - 2 \neq -10$

   $\quad\quad\quad\quad\quad\quad\quad\quad a = \frac{4}{8} = \frac{1}{2}$

   PTS: 2   REF: 011106a2   STA: A2.A.1   TOP: Absolute Value Equations

7   ANS: 3

$$\left(\frac{2}{3}\right)^2 + \cos^2 A = 1 \qquad\qquad \sin 2A = 2\sin A \cos A$$

$$\cos^2 A = \frac{5}{9} \qquad\qquad = 2\left(\frac{2}{3}\right)\left(\frac{\sqrt 5}{3}\right)$$

$$\cos A = +\frac{\sqrt 5}{3}, \text{ sin A is acute.} \qquad = \frac{4\sqrt 5}{9}$$

PTS: 2   REF: 011107a2   STA: A2.A.77   TOP: Double Angle Identities
KEY: evaluating

8   ANS: 2
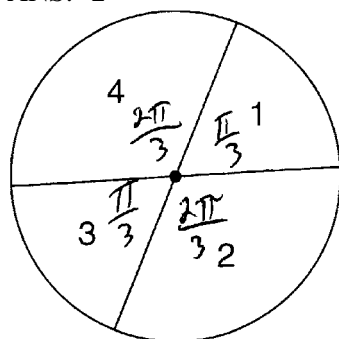
$$\frac{\dfrac{\pi}{3} + \dfrac{\pi}{3}}{2\pi} = \frac{\dfrac{2\pi}{3}}{2\pi} = \frac{1}{3}$$

PTS: 2   REF: 011108a2   STA: A2.S.13   TOP: Geometric Probability

9   ANS: 2
$$6(x^2 - 5) = 6x^2 - 30$$

PTS: 2   REF: 011109a2   STA: A2.A.42   TOP: Compositions of Functions
KEY: variables

10 ANS: 3   PTS: 2   REF: 011110a2   STA: A2.A.30
TOP: Sequences

11 ANS: 4   PTS: 2   REF: 011111a2   STA: A2.N.8
TOP: Conjugates of Complex Numbers

12 ANS: 1   PTS: 2   REF: 011112a2   STA: A2.A.64
TOP: Using Inverse Trigonometric Functions   KEY: advanced

13 ANS: 2

$$\frac{10}{\sin 35} = \frac{13}{\sin B} \quad . \quad 35 + 48 < 180$$

$$B \approx 48, 132 \quad 35 + 132 < 180$$

PTS: 2   REF: 011113a2   STA: A2.A.75   TOP: Law of Sines - The Ambiguous Case

14 ANS: 2   PTS: 2   REF: 011114a2   STA: A2.N.3
TOP: Operations with Polynomials

2

15 ANS: 3

$x^2 - 3x - 10 > 0$ or

$(x-5)(x+2) > 0$ $x - 5 < 0$ and $x + 2 < 0$

$x - 5 > 0$ and $x + 2 > 0$ $x < 5$ and $x < -2$

$x > 5$ and $x > -2$ $x < -2$

$x > 5$

PTS: 2   REF: 011115a2   STA: A2.A.4   TOP: Quadratic Inequalities
KEY: one variable

16 ANS: 2

$x^2 + 2 = 6x$

$x^2 - 6x = -2$

$x^2 - 6x + 9 = -2 + 9$

$(x - 3)^2 = 7$

PTS: 2   REF: 011116a2   STA: A2.A.24   TOP: Completing the Square

17 ANS: 1   PTS: 2   REF: 011117a2   STA: A2.S.9
TOP: Differentiating Permutations and Combinations

18 ANS: 4

$x^{-\frac{2}{5}} = \dfrac{1}{x^{\frac{2}{5}}} = \dfrac{1}{\sqrt[5]{x^2}}$

PTS: 2   REF: 011118a2   STA: A2.A.10   TOP: Fractional Exponents as Radicals

19 ANS: 3   PTS: 2   REF: 011119a2   STA: A2.A.52
TOP: Families of Functions

20 ANS: 1

$\sqrt{12^2 - 6^2} = \sqrt{108} = \sqrt{36}\sqrt{3} = 6\sqrt{3}$. $\cot J = \dfrac{A}{O} = \dfrac{6}{6\sqrt{3}} \cdot \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{\sqrt{3}}{3}$

PTS: 2   REF: 011120a2   STA: A2.A.55   TOP: Trigonometric Ratios

21 ANS: 3

$\dfrac{-b}{a} = \dfrac{-6}{2} = -3$. $\dfrac{c}{a} = \dfrac{4}{2} = 2$

PTS: 2   REF: 011121a2   STA: A2.A.21   TOP: Roots of Quadratics
KEY: basic

22 ANS: 4

$$\frac{2x+4}{\sqrt{x+2}} \cdot \frac{\sqrt{x+2}}{\sqrt{x+2}} = \frac{2(x+2)\sqrt{x+2}}{x+2} = 2\sqrt{x+2}$$

PTS: 2   REF: 011122a2   STA: A2.A.15   TOP: Rationalizing Denominators
KEY: index = 2

23 ANS: 1
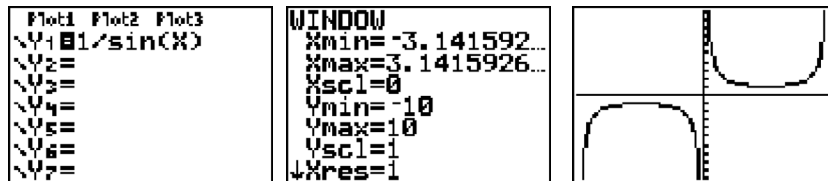
PTS: 2   REF: 011123a2   STA: A2.A.71   TOP: Graphing Trigonometric Functions

24 ANS: 4   PTS: 2   REF: 011124a2   STA: A2.A.18
TOP: Evaluating Logarithmic Expressions

25 ANS: 1

$8 \times 8 \times 7 \times 1 = 448$. The first digit cannot be 0 or 5. The second digit cannot be 5 or the same as the first digit. The third digit cannot be 5 or the same as the first or second digit.

PTS: 2   REF: 011125a2   STA: A2.S.10   TOP: Permutations

26 ANS: 2   PTS: 2   REF: 011126a2   STA: A2.A.49
TOP: Equations of Circles

27 ANS: 4   PTS: 2   REF: 011127a2   STA: A2.S.1
TOP: Analysis of Data

28 ANS:

$$16^{2x+3} = 64^{x+2}$$

$$(4^2)^{2x+3} = (4^3)^{x+2}$$

$$4x + 6 = 3x + 6$$

$$x = 0$$

PTS: 2   REF: 011128a2   STA: A2.A.27   TOP: Exponential Equations
KEY: common base not shown

29 ANS:

$$2.5 \cdot \frac{180}{\pi} \approx 143.2°$$

PTS: 2   REF: 011129a2   STA: A2.M.2   TOP: Radian Measure
KEY: degrees

30 ANS:

$$12 \cdot 6 = 9w$$

$$8 = w$$

PTS: 2   REF: 011130a2   STA: A2.A.5   TOP: Inverse Variation

31 ANS:

230. $10 + (1^3 - 1) + (2^3 - 1) + (3^3 - 1) + (4^3 - 1) + (5^3 - 1) = 10 + 0 + 7 + 26 + 63 + 124 = 230$

PTS: 2   REF: 011131a2   STA: A2.N.10   TOP: Sigma Notation
KEY: basic

32 ANS:

D: $-5 \le x \le 8$. R: $-3 \le y \le 2$

PTS: 2   REF: 011132a2   STA: A2.A.51   TOP: Domain and Range

33 ANS:

$$\frac{\sqrt{108x^5 y^8}}{\sqrt{6xy^5}} = \sqrt{18x^4 y^3} = 3x^2 y\sqrt{2y}$$

PTS: 2   REF: 011133a2   STA: A2.A.14   TOP: Operations with Radicals
KEY: with variables | index = 2

34 ANS:

68% of the students are within one standard deviation of the mean. 16% of the students are more than one standard deviation above the mean.

PTS: 2   REF: 011134a2   STA: A2.S.5   TOP: Normal Distributions
KEY: percent

35 ANS:

$$\frac{\sin^2 A}{\cos^2 A} + \frac{\cos^2 A}{\cos^2 A} = \frac{1}{\cos^2 A}$$

$$\tan^2 A + 1 = \sec^2 A$$

PTS: 2   REF: 011135a2   STA: A2.A.67   TOP: Proving Trigonometric Identities

36 ANS:

$32x^5 - 80x^4 + 80x^3 - 40x^2 + 10x - 1$. ${}_5C_0(2x)^5(-1)^0 = 32x^5$. ${}_5C_1(2x)^4(-1)^1 = -80x^4$. ${}_5C_2(2x)^3(-1)^2 = 80x^3$. ${}_5C_3(2x)^2(-1)^3 = -40x^2$. ${}_5C_4(2x)^1(-1)^4 = 10x$. ${}_5C_5(2x)^0(-1)^5 = -1$

PTS: 4   REF: 011136a2   STA: A2.A.36   TOP: Binomial Expansions

37 ANS:

$$\frac{12}{\sin 32} = \frac{10}{\sin B} \qquad . \; C \approx 180 - (32 + 26.2) \approx 121.8. \quad \frac{12}{\sin 32} = \frac{c}{\sin 121.8}$$

$$B = \sin^{-1}\frac{10\sin 32}{12} \approx 26.2 \qquad\qquad c = \frac{12\sin 121.8}{\sin 32} \approx 19.2$$

PTS: 4   REF: 011137a2   STA: A2.A.73   TOP: Law of Sines
KEY: basic

38 ANS:

0.468. $_8C_6\left(\dfrac{2}{3}\right)^6\left(\dfrac{1}{3}\right)^2 \approx 0.27313.$ $_8C_7\left(\dfrac{2}{3}\right)^7\left(\dfrac{1}{3}\right)^1 \approx 0.15607.$ $_8C_8\left(\dfrac{2}{3}\right)^8\left(\dfrac{1}{3}\right)^0 \approx 0.03902.$

PTS: 4 REF: 011138a2 STA: A2.S.15 TOP: Binomial Probability
KEY: at least or at most

39 ANS:

$\ln(T-T_0) = -kt + 4.718$. $\ln(T-68) = -0.104(10) + 4.718.$

$\ln(150-68) = -k(3) + 4.718$ $\ln(T-68) = 3.678$

$4.407 \approx -3k + 4.718$ $T - 68 \approx 39.6$

$k \approx 0.104$ $T \approx 108$

PTS: 6 REF: 011139a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: advanced

0611a2
Answer Section

1 ANS: 4   PTS: 2   REF: 061101a2   STA: A2.S.1
   TOP: Analysis of Data

2 ANS: 2

$$f(10) = \frac{-10}{(-10)^2 - 16} = \frac{-10}{84} = -\frac{5}{42}$$

   PTS: 2   REF: 061102a2   STA: A2.A.41   TOP: Functional Notation

3 ANS: 4

$$S_n = \frac{n}{2}[2a + (n-1)d] = \frac{21}{2}[2(18) + (21-1)2] = 798$$

   PTS: 2   REF: 061103a2   STA: A2.A.35   TOP: Series
   KEY: arithmetic

4 ANS: 2
$\cos(-305° + 360°) = \cos(55°)$

   PTS: 2   REF: 061104a2   STA: A2.A.57   TOP: Reference Angles

5 ANS: 2

$$4^{2x+5} = 8^{3x} \quad .$$
$$\left(2^2\right)^{2x+5} = \left(2^3\right)^{3x}$$
$$2^{4x+10} = 2^{9x}$$
$$4x + 10 = 9x$$
$$10 = 5x$$
$$2 = x$$

   PTS: 2   REF: 061105a2   STA: A2.A.27   TOP: Exponential Equations
   KEY: common base not shown

6 ANS: 3
$x = 5^4 = 625$

   PTS: 2   REF: 061106a2   STA: A2.A.28   TOP: Logarithmic Equations
   KEY: basic

7 ANS: 1

$$\sqrt[4]{16x^2y^7} = 16^{\frac{1}{4}}x^{\frac{2}{4}}y^{\frac{7}{4}} = 2x^{\frac{1}{2}}y^{\frac{7}{4}}$$

   PTS: 2   REF: 061107a2   STA: A2.A.11   TOP: Radicals as Fractional Exponents

8 ANS: 2   PTS: 2   REF: 061108a2   STA: A2.A.52
   TOP: Identifying the Equation of a Graph

9 ANS: 1

$$a_n = -\sqrt{5}(-\sqrt{2})^{n-1}$$

$$a_{15} = -\sqrt{5}(-\sqrt{2})^{15-1} = -\sqrt{5}(-\sqrt{2})^{14} = -\sqrt{5} \cdot 2^7 = -128\sqrt{5}$$

PTS: 2 REF: 061109a2 STA: A2.A.32 TOP: Sequences

10 ANS: 1

$$13^2 = 15^2 + 14^2 - 2(15)(14)\cos C$$

$$169 = 421 - 420\cos C$$

$$-252 = -420\cos C$$

$$\frac{252}{420} = \cos C$$

$$53 \approx C$$

PTS: 2 REF: 061110a2 STA: A2.A.73 TOP: Law of Cosines
KEY: find angle

11 ANS: 2

$$\frac{2\pi}{b} = \frac{2\pi}{3}$$

PTS: 2 REF: 061111a2 STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions KEY: period

12 ANS: 4 PTS: 2 REF: 061112a2 STA: A2.A.39
TOP: Domain and Range KEY: real domain

13 ANS: 1

$${}_{10}C_4 = 210$$

PTS: 2 REF: 061113a2 STA: A2.S.11 TOP: Combinations
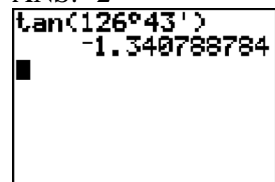
14 ANS: 3 PTS: 2 REF: 061114a2 STA: A2.A.38
TOP: Defining Functions KEY: graphs

15 ANS: 2

```
tan(126°43')
    -1.340788784
■
```

PTS: 2 REF: 061115a2 STA: A2.A.66 TOP: Determining Trigonometric Functions

16 ANS: 3

$$\frac{4}{5-\sqrt{13}} \cdot \frac{5+\sqrt{13}}{5+\sqrt{13}} = \frac{4(5+\sqrt{13})}{25-13} = \frac{5+\sqrt{13}}{3}$$

PTS: 2 REF: 061116a2 STA: A2.N.5 TOP: Rationalizing Denominators

17 ANS: 3

$$75000 = 25000e^{.0475t}$$

$$3 = e^{.0475t}$$

$$\ln 3 = \ln e^{.0475t}$$

$$\frac{\ln 3}{.0475} = \frac{.0475t \cdot \ln e}{.0475}$$

$$23.1 \approx t$$

PTS: 2 REF: 061117a2 STA: A2.A.6 TOP: Exponential Growth

18 ANS: 1

n	3	4	5	Σ
$-r^2 + r$	$-3^2 + 3 = -6$	$-4^2 + 4 = -12$	$-5^2 + 5 = -20$	-38

PTS: 2 REF: 061118a2 STA: A2.N.10 TOP: Sigma Notation
KEY: basic

19 ANS: 3 PTS: 2 REF: 061119a2 STA: A2.A.65
TOP: Graphing Trigonometric Functions

20 ANS: 4 PTS: 2 REF: 061120a2 STA: A2.A.19
TOP: Properties of Logarithms KEY: splitting logs

21 ANS: 3

$$3x + 16 = (x + 2)^2 \qquad . \ -4 \text{ is an extraneous solution.}$$

$$3x + 16 = x^2 + 4x + 4$$

$$0 = x^2 + x - 12$$

$$0 = (x + 4)(x - 3)$$

$$x = -4 \quad x = 3$$

PTS: 2 REF: 061121a2 STA: A2.A.22 TOP: Solving Radicals
KEY: extraneous solutions

22 ANS: 2 PTS: 2 REF: 061122a2 STA: A2.A.24
TOP: Completing the Square

23 ANS: 3

$$\frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta} = \frac{1}{\cos^2 \theta} = \sec^2 \theta$$

PTS: 2 REF: 061123a2 STA: A2.A.58 TOP: Reciprocal Trigonometric Relationships

24 ANS: 4 PTS: 2 REF: 061124a2 STA: A2.S.3
TOP: Average Known with Missing Data

25 ANS: 3

$$2\pi \cdot \frac{5}{12} = \frac{10\pi}{12} = \frac{5\pi}{6}$$

PTS: 2 REF: 061125a2 STA: A2.M.1 TOP: Radian Measure

26 ANS: 1

$$_9C_3 a^6(-4b)^3 = -5376a^6 b^3$$

PTS: 2 REF: 061126a2 STA: A2.A.36 TOP: Binomial Expansions

27 ANS: 3 PTS: 2 REF: 061127a2 STA: A2.S.6
TOP: Regression

28 ANS:

$$6y^3 - \frac{37}{10}y^2 - \frac{1}{5}y. \ \left(\frac{1}{2}y^2 - \frac{1}{3}y\right)\left(12y + \frac{3}{5}\right) = 6y^3 + \frac{3}{10}y^2 - 4y^2 - \frac{1}{5}y = 6y^3 - \frac{37}{10}y^2 - \frac{1}{5}y$$

PTS: 2 REF: 061128a2 STA: A2.N.3 TOP: Operations with Polynomials

29 ANS:
no. over 20 is more than 1 standard deviation above the mean. $0.159 \cdot 82 \approx 13.038$

PTS: 2 REF: 061129a2 STA: A2.S.5 TOP: Normal Distributions
KEY: predict

30 ANS:

$$x^2 - 6x - 27 = 0, \ \frac{-b}{a} = 6. \ \frac{c}{a} = -27. \ \text{If } a = 1 \text{ then } b = -6 \text{ and } c = -27$$

PTS: 4 REF: 061130a2 STA: A2.A.21 TOP: Roots of Quadratics
KEY: basic

31 ANS:

$$e^{3\ln 2} = e^{\ln 2^3} = e^{\ln 8} = 8$$

PTS: 2 REF: 061131a2 STA: A2.A.12 TOP: Evaluating Exponential Expressions

32 ANS:

$$y = x^2 - 6. \ \text{f}^{-1}(x) \text{ is not a function.}$$
$$x = y^2 - 6$$
$$x + 6 = y^2$$
$$\pm\sqrt{x+6} = y$$

PTS: 2 REF: 061132a2 STA: A2.A.44 TOP: Inverse of Functions
KEY: equations

33 ANS:

$$12t^8 - 75t^4 = 3t^4(4t^4 - 25) = 3t^4(2t^2 + 5)(2t^2 - 5)$$

PTS: 2 REF: 061133a2 STA: A2.A.7
TOP: Factoring the Difference of Perfect Squares KEY: binomial

4

34 ANS:

$$\frac{12x^2}{y^9} \cdot \frac{3x^{-4}y^5}{(2x^3y^{-7})^{-2}} = \frac{3y^5(2x^3y^{-7})^2}{x^4} = \frac{3y^5(4x^6y^{-14})}{x^4} = \frac{12x^6y^{-9}}{x^4} = \frac{12x^2}{y^9}$$

PTS: 2   REF: 061134a2   STA: A2.A.9   TOP: Negative Exponents

35 ANS:

7. $f(-3) = (-3)^2 - 6 = 3$. $g(x) = 2^3 - 1 = 7$.
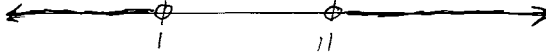
PTS: 2   REF: 061135a2   STA: A2.A.42   TOP: Compositions of Functions
KEY: numbers

36 ANS:
$\sin(45 + 30) = \sin 45 \cos 30 + \cos 45 \sin 30$

$$= \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} + \frac{\sqrt{2}}{2} \cdot \frac{1}{2} = \frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4} = \frac{\sqrt{6} + \sqrt{2}}{4}$$

PTS: 4   REF: 061136a2   STA: A2.A.76   TOP: Angle Sum and Difference Identities
KEY: evaluating

37 ANS:

$-3|6 - x| < -15$.

$|6 - x| > 5$

$6 - x > 5 \text{ or } 6 - x < -5$

$1 > x \text{ or } 11 < x$

PTS: 2   REF: 061137a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph

38 ANS:

$\frac{51}{243}$. $_5C_3 \left(\frac{1}{3}\right)^3 \left(\frac{2}{3}\right)^2 = \frac{40}{243}$

$_5C_4 \left(\frac{1}{3}\right)^4 \left(\frac{2}{3}\right)^1 = \frac{10}{243}$

$_5C_3 \left(\frac{1}{3}\right)^5 \left(\frac{2}{3}\right)^0 = \frac{1}{243}$

PTS: 4   REF: 061138a2   STA: A2.S.15   TOP: Binomial Probability
KEY: at least or at most

39 ANS:

$\left(-\dfrac{9}{2}, \dfrac{1}{2}\right)$ and $\left(\dfrac{1}{2}, \dfrac{11}{2}\right)$. $y = x + 5$. $4x^2 + 17x - 4 = x + 5$

$y = 4x^2 + 17x - 4$ $4x^2 + 16x - 9 = 0$

$(2x + 9)(2x - 1) = 0$

$x = -\dfrac{9}{2}$ and $x = \dfrac{1}{2}$

$y = -\dfrac{9}{2} + 5 = \dfrac{1}{2}$ and $y = \dfrac{1}{2} + 5 = \dfrac{11}{2}$

PTS: 6   REF: 061139a2   STA: A2.A.3   TOP: Quadratic-Linear Systems
KEY: equations

0112a2
Answer Section

1 ANS: 4   PTS: 2   REF: 011201a2   STA: A2.S.2
   TOP: Analysis of Data

2 ANS: 3

$$S_n = \frac{n}{2}\,[2a + (n-1)d] = \frac{19}{2}\,[2(3) + (19-1)7] = 1254$$

   PTS: 2   REF: 011202a2   STA: A2.A.35   TOP: Summations
   KEY: arithmetic

3 ANS: 1
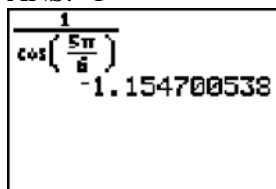
   PTS: 2   REF: 011203a2   STA: A2.A.66   TOP: Determining Trigonometric Functions

4 ANS: 4

$$g\left(\frac{1}{2}\right) = \frac{1}{\frac{1}{2}} = 2. \;\; f(2) = 4(2) - 2^2 = 4$$

   PTS: 2   REF: 011204a2   STA: A2.A.42   TOP: Compositions of Functions
   KEY: numbers

5 ANS: 2

$$320 = 10(2)^{\frac{t}{60}}$$

$$32 = (2)^{\frac{t}{60}}$$

$$\log 32 = \log(2)^{\frac{t}{60}}$$

$$\log 32 = \frac{t \log 2}{60}$$

$$\frac{60 \log 32}{\log 2} = t$$

$$300 = t$$

   PTS: 2   REF: 011205a2   STA: A2.A.6   TOP: Exponential Growth

6 ANS: 2
   The binomials are conjugates, so use FL.

   PTS: 2   REF: 011206a2   STA: A2.N.3   TOP: Operations with Polynomials

7 ANS: 3
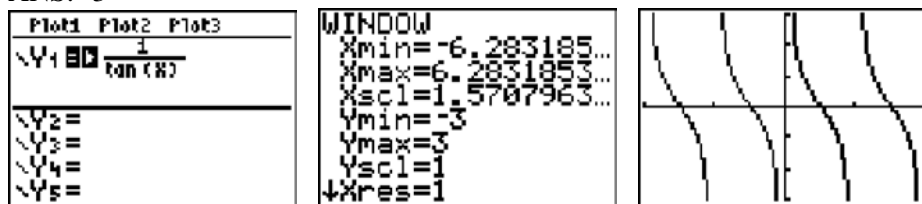
   PTS: 2   REF: 011207a2   STA: A2.A.71   TOP: Graphing Trigonometric Functions

8 ANS: 2   PTS: 2   REF: 011208a2   STA: A2.A.67

   TOP: Proving Trigonometric Identities

9 ANS: 2

sum: $\dfrac{-b}{a} = \dfrac{4}{6} = \dfrac{2}{3}$. product: $\dfrac{c}{a} = \dfrac{-12}{6} = -2$

   PTS: 2   REF: 011209a2   STA: A2.A.20   TOP: Roots of Quadratics

10 ANS: 1

$\dfrac{9}{\sin A} = \dfrac{10}{\sin 70}$. $58° + 70°$ is possible. $122° + 70°$ is not possible.

    $A \approx 58$

   PTS: 2   REF: 011210a2   STA: A2.A.75   TOP: Law of Sines - The Ambiguous Case

11 ANS: 2

$$\frac{x^{-1}+1}{x+1} = \frac{\frac{1}{x}+1}{x+1} = \frac{\frac{1+x}{x}}{x+1} = \frac{1}{x}$$

   PTS: 2   REF: 011211a2   STA: A2.A.9   TOP: Negative Exponents

12 ANS: 3

   $34.1\% + 19.1\% = 53.2\%$

   PTS: 2   REF: 011212a2   STA: A2.S.5   TOP: Normal Distributions

   KEY: probability

13 ANS: 2   PTS: 2   REF: 011213a2   STA: A2.N.8

   TOP: Conjugates of Complex Numbers

14 ANS: 1

$\cos(A - B) = \left(\dfrac{5}{13}\right)\left(-\dfrac{3}{5}\right) + \left(\dfrac{12}{13}\right)\left(\dfrac{4}{5}\right) = -\dfrac{15}{65} + \dfrac{48}{65} = \dfrac{33}{65}$

   PTS: 2   REF: 011214a2   STA: A2.A.76   TOP: Angle Sum and Difference Identities

   KEY: evaluating

15 ANS: 3

   ${}_3C_2(2x^4)^1(-y)^2 = 6x^4y^2$

   PTS: 2   REF: 011215a2   STA: A2.A.36   TOP: Binomial Expansions

16 ANS: 3

$$3x^5 - 48x = 0$$

$$3x(x^4 - 16) = 0$$

$$3x(x^2 + 4)(x^2 - 4) = 0$$

$$3x(x^2 + 4)(x + 2)(x - 2) = 0$$

PTS: 2   REF: 011216a2   STA: A2.A.26   TOP: Solving Polynomial Equations

17 ANS: 4

$$\frac{10}{4} = 2.5$$

PTS: 2   REF: 011217a2   STA: A2.A.29   TOP: Sequences

18 ANS: 1

$$\frac{1}{2}(7.4)(3.8)\sin 126 \approx 11.4$$

PTS: 2   REF: 011218a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
KEY: basic

19 ANS: 4   PTS: 2   REF: 011219a2   STA: A2.A.52
TOP: Properties of Graphs of Functions and Relations

20 ANS: 1

$$2 \cdot \frac{180}{\pi} = \frac{360}{\pi}$$

PTS: 2   REF: 011220a2   STA: A2.M.2   TOP: Radian Measure
KEY: degrees

21 ANS: 4

$$_3C_2 \left(\frac{5}{8} \right)^2 \left(\frac{3}{8} \right)^1 = \frac{225}{512}$$

PTS: 2   REF: 011221a2   STA: A2.S.15   TOP: Binomial Probability
KEY: spinner

22 ANS: 2   PTS: 2   REF: 011222a2   STA: A2.A.39
TOP: Domain and Range   KEY: real domain

23 ANS: 1
(4) shows the strongest linear relationship, but if $r < 0$, $b < 0$. The Regents announced that a correct solution was not provided for this question and all students should be awarded credit.

PTS: 2   REF: 011223a2   STA: A2.S.8   TOP: Correlation Coefficient

24 ANS: 2

$$\log x^2 = \log 3a + \log 2a$$

$$2\log x = \log 6a^2$$

$$\log x = \frac{\log 6}{2} + \frac{\log a^2}{2}$$

$$\log x = \frac{1}{2}\log 6 + \frac{2\log a}{2}$$

$$\log x = \frac{1}{2}\log 6 + \log a$$

PTS: 2   REF: 011224a2   STA: A2.A.19   TOP: Properties of Logarithms
KEY: splitting logs

25 ANS: 2   PTS: 2   REF: 011225a2   STA: A2.A.43
TOP: Defining Functions

26 ANS: 1

$$10 \cdot \frac{3}{2} = \frac{3}{5}p$$

$$15 = \frac{3}{5}p$$

$$25 = p$$

PTS: 2   REF: 011226a2   STA: A2.A.5   TOP: Inverse Variation

27 ANS: 4

$$\frac{2\pi}{b} = 30$$

$$b = \frac{\pi}{15}$$

PTS: 2   REF: 011227a2   STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

28 ANS:

$x < -1$ or $x > 5$. $x^2 - 4x - 5 > 0$. $x - 5 > 0$ and $x + 1 > 0$ or $x - 5 < 0$ and $x + 1 < 0$

$$(x-5)(x+1) > 0 \qquad x > 5 \text{ and } x > -1 \qquad x < 5 \text{ and } x < -1$$

$$x > 5 \qquad\qquad\qquad x < -1$$

PTS: 2   REF: 011228a2   STA: A2.A.4   TOP: Quadratic Inequalities
KEY: one variable

29 ANS:

7. $4 - \sqrt{2x - 5} = 1$

$-\sqrt{2x - 5} = -3$

$2x - 5 = 9$

$2x = 14$

$x = 7$

PTS: 2   REF: 011229a2   STA: A2.A.22   TOP: Solving Radicals
KEY: basic

30 ANS:

-104.

PTS: 2   REF: 011230a2   STA: A2.N.10   TOP: Sigma Notation
KEY: basic

31 ANS:

$-\dfrac{a^2 b^3}{4}$

PTS: 2   REF: 011231a2   STA: A2.A.13   TOP: Simplifying Radicals
KEY: index > 2

32 ANS:

$_{25}C_{20} = 53,130$

PTS: 2   REF: 011232a2   STA: A2.S.11   TOP: Combinations

33 ANS:
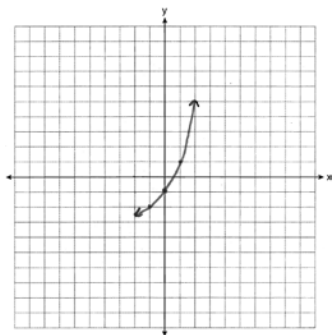
PTS: 2   REF: 011234a2   STA: A2.A.53   TOP: Graphing Exponential Functions

34 ANS:

$r = \sqrt{2^2 + 3^2} = \sqrt{13}$. $(x + 5)^2 + (y - 2)^2 = 13$

PTS: 2   REF: 011234a2   STA: A2.A.49   TOP: Writing Equations of Circles

35 ANS:

$\dfrac{2\sqrt{3}}{3}$. If $\sin 60 = \dfrac{\sqrt{3}}{2}$, then $\csc 60 = \dfrac{2}{\sqrt{3}} \cdot \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{2\sqrt{3}}{3}$

PTS: 2   REF: 011235a2   STA: A2.A.59   TOP: Reciprocal Trigonometric Relationships

36 ANS:

88. $\dfrac{100}{\sin 33} = \dfrac{x}{\sin 32}$. $\sin 66 \approx \dfrac{T}{97.3}$

       $x \approx 97.3$ $t \approx 88$

PTS: 4   REF: 011236a2   STA: A2.A.73   TOP: Law of Sines
KEY: advanced

37 ANS:

800. $x = 4^{2.5} = 32$. $y^{-\frac{3}{2}} = 125$. $\dfrac{x}{y} = \dfrac{32}{\frac{1}{25}} = 800$

         $y = 125^{-\frac{2}{3}} = \dfrac{1}{25}$

PTS: 4   REF: 011237a2   STA: A2.A.28   TOP: Logarithmic Equations
KEY: advanced

38 ANS:

$y = 27.2025(1.1509)^x$. $y = 27.2025(1.1509)^{18} \approx 341$

PTS: 4   REF: 011238a2   STA: A2.S.7   TOP: Exponential Regression

39 ANS:

$$\dfrac{-2(x^2 + 6)}{x^4} \cdot \dfrac{x^2(x-3) + 6(x-3)}{x^2 - 4x} \cdot \dfrac{2x - 4}{x^4 - 3x^3} \div \dfrac{x^2 + 2x - 8}{16 - x^2}$$

$$\dfrac{(x^2 + 6)(x - 3)}{x(x - 4)} \cdot \dfrac{2(x - 2)}{x^3(x - 3)} \cdot \dfrac{(4 + x)(4 - x)}{(x + 4)(x - 2)}$$

$$\dfrac{-2(x^2 + 6)}{x^4}$$

PTS: 6   REF: 011239a2   STA: A2.A.16   TOP: Multiplication and Division of Rationals
KEY: division

0612a2
Answer Section

1   ANS: 1
The binomials are conjugates, so use FL.

PTS: 2   REF: 061201a2   STA: A2.N.3   TOP: Operations with Polynomials
2   ANS: 1   PTS: 2   REF: 061202a2   STA: A2.A.51
TOP: Domain and Range
3   ANS: 4

$2\cos\theta = 1$

$\cos\theta = \dfrac{1}{2}$

$\theta = \cos^{-1}\dfrac{1}{2} = 60,\ 300$
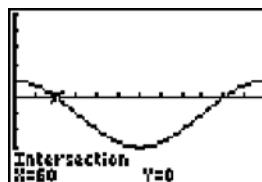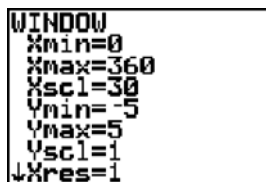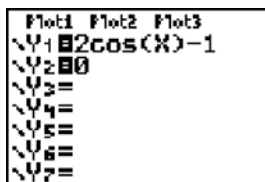
PTS: 2   REF: 061203a2   STA: A2.A.68   TOP: Trigonometric Equations
KEY: basic
4   ANS: 3
$\sqrt[3]{4^3 a^{15} a} = 4a^5\sqrt[3]{a}$

PTS: 2   REF: 061204a2   STA: A2.A.13   TOP: Simplifying Radicals
KEY: index > 2
5   ANS: 2   PTS: 2   REF: 061205a2   STA: A2.A.34
TOP: Sigma Notation
6   ANS: 4   PTS: 2   REF: 061206a2   STA: A2.A.60
TOP: Unit Circle
7   ANS: 4   PTS: 2   REF: 061207a2   STA: A2.A.19
TOP: Properties of Logarithms   KEY: antilogarithms
8   ANS: 3

sum of the roots, $\dfrac{-b}{a} = \dfrac{-(-9)}{4} = \dfrac{9}{4}$. product of the roots, $\dfrac{c}{a} = \dfrac{3}{4}$

PTS: 2   REF: 061208a2   STA: A2.A.21   TOP: Roots of Quadratics
KEY: basic

9 ANS: 3

$$\frac{4x-5}{3} > 1 \text{ or } \frac{4x-5}{3} < -1$$

$$4x-5 > 3 \qquad 4x-5 < -3$$

$$4x > 8 \qquad\quad 4x < 2$$

$$x > 2 \qquad\qquad x < \frac{1}{2}$$

PTS: 2   REF: 061209a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph

10 ANS: 1   PTS: 2   REF: 061210a2   STA: A2.A.9
TOP: Negative Exponents

11 ANS: 1   PTS: 2   REF: 061211a2   STA: A2.A.54
TOP: Graphing Logarithmic Functions

12 ANS: 3

$$s = \theta r = \frac{2\pi}{8} \cdot 6 = \frac{3\pi}{2}$$

PTS: 2   REF: 061212a2   STA: A2.A.61   TOP: Arc Length
KEY: arc length

13 ANS: 1

$$5x + 29 = (x+3)^2 \qquad . \ (-5) + 3 \text{ shows an extraneous solution.}$$

$$5x + 29 = x^2 + 6x + 9$$

$$0 = x^2 + x - 20$$

$$0 = (x+5)(x-4)$$

$$x = -5, 4$$

PTS: 2   REF: 061213a2   STA: A2.A.22   TOP: Solving Radicals
KEY: extraneous solutions

14 ANS: 2

$$x^3 + 3x^2 - 4x - 12$$

$$x^2(x+3) - 4(x+3)$$

$$(x^2 - 4)(x+3)$$

$$(x+2)(x-2)(x+3)$$

PTS: 2   REF: 061214a2   STA: A2.A.7   TOP: Factoring by Grouping

15 ANS: 3

$$_6C_3\left(\frac{x}{2}\right)^3(-2y)^3 = 20 \cdot \frac{x^3}{8} \cdot -8y^3 = -20x^3y^3$$

PTS: 2   REF: 061215a2   STA: A2.A.36   TOP: Binomial Expansions

16 ANS: 2   PTS: 2   REF: 061216a2   STA: A2.A.42
    TOP: Compositions of Functions   KEY: variables

17 ANS: 4

$$\frac{1}{\sin(138°23')}$$
$$1.505698217$$

■
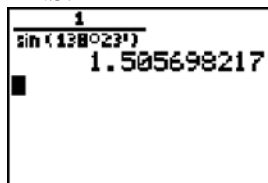
    PTS: 2   REF: 061217a2   STA: A2.A.66   TOP: Determining Trigonometric Functions

18 ANS: 2   PTS: 2   REF: 061218a2   STA: A2.A.43
    TOP: Defining Functions

19 ANS: 3   PTS: 2   REF: 061219a2   STA: A2.N.8
    TOP: Conjugates of Complex Numbers

20 ANS: 1

If $\sin x = 0.8$, then $\cos x = 0.6$. $\tan \frac{1}{2} x = \sqrt{\frac{1-0.6}{1+0.6}} = \sqrt{\frac{0.4}{1.6}} = 0.5$.

    PTS: 2   REF: 061220a2   STA: A2.A.77   TOP: Half Angle Identities

21 ANS: 4

$$\frac{4 \cdot 0 + 6 \cdot 1 + 10 \cdot 2 + 0 \cdot 3 + 4k + 2 \cdot 5}{4 + 6 + 10 + 0 + k + 2} = 2$$

$$\frac{4k + 36}{k + 22} = 2$$

$$4k + 36 = 2k + 44$$

$$2k = 8$$

$$k = 4$$

    PTS: 2   REF: 061221a2   STA: A2.S.3   TOP: Average Known with Missing Data

22 ANS: 4
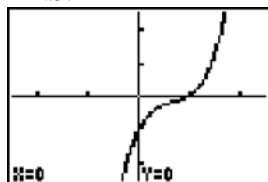
    PTS: 2   REF: 061222a2   STA: A2.A.50   TOP: Solving Polynomial Equations

23 ANS: 1   PTS: 2   REF: 061223a2   STA: A2.S.15
    TOP: Binomial Probability   KEY: modeling

24 ANS: 3   PTS: 2   REF: 061224a2   STA: A2.A.63
    TOP: Domain and Range

25 ANS: 1

PTS: 2   REF: 061225a2   STA: A2.S.8   TOP: Correlation Coefficient

26 ANS: 1

$$\frac{6}{\sin 35} = \frac{10}{\sin N}$$

$$N \approx 73$$

$$73 + 35 < 180$$

$$(180 - 73) + 35 < 180$$

PTS: 2   REF: 061226a2   STA: A2.A.75   TOP: Law of Sines - The Ambiguous Case

27 ANS: 4

$_{15}C_5 = 3,003.$ $_{25}C_5 = _{25}C_{20} = 53,130.$ $_{25}C_{15} = 3,268,760.$

PTS: 2   REF: 061227a2   STA: A2.S.11   TOP: Combinations

28 ANS:

$$i^{13} + i^{18} + i^{31} + n = 0$$

$$i + (-1) - i + n = 0$$

$$-1 + n = 0$$

$$n = 1$$

PTS: 2   REF: 061228a2   STA: A2.N.7   TOP: Imaginary Numbers

29 ANS:

$$A = 750e^{(0.03)(8)} \approx 953$$

PTS: 2   REF: 061229a2   STA: A2.A.12   TOP: Evaluating Exponential Expressions

30 ANS:

$$\cos \theta \cdot \frac{1}{\cos \theta} - \cos^2 \theta = 1 - \cos^2 \theta = \sin^2 \theta$$

PTS: 2   REF: 061230a2   STA: A2.A.58   TOP: Reciprocal Trigonometric Relationships

31 ANS:

$$y = 180.377(0.954)^x$$

PTS: 2   REF: 061231a2   STA: A2.S.7   TOP: Exponential Regression

32 ANS:

$$216\left(\frac{\pi}{180}\right) \approx 3.8$$

PTS: 2   REF: 061232a2   STA: A2.M.2   TOP: Radian Measure
KEY: radians

33 ANS:

$a_1 = 3$. $a_2 = 2(3) - 1 = 5$. $a_3 = 2(5) - 1 = 9$.

PTS: 2   REF: 061233a2   STA: A2.A.33   TOP: Recursive Sequences

34 ANS:

$$K = ab\sin C = 18 \cdot 22 \sin 60 = 396 \frac{\sqrt{3}}{2} = 198\sqrt{3}$$

PTS: 2   REF: 061234a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
KEY: Parallelograms

35 ANS:

$y = -3\sin 2x$. The period of the function is π, the amplitude is 3 and it is reflected over the x-axis.

PTS: 2   REF: 061235a2   STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

36 ANS:

$$\frac{-(x^2 - 4)}{(x+4)(x+3)} \times \frac{x+3}{2(x-2)} = \frac{-(x+2)(x-2)}{x+4} \times \frac{1}{2(x-2)} = \frac{-(x+2)}{2(x+4)}$$

PTS: 4   REF: 061236a2   STA: A2.A.16   TOP: Multiplication and Division of Rationals
KEY: division

37 ANS:

$\sigma_x = 14.9$. $\overline{x} = 40$. There are 8 scores between 25.1 and 54.9.

PTS: 4   REF: 061237a2   STA: A2.S.4   TOP: Dispersion
KEY: advanced

38 ANS:
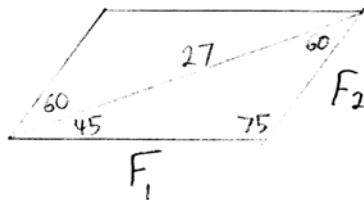
$$\frac{27}{\sin 75} = \frac{F_1}{\sin 60}. \quad \frac{27}{\sin 75} = \frac{F_2}{\sin 45}.$$

$$F_1 \approx 24 \qquad F_2 \approx 20$$

PTS: 4   REF: 061238a2   STA: A2.A.73   TOP: Vectors

39 ANS:

$$81^{x^3 + 2x^2} = 27^{\frac{5x}{3}}$$

$$\left(3^4\right)^{x^3 + 2x^2} = \left(3^3\right)^{\frac{5x}{3}}$$

$$3^{4x^3 + 8x^2} = 3^{5x}$$

$$4x^3 + 8x^2 - 5x = 0$$

$$x(4x^2 + 8x - 5) = 0$$

$$x(2x - 1)(2x + 5) = 0$$

$$x = 0, \frac{1}{2}, -\frac{5}{2}$$

PTS: 6   REF: 061239a2   STA: A2.A.27   TOP: Exponential Equations
KEY: common base not shown

0113a2
Answer Section

1 ANS: 2   PTS: 2   REF: 011301a2   STA: A2.A.52
   TOP: Identifying the Equation of a Graph
2 ANS: 3

$$x + y = 5 \qquad . \quad -5 + y = 5$$
$$y = -x + 5 \qquad y = 10$$

$$(x + 3)^2 + (-x + 5 - 3)^2 = 53$$

$$x^2 + 6x + 9 + x^2 - 4x + 4 = 53$$

$$2x^2 + 2x - 40 = 0$$

$$x^2 + x - 20 = 0$$

$$(x + 5)(x - 4) = 0$$

$$x = -5, 4$$

   PTS: 2   REF: 011302a2   STA: A2.A.3   TOP: Quadratic-Linear Systems
   KEY: equations
3 ANS: 2
   Since the coefficient of t is greater than 0, $r > 0$.

   PTS: 2   REF: 011303a2   STA: A2.S.8   TOP: Correlation Coefficient
4 ANS: 3
$$\frac{4}{-2} = -2$$

   PTS: 2   REF: 011304a2   STA: A2.A.31   TOP: Sequences
5 ANS: 3   PTS: 2   REF: 011305a2   STA: A2.A.37
   TOP: Defining Functions
6 ANS: 1   PTS: 2   REF: 011306a2   STA: A2.A.8
   TOP: Negative and Fractional Exponents
7 ANS: 2

$$\overline{x} \pm \sigma$$

$$153 \pm 22$$

$$131 - 175$$

   PTS: 2   REF: 011307a2   STA: A2.S.5   TOP: Normal Distributions
   KEY: interval
8 ANS: 3
$$_8C_3 \cdot x^{8-3} \cdot (-2)^3 = 56x^5 \cdot (-8) = -448x^5$$

   PTS: 2   REF: 011308a2   STA: A2.A.36   TOP: Binomial Expansions

9 ANS: 4

$$8^{3k+4} = 4^{2k-1} \quad .$$

$$(2^3)^{3k+4} = (2^2)^{2k-1}$$

$$2^{9k+12} = 2^{4k-2}$$

$$9k + 12 = 4k - 2$$

$$5k = -14$$

$$k = -\frac{14}{5}$$

PTS: 2   REF: 011309a2   STA: A2.A.27   TOP: Exponential Equations
KEY: common base not shown

10 ANS: 1   PTS: 2   REF: 011310a2   STA: A2.S.9
TOP: Differentiating Permutations and Combinations

11 ANS: 4

$$\cos 2A = 1 - 2\sin^2 A = 1 - 2\left(\frac{1}{3}\right)^2 = 1 - \frac{2}{9} = \frac{7}{9}$$

PTS: 2   REF: 011311a2   STA: A2.A.77   TOP: Double Angle Identities
KEY: evaluating

12 ANS: 4   PTS: 1   REF: 011312a2   STA: A2.A.56
TOP: Determining Trigonometric Functions   KEY: degrees, common angles

13 ANS: 1   PTS: 2   REF: 011313a2   STA: A2.A.39
TOP: Domain and Range   KEY: real domain

14 ANS: 1   PTS: 2   REF: 011314a2   STA: A2.N.3
TOP: Operations with Polynomials

15 ANS: 2   PTS: 2   REF: 011315a2   STA: A2.A.55
TOP: Trigonometric Ratios

16 ANS: 3

$$42 = \frac{1}{2}(a)(8)\sin 61$$

$$42 \approx 3.5a$$

$$12 \approx a$$

PTS: 2   REF: 011316a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
KEY: basic

17 ANS: 3

$$3x^3 - 5x^2 - 48x + 80$$

$$x^2(3x - 5) - 16(3x - 5)$$

$$(x^2 - 16)(3x - 5)$$

$$(x + 4)(x - 4)(3x - 5)$$

PTS: 2   REF: 011317a2   STA: A2.A.7   TOP: Factoring by Grouping

18 ANS: 1
$\sin(180 + x) = (\sin 180)(\cos x) + (\cos 180)(\sin x) = 0 + (-\sin x) = -\sin x$

PTS: 2 REF: 011318a2 STA: A2.A.76 TOP: Angle Sum and Difference Identities
KEY: identities

19 ANS: 3
$\sqrt[3]{6a^4b^2} + \sqrt[3]{(27 \cdot 6)a^4b^2}$

$a\sqrt[3]{6ab^2} + 3a\sqrt[3]{6ab^2}$

$4a\sqrt[3]{6ab^2}$

PTS: 2 REF: 011319a2 STA: A2.N.2 TOP: Operations with Radicals

20 ANS: 1 PTS: 2 REF: 011320a2 STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

21 ANS: 1
$20(-2) = x(-2x + 2)$

$-40 = -2x^2 + 2x$

$2x^2 - 2x - 40 = 0$

$x^2 - x - 20 = 0$

$(x + 4)(x - 5) = 0$

$x = -4, 5$

PTS: 2 REF: 011321a2 STA: A2.A.5 TOP: Inverse Variation

22 ANS: 3
$-\sqrt{2}\sec x = 2$

$\sec x = -\dfrac{2}{\sqrt{2}}$

$\cos x = -\dfrac{\sqrt{2}}{2}$

$x = 135, 225$

PTS: 2 REF: 011322a2 STA: A2.A.68 TOP: Trigonometric Equations
KEY: reciprocal functions

23 ANS: 4 PTS: 2 REF: 011323a2 STA: A2.A.2
TOP: Using the Discriminant KEY: determine nature of roots given equation

24 ANS: 1
$\dfrac{_6P_6}{3!2!} = \dfrac{720}{12} = 60$

PTS: 2 REF: 011324a2 STA: A2.S.10 TOP: Permutations

25 ANS: 3

$$\frac{3y}{2y-6} + \frac{9}{6-2y} = \frac{3y}{2y-6} - \frac{9}{2y-6} = \frac{3y-9}{2y-6} = \frac{3(y-3)}{2(y-3)} = \frac{3}{2}$$

PTS: 2   REF: 011325a2   STA: A2.A.16   TOP: Addition and Subtraction of Rationals

26 ANS: 2

$$\log 9 - \log 20$$

$$\log 3^2 - \log(10 \cdot 2)$$

$$2\log 3 - (\log 10 + \log 2)$$

$$2b - (1 + a)$$

$$2b - a - 1$$

PTS: 2   REF: 011326a2   STA: A2.A.19   TOP: Properties of Logarithms
KEY: expressing logs algebraically

27 ANS: 4

$$(x+i)^2 - (x-i)^2 = x^2 + 2xi + i^2 - (x^2 - 2xi + i^2) = 4xi$$

PTS: 2   REF: 011327a2   STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers

28 ANS:

$$a_n = 9n - 4 \qquad \cdot \ S_n = \frac{20(5 + 176)}{2} = 1810$$

$$a_1 = 9(1) - 4 = 5$$

$$a_{20} = 9(20) - 4 = 176$$

PTS: 2   REF: 011328a2   STA: A2.A.35   TOP: Summations
KEY: arithmetic

29 ANS:

$$3x^2 - 11x + 6 = 0. \ \text{Sum} \ \frac{-b}{a} = \frac{11}{3}. \ \text{Product} \ \frac{c}{a} = \frac{6}{3} = 2$$

PTS: 2   REF: 011329a2   STA: A2.A.20   TOP: Roots of Quadratics

30 ANS:

$$a + 15 + 2a = 90$$

$$3a + 15 = 90$$

$$3a = 75$$

$$a = 25$$

PTS: 2   REF: 011330a2   STA: A2.A.58   TOP: Cofunction Trigonometric Relationships

ID: A

31 ANS:
Ordered, the heights are 71, 71, 72, 74, 74, 75, 78, 79, 79, 83. $Q_1 = 72$ and $Q_3 = 79$. $79 - 72 = 7$.

PTS: 2   REF: 011331a2   STA: A2.S.4   TOP: Dispersion
KEY: range, quartiles, interquartile range, variance

32 ANS:
$$\frac{2 \pm \sqrt{(-2)^2 - 4(6)(-3)}}{2(6)} = \frac{2 \pm \sqrt{76}}{12} = \frac{2 \pm \sqrt{4}\sqrt{19}}{12} = \frac{2 \pm 2\sqrt{19}}{12} = \frac{1 \pm \sqrt{19}}{6}$$

PTS: 2   REF: 011332a2   STA: A2.A.25   TOP: Quadratics with Irrational Solutions

33 ANS:
$$30700 = 50e^{3t}$$
$$614 = e^{3t}$$
$$\ln 614 = \ln e^{3t}$$
$$\ln 614 = 3t \ln e$$
$$\ln 614 = 3t$$
$$2.14 \approx t$$

PTS: 2   REF: 011333a2   STA: A2.A.6   TOP: Exponential Growth
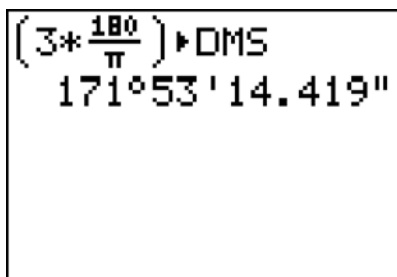
34 ANS:
$3 - 2x \geq 7$ or $3 - 2x \leq -7$
$-2x \geq 4$ $-2x \leq -10$
$x \leq -2$ $x \geq 5$

PTS: 2   REF: 011334a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph

35 ANS:

$3 \times \dfrac{180}{\pi} \approx 171.89° \approx 171°53'$.

PTS: 2   REF: 011335a2   STA: A2.M.2   TOP: Radian Measure
KEY: degrees

5

36 ANS:

$$(x+4)^2 = 17x - 4$$

$$x^2 + 8x + 16 = 17x - 4$$

$$x^2 - 9x + 20 = 0$$

$$(x-4)(x-5) = 0$$

$$x = 4, 5$$

PTS: 4   REF: 011336a2   STA: A2.A.28   TOP: Logarithmic Equations
KEY: basic

37 ANS:

$y = 215.983(1.652)^x$. $215.983(1.652)^7 \approx 7250$

PTS: 4   REF: 011337a2   STA: A2.S.7   TOP: Exponential Regression

38 ANS:

$$\frac{100}{\sin 32} = \frac{b}{\sin 105}. \quad \frac{100}{\sin 32} = \frac{a}{\sin 43}$$

$$b \approx 182.3 \qquad a \approx 128.7$$

PTS: 4   REF: 011338a2   STA: A2.A.73   TOP: Law of Sines
KEY: basic

39 ANS:

$$\sqrt{x^2 + x - 1} = -4x + 3 \qquad -4\left(\frac{2}{3}\right) + 3 \geq 0$$

$$x^2 + x - 1 = 16x^2 - 24x + 9$$

$$0 = 15x^2 - 25x + 10 \qquad \frac{1}{3} \geq 0$$

$$0 = 3x^2 - 5x + 2 \qquad -4(1) + 3 < 0$$

$$0 = (3x - 2)(x - 1) \qquad \text{1 is extraneous}$$

$$x = \frac{2}{3}, \; x \neq 1$$

PTS: 6   REF: 011339a2   STA: A2.A.22   TOP: Solving Radicals
KEY: extraneous solutions

0613a2
Answer Section

1 ANS: 2   PTS: 2   REF: 061301a2   STA: A2.S.1
   TOP: Analysis of Data
2 ANS: 2

$$\frac{8\pi}{5} \cdot \frac{180}{\pi} = 288$$

   PTS: 2   REF: 061302a2   STA: A2.M.2   TOP: Radian Measure
   KEY: degrees
3 ANS: 4   PTS: 2   REF: 061303a2   STA: A2.A.43
   TOP: Defining Functions
4 ANS: 3

$$S_8 = \frac{3(1-(-4)^8)}{1-(-4)} = \frac{196,605}{5} = -39,321$$

   PTS: 2   REF: 061304a2   STA: A2.A.35   TOP: Summations
   KEY: geometric
5 ANS: 2

$$\frac{1 - \dfrac{4}{x}}{1 - \dfrac{2}{x} - \dfrac{8}{x^2}} \times \frac{x^2}{x^2} = \frac{x^2 - 4x}{x^2 - 2x - 8} = \frac{x(x-4)}{(x-4)(x+2)} = \frac{x}{x+2}$$

   PTS: 2   REF: 061305a2   STA: A2.A.17   TOP: Complex Fractions
6 ANS: 3   PTS: 2   REF: 061306a2   STA: A2.A.72
   TOP: Identifying the Equation of a Trigonometric Graph
7 ANS: 1
   $2x - 1 > 5.\quad 2x - 1 < -5$

   $\quad 2x > 6 \qquad 2x > -4$

   $\quad\ \ x > 3 \qquad\ \ x < -2$

   PTS: 2   REF: 061307a2   STA: A2.A.1   TOP: Absolute Value Inequalities
   KEY: graph
8 ANS: 3   PTS: 2   REF: 061308ge   STA: A2.A.51
   TOP: Domain and Range
9 ANS: 4
   $\sin(\theta + 90) = \sin\theta \cdot \cos 90 + \cos\theta \cdot \sin 90 = \sin\theta \cdot (0) + \cos\theta \cdot (1) = \cos\theta$

   PTS: 2   REF: 061309a2   STA: A2.A.76   TOP: Angle Sum and Difference Identities
   KEY: identities

1

10 ANS: 2

$2^2 \cdot 3 = 12$. $6^2 d = 12$

$4^2 \cdot \dfrac{3}{4} = 12$ $36d = 12$

$d = \dfrac{1}{3}$

PTS: 2   REF: 061310a2   STA: A2.A.5   TOP: Inverse Variation

11 ANS: 2

$\sin S = \dfrac{8}{17}$

$S = \sin^{-1} \dfrac{8}{17}$

$S \approx 28°4'$

PTS: 2   REF: 061311a2   STA: A2.A.55   TOP: Trigonometric Ratios

12 ANS: 4

$x = 2y$. $y^2 - (3y)^2 + 32 = 0$. $x = 3(-2) = -6$

$y^2 - 9y^2 = -32$

$-8y^2 = -32$

$y^2 = 4$

$y = \pm 2$

PTS: 2   REF: 061312a2   STA: A2.A.3   TOP: Quadratic-Linear Systems
KEY: equations

13 ANS: 3

$1000 = 500e^{.05t}$

$2 = e^{.05t}$

$\ln 2 = \ln e^{.05t}$

$\dfrac{\ln 2}{.05} = \dfrac{.05t \cdot \ln e}{.05}$

$13.9 \approx t$

PTS: 2   REF: 061313a2   STA: A2.A.6   TOP: Exponential Growth

14 ANS: 3

$6n^{-1} < 4n^{-1}$. Flip sign when multiplying each side of the inequality by n, since a negative number.

$\dfrac{6}{n} < \dfrac{4}{n}$

$6 > 4$

PTS: 2   REF: 061314a2   STA: A2.N.1   TOP: Negative and Fractional Exponents

15 ANS: 4

$4 + 3(2 - x) + 3(3 - x) + 3(4 - x) + 3(5 - x)$

$4 + 6 - 3x + 9 - 3x + 12 - 3x + 15 - 3x$

$46 - 12x$

PTS: 2   REF: 061315a2   STA: A2.N.10   TOP: Sigma Notation
KEY: basic

16 ANS: 1   PTS: 2   REF: 061316a2   STA: A2.S.8
TOP: Correlation Coefficient

17 ANS: 1   PTS: 2   REF: 061317a2   STA: A2.S.9
TOP: Differentiating Permutations and Combinations

18 ANS: 4   PTS: 2   REF: 061318a2   STA: A2.A.49
TOP: Equations of Circles

19 ANS: 3

$(3i)(2i)^2(m + i)$

$(3i)(4i^2)(m + i)$

$(3i)(-4)(m + i)$

$(-12i)(m + i)$

$-12mi - 12i^2$

$-12mi + 12$

PTS: 2   REF: 061319a2   STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers

20 ANS: 3

If $\csc P > 0$, $\sin P > 0$. If $\cot P < 0$ and $\sin P > 0$, $\cos P < 0$

PTS: 2   REF: 061320a2   STA: A2.A.60   TOP: Finding the Terminal Side of an Angle

21 ANS: 3

$\log 4m^2 = \log 4 + \log m^2 = \log 4 + 2\log m$

PTS: 2   REF: 061321a2   STA: A2.A.19   TOP: Properties of Logarithms
KEY: splitting logs

22 ANS: 2   PTS: 2   REF: 061322a2   STA: A2.A.73
TOP: Law of Sines   KEY: side, without calculator

23 ANS: 2

$$\tan 30 = \frac{\sqrt{3}}{3}. \quad \text{Arc}\cos \frac{\sqrt{3}}{k} = 30$$

$$\frac{\sqrt{3}}{k} = \cos 30$$

$$k = 2$$

PTS: 2   REF: 061323a2   STA: A2.A.64   TOP: Using Inverse Trigonometric Functions
KEY: advanced

24 ANS: 1   PTS: 2   REF: 061324a2   STA: A2.A.9
TOP: Negative Exponents

25 ANS: 4

$$\frac{x}{x - \sqrt{x}} \times \frac{x + \sqrt{x}}{x + \sqrt{x}} = \frac{x^2 + x\sqrt{x}}{x^2 - x} = \frac{x(x + \sqrt{x})}{x(x-1)} = \frac{x + \sqrt{x}}{x - 1}$$

PTS: 2   REF: 061325a2   STA: A2.A.15   TOP: Rationalizing Denominators
KEY: index = 2

26 ANS: 2

$$\frac{-\frac{3}{32} a^3 b^4}{\frac{1}{64} a^5 b^3} = -\frac{6b}{a^2}$$

PTS: 2   REF: 061326a2   STA: A2.A.31   TOP: Sequences

27 ANS: 4

$$\frac{13}{\sin 40} = \frac{20}{\sin M}. \quad 81 + 40 < 180. \quad (180 - 81) + 40 < 180$$

$$M \approx 81$$

PTS: 2   REF: 061327a2   STA: A2.A.75   TOP: Law of Sines - The Ambiguous Case

28 ANS:

$$\text{Sum } \frac{-b}{a} = -\frac{1}{12}. \quad \text{Product } \frac{c}{a} = -\frac{1}{2}$$

PTS: 2   REF: 061328a2   STA: A2.A.20   TOP: Roots of Quadratics

29 ANS:

$$2x - 1 = 27^{\frac{4}{3}}$$

$$2x - 1 = 81$$

$$2x = 82$$

$$x = 41$$

PTS: 2   REF: 061329a2   STA: A2.A.28   TOP: Logarithmic Equations
KEY: advanced

30 ANS:

$$\frac{_{10}P_{10}}{3!\cdot 3!\cdot 2!} = \frac{3,628,800}{72} = 50,400$$

PTS: 2   REF: 061330a2   STA: A2.S.10   TOP: Permutations

31 ANS:

$$\frac{\sqrt{3}}{2} \times \frac{\sqrt{2}}{2} = \frac{\sqrt{6}}{4}$$

PTS: 2   REF: 061331a2   STA: A2.A.56   TOP: Determining Trigonometric Functions
KEY: degrees, common angles

32 ANS:

$5\csc\theta = 8$

$\csc\theta = \dfrac{8}{5}$

$\sin\theta = \dfrac{5}{8}$

$\theta \approx 141$

PTS: 2   REF: 061332a2   STA: A2.A.68   TOP: Trigonometric Equations
KEY: reciprocal functions

33 ANS:

$$g(10) = \left(a(10)\sqrt{1-x}\right)^2 = 100a^2(-9) = -900a^2$$

PTS: 2   REF: 061333a2   STA: A2.A.41   TOP: Functional Notation

34 ANS:

$$\frac{\cot x \sin x}{\sec x} = \frac{\frac{\cos x}{\sin x}\sin x}{\frac{1}{\cos x}} = \cos^2 x$$

PTS: 2   REF: 061334a2   STA: A2.A.58   TOP: Reciprocal Trigonometric Relationships

35 ANS:

$${}_7C_3\left(\frac{1}{4}\right)^3\left(\frac{3}{4}\right)^4 = 35\left(\frac{1}{64}\right)\left(\frac{81}{256}\right) = \frac{2835}{16384} \approx 0.173$$

PTS: 2   REF: 061335a2   STA: A2.S.15   TOP: Binomial Probability
KEY: exactly

36 ANS:

$\dfrac{13}{x} = 10 - x$ $x = \dfrac{10 \pm \sqrt{100 - 4(1)(13)}}{2(1)} = \dfrac{10 \pm \sqrt{48}}{2} = \dfrac{10 \pm 4\sqrt{3}}{2} = 5 \pm 2\sqrt{3}$

$13 = 10x - x^2$

$x^2 - 10x + 13 = 0$

PTS: 4   REF: 061336a2   STA: A2.A.23   TOP: Solving Rationals
KEY: irrational and complex solutions

37 ANS:

$\dfrac{15}{\sin 103} = \dfrac{a}{\sin 42}$. $\dfrac{1}{2}(15)(10.3)\sin 35 \approx 44$

$\quad a \approx 10.3$

PTS: 4   REF: 061337a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
KEY: advanced

38 ANS:

$\sigma_x \approx 6.2$. 6 scores are within a population standard deviation of the mean. $Q_3 - Q_1 = 41 - 37 = 4$

$\bar{x} \approx 38.2$

PTS: 4   REF: 061338a2   STA: A2.S.4   TOP: Dispersion
KEY: advanced

39 ANS:

$x^4 + 4x^3 + 4x^2 + 16x = 0$

$x(x^3 + 4x^2 + 4x + 16) = 0$

$x(x^2(x+4) + 4(x+4)) = 0$

$x(x^2 + 4)(x + 4) = 0$

$x = 0, \pm 2i, -4$

PTS: 6   REF: 061339a2   STA: A2.A.26   TOP: Solving Polynomial Equations

0114a2
Answer Section

1 ANS: 1
$(4a + 4) - (2a + 1) = 2a + 3$

   PTS: 2   REF: 011401a2   STA: A2.A.30   TOP: Sequences
2 ANS: 1   PTS: 2   REF: 011402a2   STA: A2.A.8
   TOP: Negative and Fractional Exponents
3 ANS: 3
$h(-8) = \frac{1}{2}(-8) - 2 = -4 - 2 = -6.$ $g(-6) = \frac{1}{2}(-6) + 8 = -3 + 8 = 5$

   PTS: 2   REF: 011403a2   STA: A2.A.42   TOP: Compositions of Functions
   KEY: numbers
4 ANS: 1

$$\frac{1}{7 - \sqrt{11}} \cdot \frac{7 + \sqrt{11}}{7 + \sqrt{11}} = \frac{7 + \sqrt{11}}{49 - 11} = \frac{7 + \sqrt{11}}{38}$$

   PTS: 2   REF: 011404a2   STA: A2.N.5   TOP: Rationalizing Denominators
5 ANS: 3

$$\frac{a + \frac{b}{c}}{d - \frac{b}{c}} = \frac{\frac{ac + b}{c}}{\frac{cd - b}{c}} = \frac{ac + b}{c} \cdot \frac{c}{cd - b} = \frac{ac + b}{cd - b}$$

   PTS: 2   REF: 011405a2   STA: A2.A.17   TOP: Complex Fractions
6 ANS: 4   PTS: 2   REF: 011406a2   STA: A2.S.1
   TOP: Analysis of Data
7 ANS: 2   PTS: 2   REF: 011407a2   STA: A2.A.43
   TOP: Defining Functions
8 ANS: 2
$(x + 2)^2 = -9$

$x + 2 = \pm\sqrt{-9}$

$x = -2 \pm 3i$

   PTS: 2   REF: 011408a2   STA: A2.A.24   TOP: Completing the Square
9 ANS: 4   PTS: 2   REF: 011409a2   STA: A2.S.10
   TOP: Permutations
10 ANS: 3

$$5000\left(1 + \frac{.03}{4}\right)^{4 \cdot 5} = 5000(1.0075)^{20} \approx 5805.92$$

   PTS: 2   REF: 011410a2   STA: A2.A.12   TOP: Evaluating Exponential Expressions

11 ANS: 2

$b^2 - 4ac = (-9)^2 - 4(2)(4) = 81 - 32 = 49$

PTS: 2   REF: 011411a2   STA: A2.A.2   TOP: Using the Discriminant
KEY: determine nature of roots given equation

12 ANS: 3

$20 \cdot 2 = -5t$

$-8 = t$

PTS: 2   REF: 011412a2   STA: A2.A.5   TOP: Inverse Variation

13 ANS: 2

If $\sin A = -\dfrac{7}{25}$, $\cos A = \dfrac{24}{25}$, and $\tan A = \dfrac{\sin A}{\cos A} = \dfrac{-\dfrac{7}{25}}{\dfrac{24}{25}} = -\dfrac{7}{24}$

PTS: 2   REF: 011413a2   STA: A2.A.64   TOP: Using Inverse Trigonometric Functions
KEY: advanced

14 ANS: 4

$$(a-1)^2 + (a-2)^2 + (a-3)^2 + (a-4)^2$$

$$(a^2 - 2a + 1) + (a^2 - 4a + 4) + (a^2 - 6a + 9) + (a^2 - 8a + 16)$$

$$4a^2 - 20a + 30$$

PTS: 2   REF: 011414a2   STA: A2.N.10   TOP: Sigma Notation
KEY: advanced

15 ANS: 3

$$x^2 + y^2 - 16x + 6y + 53 = 0$$

$$x^2 - 16x + 64 + y^2 + 6y + 9 = -53 + 64 + 9$$

$$(x-8)^2 + (y+3)^2 = 20$$

PTS: 2   REF: 011415a2   STA: A2.A.47   TOP: Equations of Circles

16 ANS: 1   PTS: 2   REF: 011416a2   STA: A2.A.39
TOP: Domain and Range   KEY: real domain

17 ANS: 2   PTS: 2   REF: 011417a2   STA: A2.S.9
TOP: Differentiating Permutations and Combinations

18 ANS: 3

$\dfrac{-b}{a} = \dfrac{-(-4)}{1} = 4$. If the sum is 4, the roots must be 7 and –3.

PTS: 2   REF: 011418a2   STA: A2.A.21   TOP: Roots of Quadratics
KEY: advanced

19 ANS: 2

$$\frac{5}{\sin 32} = \frac{8}{\sin E} \qquad 57.98 + 32 < 180$$
$$E \approx 57.98 \quad (180 - 57.98) + 32 < 180$$

PTS: 2   REF: 011419a2   STA: A2.A.75   TOP: Law of Sines - The Ambiguous Case

20 ANS: 2

Top 6.7% = 1.5 s.d. $+ \sigma = 1.5(104) + 576 = 732$

PTS: 2   REF: 011420a2   STA: A2.S.5   TOP: Normal Distributions
KEY: predict

21 ANS: 4

$$\left(\sqrt[3]{27x^2} \right)\left(\sqrt[3]{16x^4} \right) = \sqrt[3]{3^3 \cdot 2^4 \cdot x^6} = 3 \cdot 2 \cdot x^2 \sqrt[3]{2} = 6x^2 \sqrt[3]{2}$$

PTS: 2   REF: 011421a2   STA: A2.N.2   TOP: Operations with Radicals

22 ANS: 3   PTS: 2   REF: 011422a2   STA: A2.A.54
TOP: Graphing Logarithmic Functions

23 ANS: 4

$$\frac{x^2 + 9x - 22}{x^2 - 121} \div (2 - x) = \frac{(x+11)(x-2)}{(x+11)(x-11)} \cdot \frac{-1}{x-2} = \frac{-1}{x-11}$$

PTS: 2   REF: 011423a2   STA: A2.A.16   TOP: Multiplication and Division of Rationals
KEY: Division

24 ANS: 3

$\dfrac{x+16}{x-2} - \dfrac{7(x-2)}{x-2} \le 0$ $-6x + 30 = 0$ $x - 2 = 0$. Check points such that $x < 2$, $2 < x < 5$, and $x > 5$. If $x = 1$,

$\dfrac{-6x + 30}{x - 2} \le 0$ $-6x = -30$ $x = 2$
$x = 5$

$\dfrac{-6(1) + 30}{1 - 2} = \dfrac{24}{-1} = -24$, which is less than 0. If $x = 3$, $\dfrac{-6(3) + 30}{3 - 2} = \dfrac{12}{1} = 12$, which is greater than 0. If $x = 6$,

$\dfrac{-6(6) + 30}{6 - 2} = \dfrac{-6}{4} = -\dfrac{3}{2}$, which is less than 0.

PTS: 2   REF: 011424a2   STA: A2.A.23   TOP: Rational Inequalities

25 ANS: 1

$$\frac{2\pi}{b} = 4\pi$$

$$b = \frac{1}{2}$$

PTS: 2   REF: 011425a2   STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions   KEY: period

26 ANS: 4

$$x^2(x+2) - (x+2)$$

$$(x^2 - 1)(x+2)$$

$$(x+1)(x-1)(x+2)$$

PTS: 2   REF: 011426a2   STA: A2.A.7   TOP: Factoring by Grouping

27 ANS: 1

$$5 \cdot \frac{180}{\pi} \approx 286$$

PTS: 2   REF: 011427a2   STA: A2.M.2   TOP: Radian Measure
KEY: degrees

28 ANS:

$$\sec \theta \sin \theta \cot \theta = \frac{1}{\cos \theta} \cdot \sin \theta \cdot \frac{\cos \theta}{\sin \theta} = 1$$

PTS: 2   REF: 011428a2   STA: A2.A.58   TOP: Reciprocal Trigonometric Relationships

29 ANS:

$$K = ab\sin C = 6 \cdot 6 \sin 50 \approx 27.6$$

PTS: 2   REF: 011429a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
KEY: Parallelograms

30 ANS:

$Q_1 = 3.5$ and $Q_3 = 10.5$. $10.5 - 3.5 = 7$.

PTS: 2   REF: 011430a2   STA: A2.S.4   TOP: Dispersion
KEY: range, quartiles, interquartile range, variance

31 ANS:

$$x(x+3) = 10$$

$$x^2 + 3x - 10 = 0$$

$$(x+5)(x-2) = 0$$

$$x = -5, 2$$

PTS: 2   REF: 011431a2   STA: A2.A.3   TOP: Quadratic-Linear Systems
KEY: equations

32 ANS:

$-4x + 5 < 13$ $-4x + 5 > -13$ $-2 < x < 4.5$

   $-4x < 8$ $-4x > -18$

    $x > -2$ $x < 4.5$

PTS: 2   REF: 011432a2   STA: A2.A.1   TOP: Absolute Value Inequalities

33 ANS:

$4xi + 5yi^8 + 6xi^3 + 2yi^4 = 4xi + 5y - 6xi + 2y = 7y - 2xi$

PTS: 2   REF: 011433a2   STA: A2.N.7   TOP: Imaginary Numbers

34 ANS:

$\dfrac{31 - 19}{7 - 4} = \dfrac{12}{3} = 4$ $x + (4 - 1)4 = 19$ $a_n = 7 + (n - 1)4$

$x + 12 = 19$

$x = 7$

PTS: 2   REF: 011434a2   STA: A2.A.29   TOP: Sequences

35 ANS:

$83°50' \cdot \dfrac{\pi}{180} \approx 1.463$ radians $s = \theta r = 1.463 \cdot 12 \approx 17.6$

PTS: 2   REF: 011435a2   STA: A2.A.61   TOP: Arc Length
KEY: arc length

36 ANS:

$2\sin^2 x + 5\sin x - 3 = 0$

$(2\sin x - 1)(\sin x + 3) = 0$

$\sin x = \dfrac{1}{2}$

$x = \dfrac{\pi}{6}, \dfrac{5\pi}{6}$

PTS: 4   REF: 011436a2   STA: A2.A.68   TOP: Trigonometric Equations
KEY: quadratics

37 ANS:

${}_5C_4 \cdot 0.28^4 \cdot 0.72^1 + {}_5C_5 \cdot 0.28^5 \cdot 0.72^0 \approx 0.024$

PTS: 4   REF: 011437a2   STA: A2.S.15   TOP: Binomial Probability
KEY: at least or at most

38 ANS:

$\sqrt{27^2 + 32^2 - 2(27)(32)\cos 132} \approx 54$

PTS: 4   REF: 011438a2   STA: A2.A.73   TOP: Law of Cosines
KEY: applied

39 ANS:

$\log_{(x+3)}(2x+3)(x+5) = 2$ -6 is extraneous

$$(x+3)^2 = (2x+3)(x+5)$$

$$x^2 + 6x + 9 = 2x^2 + 13x + 15$$

$$x^2 + 7x + 6 = 0$$

$$(x+6)(x+1) = 0$$

$$x = -1$$

PTS: 6   REF: 011439a2   STA: A2.A.28   TOP: Logarithmic Equations
KEY: applying properties of logarithms

0614a2
Answer Section

1 ANS: 1   PTS: 2   REF: 061401a2   STA: A2.S.2
   TOP: Analysis of Data
2 ANS: 4   PTS: 2   REF: 061402a2   STA: A2.A.8
   TOP: Negative and Fractional Exponents
3 ANS: 2

$\frac{1}{2}(22)(13)\sin 55 \approx 117$

   PTS: 2   REF: 061403a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
   KEY: basic
4 ANS: 3

$\sqrt{9}\,\sqrt{-1}\,\sqrt{2} - \sqrt{16}\,\sqrt{-1}\,\sqrt{2} = 3i\,\sqrt{2} - 4i\,\sqrt{2} = -i\,\sqrt{2}$

   PTS: 2   REF: 061404a2   STA: A2.N.6   TOP: Square Roots of Negative Numbers
5 ANS: 3
   As originally written, alternatives (2) and (3) had no domain restriction, so that both were correct.

   PTS: 2   REF: 061405a2   STA: A2.A.52
   TOP: Properties of Graphs of Functions and Relations
6 ANS: 2

$\sqrt{2x-4} = x-2$

$2x-4 = x^2 - 4x + 4$

$0 = x^2 - 6x + 8$

$0 = (x-4)(x-2)$

$x = 4, 2$

   PTS: 2   REF: 061406a2   STA: A2.A.22   TOP: Solving Radicals
   KEY: extraneous solutions
7 ANS: 3   PTS: 2   REF: 061407a2   STA: A2.N.3
   TOP: Operations with Polynomials
8 ANS: 1   PTS: 2   REF: 061408a2   STA: A2.A.24
   TOP: Completing the Square
9 ANS: 1   PTS: 2   REF: 061409a2   STA: A2.A.38
   TOP: Defining Functions   KEY: graphs
10 ANS: 2

$\dfrac{\cot x}{\csc x} = \dfrac{\dfrac{\cos x}{\sin x}}{\dfrac{1}{\sin x}} = \cos x$

   PTS: 2   REF: 061410a2   STA: A2.A.58   TOP: Reciprocal Trigonometric Relationships

11 ANS: 4 PTS: 2 REF: 061411a2 STA: A2.A.30
TOP: Sequences

12 ANS: 3 PTS: 2 REF: 061412a2 STA: A2.A.60
TOP: Finding the Terminal Side of an Angle

13 ANS: 2

$$\frac{2\pi}{6} = \frac{\pi}{3}$$

PTS: 2 REF: 061413a2 STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions KEY: period

14 ANS: 4

$$2x^2 - 7x - 5 = 0$$

$$\frac{c}{a} = \frac{-5}{2}$$

PTS: 2 REF: 061414a2 STA: A2.A.20 TOP: Roots of Quadratics

15 ANS: 4

$$r = \sqrt{(6-3)^2 + (5-(-4))^2} = \sqrt{9+81} = \sqrt{90}$$

PTS: 2 REF: 061415a2 STA: A2.A.48 TOP: Equations of Circles

16 ANS: 3 PTS: 2 REF: 061416a2 STA: A2.A.12
TOP: Evaluating Exponential Expressions

17 ANS: 2

$$\frac{30}{(x+3)(x-3)} + \frac{(x+3)(x-3)}{(x+3)(x-3)} = \frac{5(x+3)}{(x-3)(x+3)} \quad 3 \text{ is an extraneous root.}$$

$$30 + x^2 - 9 = 5x + 15$$

$$x^2 - 5x + 6 = 0$$

$$(x-3)(x-2) = 0$$

$$x = 2$$

PTS: 2 REF: 061417a2 STA: A2.A.23 TOP: Solving Rationals
KEY: rational solutions

18 ANS: 3 PTS: 2 REF: 061418a2 STA: A2.A.51
TOP: Domain and Range

19 ANS: 1

$$f(g(x)) = 2(x+5)^2 - 3(x+5) + 1 = 2(x^2 + 10x + 25) - 3x - 15 + 1 = 2x^2 + 17x + 36$$

PTS: 2 REF: 061419a2 STA: A2.A.42 TOP: Compositions of Functions
KEY: variables

20 ANS: 1 PTS: 2 REF: 061420a2 STA: A2.A.34
TOP: Sigma Notation

21 ANS: 2
$$\cos(x - y) = \cos x \cos y + \sin x \sin y$$
$$= b \cdot b + a \cdot a$$
$$= b^2 + a^2$$

PTS: 2   REF: 061421a2   STA: A2.A.76   TOP: Angle Sum and Difference Identities
KEY: simplifying

22 ANS: 3
$$_3C_1 \cdot {}_5C_2 = 3 \cdot 10 = 30$$

PTS: 2   REF: 061422a2   STA: A2.S.12   TOP: Combinations

23 ANS: 3
$$(-5)^2 - 4(2)(0) = 25$$

PTS: 2   REF: 061423a2   STA: A2.A.2   TOP: Using the Discriminant
KEY: determine equation given nature of roots

24 ANS: 2

$$60 = -16t^2 + 5t + 105 \quad t = \frac{-5 \pm \sqrt{5^2 - 4(-16)(45)}}{2(-16)} \approx \frac{-5 \pm 53.89}{-32} \approx 1.84$$
$$0 = -16t^2 + 5t + 45$$

PTS: 2   REF: 061424a2   STA: A2.A.25   TOP: Quadratics with Irrational Solutions

25 ANS: 3
$$2! \cdot 2! \cdot 2! = 8$$

PTS: 2   REF: 061425a2   STA: A2.S.10   TOP: Permutations

26 ANS: 4
$$\log 2x^3 = \log 2 + \log x^3 = \log 2 + 3 \log x$$

PTS: 2   REF: 061426a2   STA: A2.A.19   TOP: Properties of Logarithms
KEY: splitting logs

27 ANS: 4   PTS: 2   REF: 061427a2   STA: A2.A.63
TOP: Domain and Range

28 ANS:
Less than 60 inches is below 1.5 standard deviations from the mean. $0.067 \cdot 450 \approx 30$

PTS: 2   REF: 061428a2   STA: A2.S.5   TOP: Normal Distributions
KEY: predict

29 ANS:
$$y = 0.488(1.116)^x$$

PTS: 2   REF: 061429a2   STA: A2.S.7   TOP: Exponential Regression

30 ANS:

$2x - 3 > 5$ or $2x - 3 < -5$

$2x > 8 \qquad 2x < -2$

$x > 4 \qquad x < -1$

PTS: 2   REF: 061430a2   STA: A2.A.1   TOP: Absolute Value Inequalities

31 ANS:

$2.5 \cdot \dfrac{180}{\pi} \approx 143°14'$

PTS: 2   REF: 061431a2   STA: A2.M.2   TOP: Radian Measure
KEY: degrees

32 ANS:

$(x + yi)(x - yi) = x^2 - y^2 i^2 = x^2 + y^2$

PTS: 2   REF: 061432a2   STA: A2.N.8   TOP: Conjugates of Complex Numbers

33 ANS:

$(5x - 1)^{\frac{1}{3}} = 4$

$5x - 1 = 64$

$5x = 65$

$x = 13$

PTS: 2   REF: 061433a2   STA: A2.A.28   TOP: Logarithmic Equations
KEY: advanced

34 ANS:

$\sec x = \sqrt{2}$

$\cos x = \dfrac{1}{\sqrt{2}}$

$\cos x = \dfrac{\sqrt{2}}{2}$

$x = 45°, 315°$

PTS: 2   REF: 061434a2   STA: A2.A.68   TOP: Trigonometric Equations
KEY: reciprocal functions

35 ANS:
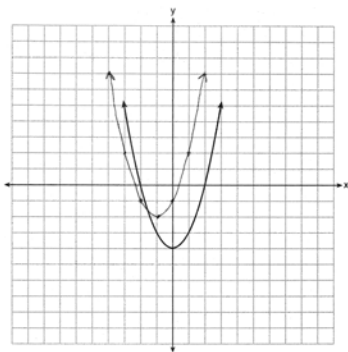
PTS: 2 REF: 061435a2 STA: A2.A.46
TOP: Transformations with Functions and Relations

36 ANS:

$$\frac{1+\dfrac{3}{x}}{1-\dfrac{5}{x}-\dfrac{24}{x^2}} \cdot \frac{x^2}{x^2} = \frac{x^2+3x}{x^2-5x-24} = \frac{x(x+3)}{(x-8)(x+3)} = \frac{x}{x-8}$$

PTS: 4 REF: 061436a2 STA: A2.A.17 TOP: Complex Fractions

37 ANS:

$$x^3 + 5x^2 - 4x - 20 = 0$$
$$x^2(x+5) - 4(x+5) = 0$$
$$(x^2 - 4)(x+5) = 0$$
$$(x+2)(x-2)(x+5) = 0$$
$$x = \pm 2, -5$$

PTS: 4 REF: 061437a2 STA: A2.A.26 TOP: Solving Polynomial Equations

38 ANS:

$$_5C_0 \cdot 0.57^0 \cdot 0.43^5 + {_5C_1} \cdot 0.57^1 \cdot 0.43^4 + {_5C_2} \cdot 0.57^2 \cdot 0.43^3 \approx 0.37$$

PTS: 4 REF: 061438a2 STA: A2.S.15 TOP: Binomial Probability
KEY: at least or at most

39 ANS:
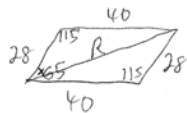
$$R = \sqrt{28^2 + 40^2 - 2(28)(40)\cos 115} \approx 58 \qquad \frac{58}{\sin 115} = \frac{40}{\sin x}$$
$$x \approx 39$$

PTS: 6 REF: 061439a2 STA: A2.A.73 TOP: Vectors

0115a2
Answer Section

1 ANS: 2 PTS: 2 REF: 011501a2 STA: A2.A.73
 TOP: Law of Cosines KEY: side, without calculator
2 ANS: 2 PTS: 2 REF: 011502a2 STA: A2.A.52
 TOP: Identifying the Equation of a Graph
3 ANS: 3 PTS: 2 REF: 011503a2 STA: A2.A.28
 TOP: Logarithmic Equations KEY: basic
4 ANS: 4 PTS: 2 REF: 011504a2 STA: A2.A.34
 TOP: Sigma Notation
5 ANS: 1 PTS: 2 REF: 011506a2 STA: A2.A.53
 TOP: Graphing Exponential Functions
6 ANS: 2

$(-5)^2 - 4(1)(4) = 9$

 PTS: 2 REF: 011506a2 STA: A2.A.2 TOP: Using the Discriminant
7 ANS: 2 PTS: 2 REF: 011507a2 STA: A2.A.38
 TOP: Defining Functions KEY: graphs
8 ANS: 1

$$\frac{\frac{3}{4}}{-\frac{1}{2}} = -\frac{3}{2}$$

 PTS: 2 REF: 011508a2 STA: A2.A.31 TOP: Sequences
9 ANS: 3
 $_{20}C_4 = 4,845$

 PTS: 2 REF: 011509a2 STA: A2.S.11 TOP: Combinations
10 ANS: 3

$$\cos 2A = 1 - 2\sin^2 A = 1 - 2\left(\frac{3}{8}\right)^2 = \frac{32}{32} - \frac{9}{32} = \frac{23}{32}$$

 PTS: 2 REF: 011510a2 STA: A2.A.77 TOP: Double Angle Identities
 KEY: evaluating
11 ANS: 2
 $x^3 - 2x^2 - 9x + 18$

 $x^2(x-2) - 9(x-2)$

 $(x^2 - 9)(x-2)$

 $(x+3)(x-3)(x-2)$

 PTS: 2 REF: 011511a2 STA: A2.A.7 TOP: Factoring by Grouping

12 ANS: 4

$(-3 - 2i)(-3 + 2i) = 9 - 4i^2 = 9 + 4 = 13$

PTS: 2   REF: 011512a2   STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers

13 ANS: 4   PTS: 2   REF: 011513a2   STA: A2.A.49
TOP: Equations of Circles

14 ANS: 2

$5^2 a^{-3} b^4 = \dfrac{25b^4}{a^3}$

PTS: 2   REF: 011514a2   STA: A2.A.9   TOP: Negative Exponents

15 ANS: 3

$\sin^2 x \left(1 + \dfrac{\cos^2 x}{\sin^2 x} \right) = \sin^2 x + \cos^2 x = 1 \quad \dfrac{1}{\cos^2 x}(\cos^2 x) = 1 \quad \cos^2 x \left(\dfrac{\sin^2 x}{\cos^2 x} - 1 \right) = \sin^2 x - \cos^2 x \neq 1$

$\dfrac{\cos^2 x}{\sin^2 x} \left(\dfrac{1}{\cos^2 x} - 1 \right) = \dfrac{1}{\sin^2 x} - \dfrac{\cos^2 x}{\sin^2 x} = \csc^2 x - \cot x = 1$

PTS: 2   REF: 011515a2   STA: A2.A.67   TOP: Proving Trigonometric Identities

16 ANS: 1

$\sqrt[3]{64a^5 b^6} = \sqrt[3]{4^3 a^3 a^2 b^6} = 4ab^2 \sqrt[3]{a^2}$

PTS: 2   REF: 011516a2   STA: A2.N.2   TOP: Operations with Radicals

17 ANS: 3

$\dfrac{c}{a} = \dfrac{-3}{4}$

PTS: 2   REF: 011517a2   STA: A2.A.20   TOP: Roots of Quadratics

18 ANS: 1

$\dfrac{_{11}P_{11}}{2!2!2!2!} = \dfrac{39,916,800}{16} = 2,494,800$

PTS: 2   REF: 011518a2   STA: A2.S.10   TOP: Permutations

19 ANS: 1

$_5 C_2 (2x)^{5-2} (-3)^2 = 720x^3$

PTS: 2   REF: 011519a2   STA: A2.A.36   TOP: Binomial Expansions

20 ANS: 2

$\sec\theta = \dfrac{\sqrt{x^2 + y^2}}{x} = \dfrac{\sqrt{(-4)^2 + 0^2}}{-4} = \dfrac{4}{-4} = -1$

PTS: 2   REF: 011520a2   STA: A2.A.62   TOP: Determining Trigonometric Functions

21 ANS: 2   PTS: 2   REF: 011521a2   STA: A2.A.39
TOP: Domain and Range   KEY: real domain

2

22 ANS: 3

$$\frac{5x}{x(x-3)} - \frac{2(x-3)}{x(x-3)} = \frac{x(x-3)}{x(x-3)}$$

$$5x - 2x + 6 = x^2 - 3x$$

$$0 = x^2 - 6x - 6$$

PTS: 2   REF: 011522a2   STA: A2.A.23   TOP: Solving Rationals
KEY: irrational and complex solutions

23 ANS: 4

$$\frac{\sqrt{34}}{\sin 30} = \frac{12}{\sin B}$$

$$B = \sin^{-1} \frac{12 \sin 30}{\sqrt{34}}$$

$$\approx \sin^{-1} \frac{6}{5.8}$$

PTS: 2   REF: 011523a2   STA: A2.A.75   TOP: Law of Sines - The Ambiguous Case

24 ANS: 4

$$\left(\frac{3}{2}x - 1\right)\left[\left(\frac{3}{2}x + 1\right) - \left(\frac{3}{2}x - 1\right)\right] = \left(\frac{3}{2}x - 1\right)(2) = 3x - 2$$

PTS: 2   REF: 011524a2   STA: A2.N.3   TOP: Operations with Polynomials

25 ANS: 2
$12 - 7 = 5$

PTS: 2   REF: 011525a2   STA: A2.S.4   TOP: Dispersion
KEY: range, quartiles, interquartile range, variance

26 ANS: 2

$$s = \theta r = \frac{2\pi}{5} \cdot 18 \approx 23$$

PTS: 2   REF: 011526a2   STA: A2.A.61   TOP: Arc Length
KEY: arc length

27 ANS: 4

$$f(a+1) = 4(a+1)^2 - (a+1) + 1$$

$$= 4(a^2 + 2a + 1) - a$$

$$= 4a^2 + 8a + 4 - a$$

$$= 4a^2 + 7a + 4$$

PTS: 2   REF: 011527a2   STA: A2.A.41   TOP: Functional Notation

28 ANS:

$25 \cdot 6 = 30q$

$5 = q$

PTS: 2   REF: 011528a2   STA: A2.A.5   TOP: Inverse Variation

29 ANS:

$$\frac{(6-x)(6+x)}{(x+6)(x+6)} \cdot \frac{(x+6)(x-3)}{x-3} = 6-x$$

PTS: 2   REF: 011529a2   STA: A2.A.16   TOP: Multiplication and Division of Rationals
KEY: division

30 ANS:

$\ln e^{4x} = \ln 12$

$4x = \ln 12$

$x = \dfrac{\ln 12}{4}$

≈ 0.62

PTS: 2   REF: 011530a2   STA: A2.A.27   TOP: Exponential Equations
KEY: without common base

31 ANS:

$$\frac{5}{11}\,\pi\left(\frac{180}{\pi}\right) = 81°49'$$

PTS: 2   REF: 011531a2   STA: A2.M.2   TOP: Radian Measure
KEY: degrees

32 ANS:

$$_6C_5\left(\frac{2}{5}\right)^5\left(\frac{3}{5}\right) = 6\left(\frac{32}{3125}\right)\left(\frac{3}{5}\right) = \frac{576}{15,625}$$

PTS: 2   REF: 011532a2   STA: A2.S.15   TOP: Binomial Probability
KEY: exactly

33 ANS:

$2xi(i - 4i^2) = 2xi^2 - 8xi^3 = 2xi^2 - 8xi^3 = -2x + 8xi$

PTS: 2   REF: 011533a2   STA: A2.N.9
TOP: Multiplication and Division of Complex Numbers

34 ANS:

$$\text{sd} = \frac{81 - 57}{3} = 8$$

$57 + 8 = 65$

$81 - 2(8) = 65$

PTS: 2   REF: 011534a2   STA: A2.S.5   TOP: Normal Distributions
KEY: mean and standard deviation

35 ANS:

$594 = 32 \cdot 46 \sin C$

$$\frac{594}{1472} = \sin C$$

$23.8 \approx C$

PTS: 2   REF: 011535a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
KEY: Parallelograms

36 ANS:

$y = 733.646(0.786)^x$ $733.646(0.786)^{12} \approx 41$

PTS: 4   REF: 011536a2   STA: A2.S.7   TOP: Exponential Regression

37 ANS:

$$a_2 = 3(2)^{-2} = \frac{3}{4} \quad a_3 = 3\left(\frac{3}{4}\right)^{-2} = \frac{16}{3} \quad a_4 = 3\left(\frac{16}{3}\right)^{-2} = \frac{27}{256}$$

PTS: 4   REF: 011537a2   STA: A2.A.33   TOP: Recursive Sequences

38 ANS:

$a = 3, b = 2, c = 1$ $y = 3\cos 2x + 1.$

PTS: 2   REF: 011538a2   STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

39 ANS:

$(x + 14)(x + 22) = 800$ $x = \dfrac{-36 \pm \sqrt{(-36)^2 - 4(1)(-492)}}{2(1)} = \dfrac{-36 + \sqrt{3264}}{2} \approx 10.6$ 10 feet increase.

$x^2 + 36x + 308 = 800$

$x^2 + 36x - 492 = 0$

PTS: 6   REF: 011539a2   STA: A2.A.25   TOP: Quadratics with Irrational Solutions

0615a2
Answer Section

1 ANS: 3   PTS: 2   REF: 061501a2   STA: A2.A.43
  TOP: Defining Functions

2 ANS: 2   PTS: 2   REF: 061502a2   STA: A2.M.1
  TOP: Radian Measure

3 ANS: 4

$g(-2) = 3(-2) - 2 = -8$ $f(-8) = 2(-8)^2 + 1 = 128 + 1 = 129$

  PTS: 2   REF: 061503a2   STA: A2.A.42   TOP: Compositions of Functions
  KEY: numbers

4 ANS: 1

$\sqrt[3]{27a^3} \cdot \sqrt[4]{16b^8} = 3a \cdot 2b^2 = 6ab^2$

  PTS: 2   REF: 061504a2   STA: A2.A.14   TOP: Operations with Radicals
  KEY: with variables | index > 2

5 ANS: 3

$$x^2 = 12x - 7$$
$$x^2 - 12x = -7$$
$$x^2 - 12x + 36 = -7 + 36$$
$$(x - 6)^2 = 29$$

  PTS: 2   REF: 061505a2   STA: A2.A.24   TOP: Completing the Square

6 ANS: 4   PTS: 2   REF: 061506a2   STA: A2.A.9
  TOP: Negative Exponents

7 ANS: 2

$$9 - x^2 < 0 \qquad \text{or } x + 3 < 0 \text{ and } x - 3 < 0$$
$$x^2 - 9 > 0 \qquad x < -3 \text{ and } x < 3$$
$$(x + 3)(x - 3) > 0 \qquad x < -3$$
$$x + 3 > 0 \text{ and } x - 3 > 0$$
$$x > -3 \text{ and } x > 3$$
$$x > 3$$

  PTS: 2   REF: 061507a2   STA: A2.A.4   TOP: Quadratic Inequalities
  KEY: one variable

8 ANS: 2

$$K = 8 \cdot 12 \sin 120 = 96 \cdot \frac{\sqrt{3}}{2} = 48\sqrt{3}$$

  PTS: 2   REF: 061508a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
  KEY: parallelograms

9 ANS: 1

$$\frac{5}{4-\sqrt{11}} \cdot \frac{4+\sqrt{11}}{4+\sqrt{11}} = \frac{5(4+\sqrt{11})}{16-11} = \frac{5(4+\sqrt{11})}{5} = 4+\sqrt{11}$$

PTS: 2   REF: 061509a2   STA: A2.N.5   TOP: Rationalizing Denominators
10 ANS: 2   PTS: 2   REF: 061510a2   STA: A2.A.5
TOP: Inverse Variation
11 ANS: 1

$$\frac{_9P_9}{4! \cdot 2! \cdot 2!} = \frac{362,880}{96} = 3,780$$

PTS: 2   REF: 061511a2   STA: A2.S.10   TOP: Permutations
12 ANS: 3

$$a_4 = 3xy^5 \left(\frac{2x}{y} \right)^3 = 3xy^5 \left(\frac{8x^3}{y^3} \right) = 24x^4y^2$$

PTS: 2   REF: 061512a2   STA: A2.A.33   TOP: Sequences
13 ANS: 2
$x - 2 = 3x + 10$ -6 is extraneous. $x - 2 = -3x - 10$

$-12 = 2x$ $4x = -8$

$-6 = x$ $x = -2$

PTS: 2   REF: 061513a2   STA: A2.A.1   TOP: Absolute Value Equations
14 ANS: 3   PTS: 2   REF: 061514a2   STA: A2.A.55
TOP: Trigonometric Ratios
15 ANS: 3   PTS: 2   REF: 061515a2   STA: A2.N.3
TOP: Operations with Polynomials
16 ANS: 1   PTS: 2   REF: 061516a2   STA: A2.A.46
TOP: Transformations with Functions and Relations
17 ANS: 1
$\log x = \log a^2 + \log b$

$\log x = \log a^2 b$

$x = a^2 b$

PTS: 2   REF: 061517a2   STA: A2.A.19   TOP: Properties of Logarithms
KEY: antilogarithms
18 ANS: 4   PTS: 2   REF: 061518a2   STA: A2.A.51
TOP: Domain and Range

19 ANS: 1

$$\frac{2\pi}{2} = \pi$$

$$\frac{\pi}{\pi} = 1$$

PTS: 2   REF: 061519a2   STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions   KEY: period

20 ANS: 4   PTS: 2   REF: 061520a2   STA: A2.A.29
TOP: Sequences

21 ANS: 2   PTS: 2   REF: 061521a2   STA: A2.A.44
TOP: Inverse of Functions   KEY: equations

22 ANS: 1

$$\frac{1 + \cos 2A}{\sin 2A} = \frac{1 + 2\cos^2 A - 1}{2\sin A \cos A} = \frac{\cos A}{\sin A} = \cot A$$

PTS: 2   REF: 061522a2   STA: A2.A.77   TOP: Double Angle Identities
KEY: simplifying

23 ANS: 3   PTS: 2   REF: 061523a2   STA: A2.S.9
TOP: Differentiating Permutations and Combinations

24 ANS: 3

$$3x^2 + x - 14 = 0 \quad 1^2 - 4(3)(-14) = 1 + 168 = 169 = 13^2$$

PTS: 2   REF: 061524a2   STA: A2.A.2   TOP: Using the Discriminant
KEY: determine nature of roots given equation

25 ANS: 2

$$x = 2 \cdot \frac{\sqrt{3}}{2} = \sqrt{3} \quad y = 2 \cdot \frac{1}{2} = 1$$

PTS: 2   REF: 061525a2   STA: A2.A.62   TOP: Determining Trigonometric Functions

26 ANS: 4

$$(3 - 2a)^0 + (3 - 2a)^1 + (3 - 2a)^2 = 1 + 3 - 2a + 9 - 12a + 4a^2 = 4a^2 - 14a + 13$$

PTS: 2   REF: 061526a2   STA: A2.N.10   TOP: Sigma Notation
KEY: advanced

27 ANS: 3

$$p(5) - p(0) = 17(1.15)^{2(5)} - 17(1.15)^{2(0)} \approx 68.8 - 17 \approx 51$$

PTS: 2   REF: 061527a2   STA: A2.A.12   TOP: Evaluating Exponential Expressions

28 ANS:

$$5^{4x} = \left(5^3\right)^{x-1}$$

$$4x = 3x - 3$$

$$x = -3$$

PTS: 2   REF: 061528a2   STA: A2.A.27   TOP: Exponential Equations
KEY: common base shown

29 ANS:

$$\frac{8}{\sin 85} = \frac{2}{\sin C}$$ $85 + 14.4 < 180$ 1 triangle

$$C = \sin^{-1}\left(\frac{2\sin 85}{8}\right)$$ $85 + 165.6 \geq 180$

$$C \approx 14.4$$

PTS: 2   REF: 061529a2   STA: A2.A.75   TOP: Law of Sines - The Ambiguous Case

30 ANS:

$$_3C_1\left(\frac{1}{4}\right)^1\left(\frac{3}{4}\right)^2 = 3 \cdot \frac{1}{4} \cdot \frac{9}{16} = \frac{27}{64}$$

PTS: 2   REF: 061530a2   STA: A2.S.15   TOP: Binomial Probability
KEY: exactly

31 ANS:

$$(x+1)^3 = 64$$

$$x + 1 = 4$$

$$x = 3$$

PTS: 2   REF: 061531a2   STA: A2.A.28   TOP: Logarithmic Equations
KEY: basic

32 ANS:

$$x^2(x-6) - 25(x-6)$$

$$(x^2 - 25)(x-6)$$

$$(x+5)(x-5)(x-6)$$

PTS: 2   REF: 061532a2   STA: A2.A.7   TOP: Factoring by Grouping

33 ANS:

$$xi^8 - yi^6 = x(1) - y(-1) = x + y$$

PTS: 2   REF: 061533a2   STA: A2.N.7   TOP: Imaginary Numbers

34 ANS:

Sum $\dfrac{-b}{a} = \dfrac{-2}{3}$. Product $\dfrac{c}{a} = \dfrac{k}{3}$

PTS: 2   REF: 061534a2   STA: A2.A.20   TOP: Roots of Quadratics

35 ANS:

$r_A \approx 0.976$ $r_B \approx 0.994$ Set B has the stronger linear relationship since r is higher.

PTS: 2   REF: 061535a2   STA: A2.S.8   TOP: Correlation Coefficient

36 ANS:

$28^2 = 47^2 + 34^2 - 2(47)(34)\cos A$

$784 = 3365 - 3196\cos A$

$-2581 = -3196\cos A$

$\dfrac{2581}{3196} = \cos A$

$36 \approx A$

PTS: 4   REF: 061536a2   STA: A2.A.73   TOP: Law of Cosines

KEY: find angle

37 ANS:

$\dfrac{3}{x} + \dfrac{x}{x+2} = -\dfrac{2}{x+2}$

$\dfrac{x+2}{x+2} = -\dfrac{3}{x}$

$1 = -\dfrac{3}{x}$

$x = -3$

PTS: 4   REF: 061537a2   STA: A2.A.23   TOP: Solving Rationals

KEY: rational solutions

38 ANS:

5.17 84.46 ± 5.17

$79.29 - 89.63$

$5 + 7 + 5 = 17$

PTS: 4   REF: 061538a2   STA: A2.S.4   TOP: Dispersion

KEY: advanced, group frequency distributions

39 ANS:

$$5\cos\theta - 2\sec\theta + 3 = 0$$

$$5\cos\theta - \frac{2}{\cos\theta} + 3 = 0$$

$$5\cos^2\theta + 3\cos\theta - 2 = 0$$

$$(5\cos\theta - 2)(\cos\theta + 1) = 0$$

$$\cos\theta = \frac{2}{5}, -1$$

$$\theta \approx 66.4, 293.6, 180$$

PTS: 6   REF: 061539a2   STA: A2.A.68   TOP: Trigonometric Equations
KEY: reciprocal functions

0815a2
Answer Section

1 ANS: 1 PTS: 2 REF: 081501a2 STA: A2.A.50
TOP: Solving Polynomial Equations

2 ANS: 2 PTS: 2 REF: 081502a2 STA: A2.S.8
TOP: Correlation Coefficient

3 ANS: 4

$$f(16) = 4(16)^{\frac{1}{2}} + 16^0 + 16^{-\frac{1}{4}}$$

$$= 4(4) + 1 + \frac{1}{2}$$

$$= 17\frac{1}{2}$$

PTS: 2 REF: 081503a2 STA: A2.N.1 TOP: Negative and Fractional Exponents

4 ANS: 1

$$\sqrt[4]{81x^2y^5} = 81^{\frac{1}{4}}x^{\frac{2}{4}}y^{\frac{5}{4}} = 3x^{\frac{1}{2}}y^{\frac{5}{4}}$$

PTS: 2 REF: 081504a2 STA: A2.A.11 TOP: Radicals as Fractional Exponents

5 ANS: 1

$$\sin 120 = \frac{\sqrt{3}}{2} \quad \csc 120 = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$$

PTS: 2 REF: 081505a2 STA: A2.A.59 TOP: Reciprocal Trigonometric Relationships

6 ANS: 2

$$P = \frac{c}{a} = \frac{-12}{3} = -4$$

PTS: 2 REF: 081506a2 STA: A2.A.20 TOP: Roots of Quadratics

7 ANS: 4

$$3 \cdot 400 = 8x$$

$$150 = x$$

PTS: 2 REF: 081507a2 STA: A2.A.5 TOP: Inverse Variation

8 ANS: 1

$$\text{If } \sin\theta = \frac{15}{17}, \text{ then } \cos\theta = \frac{8}{17}. \quad \tan\theta = \frac{\frac{8}{17}}{\frac{15}{17}} = \frac{8}{15}$$

PTS: 2 REF: 081508a2 STA: A2.A.64 TOP: Using Inverse Trigonometric Functions
KEY: advanced

9 ANS: 2   PTS: 2   REF: 081509a2   STA: A2.S.4
   TOP: Dispersion   KEY: basic, group frequency distributions
10 ANS: 3

$$\frac{40-10}{6-1}=\frac{30}{5}=6 \ a_n = 6n+4$$
$$a_{20}=6(20)+4=124$$

   PTS: 2   REF: 081510a2   STA: A2.A.32   TOP: Sequences
11 ANS: 2

$$A=50\left(1+\frac{.0325}{4}\right)^{4 \cdot 12}=50(1.008125)^{48} \approx 73.73$$

   PTS: 2   REF: 081511a2   STA: A2.A.12   TOP: Evaluating Exponential Expressions
12 ANS: 1

$$\frac{_{11}P_{11}}{3!2!2!2!}=\frac{39,916,800}{48}=831,600$$

   PTS: 2   REF: 081512a2   STA: A2.S.10   TOP: Permutations
13 ANS: 3
   $_9C_3 = 84$

   PTS: 2   REF: 081513a2   STA: A2.S.11   TOP: Combinations
14 ANS: 2
   $(2\sin x - 1)(\sin x + 1) = 0$

   $\sin x = \dfrac{1}{2}, -1$

   $x = 30, 150, 270$

   PTS: 2   REF: 081514a2   STA: A2.A.68   TOP: Trigonometric Equations
   KEY: quadratics
15 ANS: 2   PTS: 2   REF: 081515a2   STA: A2.A.57
   TOP: Reference Angles
16 ANS: 3
   $r = \sqrt{(6-2)^2 + (2--3)^2} = \sqrt{16+25} = \sqrt{41}$

   PTS: 2   REF: 081516a2   STA: A2.A.48   TOP: Equations of Circles
17 ANS: 3   PTS: 2   REF: 081517a2   STA: A2.A.39
   TOP: Domain and Range   KEY: real domain
18 ANS: 4

$$\frac{3-\sqrt{8}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{3\sqrt{3}-\sqrt{24}}{3} = \frac{3\sqrt{3}-2\sqrt{6}}{3} = \sqrt{3} - \frac{2}{3}\sqrt{6}$$

   PTS: 2   REF: 081518a2   STA: A2.N.5   TOP: Rationalizing Denominators

19 ANS: 3

$$\frac{2\pi}{2} = \pi$$

PTS: 2   REF: 081519a2   STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions   KEY: period
20 ANS: 1   PTS: 2   REF: 081520a2   STA: A2.A.33
TOP: Sequences
21 ANS: 4

$$\frac{91 - 82}{3.6} = 2.5 \, \text{sd}$$

PTS: 2   REF: 081521a2   STA: A2.S.5   TOP: Normal Distributions
KEY: interval
22 ANS: 1

$$\cos 2\theta = 2\left(\frac{3}{4}\right)^2 - 1 = 2\left(\frac{9}{16}\right) - 1 = \frac{9}{8} - \frac{8}{8} = \frac{1}{8}$$

PTS: 2   REF: 081522a2   STA: A2.A.77   TOP: Double Angle Identities
KEY: evaluating
23 ANS: 2   PTS: 2   REF: 081523a2   STA: A2.A.44
TOP: Inverse of Functions   KEY: ordered pairs
24 ANS: 4

$$\sqrt{-180x^{16}} = 6x^8 i\sqrt{5}$$

PTS: 2   REF: 081524a2   STA: A2.N.6   TOP: Square Roots of Negative Numbers
25 ANS: 3   PTS: 2   REF: 081525a2   STA: A2.A.36
TOP: Binomial Expansions
26 ANS: 4   PTS: 2   REF: 081526a2   STA: A2.S.9
TOP: Differentiating Permutations and Combinations
27 ANS: 1

$$\left(\frac{1}{2}\left(-\frac{1}{4}\right)\right)^2 = \frac{1}{64}$$

PTS: 2   REF: 081527a2   STA: A2.A.24   TOP: Completing the Square
28 ANS:

$$2.5\left(\frac{180}{\pi}\right) = 143°14'$$

PTS: 2   REF: 081528a2   STA: A2.M.2   TOP: Radian Measure
KEY: degrees

29 ANS:

$2^{-4} = 2^{3x-1}$

$-4 = 3x - 1$

$-3 = 3x$

$-1 = x$

PTS: 2   REF: 081529a2   STA: A2.A.27   TOP: Exponential Equations
KEY: common base shown

30 ANS:

$(x+1)^2 - (x+1) = x^2 + 2x + 1 - x - 1 = x^2 + x$

PTS: 2   REF: 081530a2   STA: A2.A.42   TOP: Compositions of Functions
KEY: variables

31 ANS:

$_7C_4 \left(\dfrac{2}{3}\right)^4 \left(\dfrac{1}{3}\right)^3 = 35\left(\dfrac{16}{81}\right)\left(\dfrac{1}{27}\right) = \dfrac{560}{2187}$

PTS: 2   REF: 081531a2   STA: A2.S.15   TOP: Binomial Probability
KEY: exactly

32 ANS:

$r = \dfrac{6.6}{\dfrac{2}{3}} = 9.9$

PTS: 2   REF: 081532a2   STA: A2.A.61   TOP: Arc Length
KEY: radius

33 ANS:

$\dfrac{\dfrac{1}{\cos^2 x} - 1}{\dfrac{1}{\cos^2 x}} \cdot \dfrac{\cos^2 x}{\cos^2 x} = \dfrac{1 - \cos^2 x}{1} = \sin^2 x$

PTS: 2   REF: 081533a2   STA: A2.A.58   TOP: Reciprocal Trigonometric Relationships

34 ANS:

$$\frac{10x}{4} = \frac{1}{x} + \frac{x}{4}$$

$$\frac{9x}{4} = \frac{1}{x}$$

$$9x^2 = 4$$

$$x^2 = \frac{4}{9}$$

$$x = \pm\frac{2}{3}$$

PTS: 2   REF: 081534a2   STA: A2.A.23   TOP: Solving Rationals
KEY: rational solutions

35 ANS:
$x - 1 + x - 4 + x - 9 + x - 16 = 4x - 30$

PTS: 2   REF: 081535a2   STA: A2.N.10   TOP: Sigma Notation
KEY: advanced

36 ANS:
$a = \sqrt{8^2 + 11^2 - 2(8)(11)\cos 82} \approx 12.67.$ The angle opposite the shortest side: $\frac{8}{\sin x} = \frac{12.67}{\sin 82}$

$$x \approx 38.7$$

PTS: 4   REF: 081536a2   STA: A2.A.73   TOP: Law of Cosines
KEY: advanced

37 ANS:
$x^2(2x - 1) - 4(2x - 1) = 0$

$$(x^2 - 4)(2x - 1) = 0$$

$$(x + 2)(x - 2)(2x - 1) = 0$$

$$x = \pm 2, \frac{1}{2}$$

PTS: 4   REF: 081537a2   STA: A2.A.26   TOP: Solving Polynomial Equations

38 ANS:
$|3x - 5| < x + 17$ $3x - 5 < x + 17$ and $3x - 5 > -x - 17$ $-3 < x < 11$

$$2x < 22 \qquad\qquad 4x > -12$$

$$x < 11 \qquad\qquad x > -3$$

PTS: 4   REF: 081538a2   STA: A2.A.1   TOP: Absolute Value Inequalities

39 ANS:

$$\log_2\left(\frac{x^2 - 7x + 12}{2x - 10}\right) = 3 \qquad x = \frac{23 \pm \sqrt{(-23)^2 - 4(1)(92)}}{2(1)} \approx 17.84, 5.16$$

$$\frac{x^2 - 7x + 12}{2x - 10} = 8$$

$$x^2 - 7x + 12 = 16x - 80$$

$$x^2 - 23x + 92 = 0$$

PTS: 6   REF: 081539a2   STA: A2.A.28   TOP: Logarithmic Equations
KEY: applying properties of logarithms

0116a2
Answer Section

1 ANS: 4   PTS: 2   REF: 011601a2   STA: A2.S.2
   TOP: Analysis of Data

2 ANS: 1
   $-300° + 360° = 60°$, which terminates in Quadrant I.

   PTS: 2   REF: 011602a2   STA: A2.A.60   TOP: Unit Circle

3 ANS: 4

   $$\dfrac{\dfrac{3x+y}{xy}}{\dfrac{2}{xy}} = \dfrac{3x+y}{xy} \cdot \dfrac{xy}{2} = \dfrac{3x+y}{2}$$

   PTS: 2   REF: 011603a2   STA: A2.A.17   TOP: Complex Fractions

4 ANS: 3   PTS: 2   REF: 011604a2   STA: A2.A.38
   TOP: Defining Functions   KEY: ordered pairs

5 ANS: 4   PTS: 2   REF: 011605a2   STA: A2.S.15
   TOP: Binomial Probability   KEY: modeling

6 ANS: 1

   $$\sqrt[3]{27a^{-6}b^3c^2} = 3a^{-2}bc^{\frac{2}{3}} = \dfrac{3bc^{\frac{2}{3}}}{a^2}$$

   PTS: 2   REF: 011606a2   STA: A2.A.11   TOP: Radicals as Fractional Exponents

7 ANS: 4

   $A = 5000e^{(.04)(18)} \approx 10272.17$

   PTS: 2   REF: 011607a2   STA: A2.A.12   TOP: Evaluating Exponential Expressions

8 ANS: 3

   $$\dfrac{x}{x-1} + \dfrac{1}{2x-2} = \dfrac{2x}{2(x-1)} + \dfrac{1}{2(x-1)} = \dfrac{2x+1}{2(x-1)}$$

   PTS: 2   REF: 011608a2   STA: A2.A.16   TOP: Addition and Subtraction of Rationals

9 ANS: 2

   $$2x^2 - (x+2)^2 = 8$$
   $$2x^2 - (x^2 + 4x + 4) - 8 = 0$$
   $$x^2 - 4x - 12 = 0$$
   $$(x-6)(x+2) = 0$$
   $$x = 6, -2$$

   PTS: 2   REF: 011609a2   STA: A2.A.3   TOP: Quadratic-Linear Systems
   KEY: equations

10 ANS: 2   PTS: 2   REF: 011610a2   STA: A2.A.30
TOP: Sequences

11 ANS: 3

$$s = \theta\, r = \frac{4\pi}{3} \cdot \frac{24}{2} = 16\pi$$

PTS: 2   REF: 011611a2   STA: A2.A.61   TOP: Arc Length
KEY: arc length

12 ANS: 2

$4|2x + 6| < 32 \quad 2x + 6 < 8 \quad 2x + 6 > -8$

$\quad |2x + 6| < 8 \qquad 2x < 2 \qquad 2\dot{x} > -14$

$\qquad\qquad\qquad\qquad x < 1 \qquad x > -7$

PTS: 2   REF: 011612a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph

13 ANS: 2

$$\frac{-b}{a} = \frac{-6}{-3} = 2$$

PTS: 2   REF: 011613a2   STA: A2.A.20   TOP: Roots of Quadratics

14 ANS: 2

$$\frac{60 - 50}{5} = 2 \text{ standards above the mean or } 2.3\% \quad 2.3\% \cdot 1000 = 23$$

PTS: 2   REF: 011614a2   STA: A2.S.5   TOP: Normal Distributions
KEY: predict

15 ANS: 1

$$\log T = \log\frac{10x^2}{y} = \log 10 + \log x^2 - \log y = 1 + 2\log x - \log y$$

PTS: 2   REF: 011615a2   STA: A2.A.19   TOP: Properties of Logarithms
KEY: splitting logs

16 ANS: 3   PTS: 2   REF: 011616a2   STA: A2.S.8
TOP: Correlation Coefficient

17 ANS: 2

$$\cos\frac{\pi}{2} + \cos\pi + \cos\frac{3\pi}{2} = 0 + -1 + 0 = -1$$

PTS: 2   REF: 011617a2   STA: A2.N.10   TOP: Sigma Notation
KEY: advanced

18 ANS: 4

$$4x^2 + 3x - 4 = 0 \quad b^2 - 4ac = 3^2 - 4(4)(-4) = 9 + 64 = 73$$

PTS: 2   REF: 011618a2   STA: A2.A.2   TOP: Using the Discriminant
KEY: determine nature of roots given equation

19 ANS: 3

$$f(x+3) = 2(x+3)^2 - 3(x+3) + 4 = 2x^2 + 12x + 18 - 3x - 9 + 4 = 2x^2 + 9x + 13$$

PTS: 2   REF: 011619a2   STA: A2.A.41   TOP: Functional Notation

20 ANS: 3

$$x(27i^6) + x(2i^{12}) = -27x + 2x = -25x$$

PTS: 2   REF: 011620a2   STA: A2.N.7   TOP: Imaginary Numbers

21 ANS: 4

$$\cos \theta = -\frac{3}{5} \quad \sec \theta = -\frac{5}{3}$$

PTS: 2   REF: 011621a2   STA: A2.A.62   TOP: Determining Trigonometric Functions

22 ANS: 4   PTS: 2   REF: 011622a2   STA: A2.A.63
TOP: Domain and Range

23 ANS: 1

$$a_2 = \frac{1}{2}(-6) - 2 = -5$$

$$a_3 = \frac{1}{2}(-5) - 3 = -\frac{11}{2}$$

PTS: 2   REF: 011623a2   STA: A2.A.33   TOP: Sequences

24 ANS: 3

$$r = \sqrt{(3-0)^2 + (-5-(-2))^2} = \sqrt{9+9} = \sqrt{18}$$

PTS: 2   REF: 011624a2   STA: A2.A.48   TOP: Equations of Circles

25 ANS: 3

Cofunctions secant and cosecant are complementary

PTS: 2   REF: 011625a2   STA: A2.A.58   TOP: Cofunction Trigonometric Relationships

26 ANS: 1

$$c = \sqrt{\left(x+\sqrt{2}\right)^2 + \left(x-\sqrt{2}\right)^2} = \sqrt{x^2 + 2\sqrt{2}x + 2 + x^2 - 2\sqrt{2}x + 2} = \sqrt{2x^2 + 4}$$

PTS: 2   REF: 011626a2   STA: A2.A.14   TOP: Operations with Radicals
KEY: with variables | index = 2

27 ANS: 4   PTS: 2   REF: 011627a2   STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions   KEY: period

28 ANS:

$$\sqrt{2x+1} = 4$$
$$2x + 1 = 16$$
$$2x = 15$$
$$x = \frac{15}{2}$$

PTS: 2   REF: 011628a2   STA: A2.A.22   TOP: Solving Radicals
KEY: basic

29 ANS:

$$x^2(x+3) + 2(x+3) = (x^2+2)(x+3)$$

PTS: 2   REF: 011629a2   STA: A2.A.7   TOP: Factoring by Grouping

30 ANS:

$$8^{x+1} = 16$$
$$2^{3(x+1)} = 2^4$$
$$3x + 3 = 4$$
$$3x = 1$$
$$x = \frac{1}{3}$$

PTS: 2   REF: 011630a2   STA: A2.A.28   TOP: Logarithmic Equations
KEY: basic

31 ANS:

$$\frac{11!}{3! \cdot 2! \cdot 2!} = 1,663,200$$

PTS: 2   REF: 011631a2   STA: A2.S.10   TOP: Permutations

32 ANS:

$$-130 \cdot \frac{\pi}{180} \approx -2.27$$

PTS: 2   REF: 011632a2   STA: A2.M.2   TOP: Radian Measure
KEY: radians

33 ANS:

$$\frac{1}{2} \cdot 15 \cdot 31.6 \sin 125 \approx 194$$

PTS: 2   REF: 011633a2   STA: A2.A.74   TOP: Using Trigonometry to Find Area
KEY: advanced

34 ANS:

$$\frac{1}{\sin\theta}\cdot\sin^2\theta\cdot\frac{\cos\theta}{\sin\theta}=\cos\theta$$

$$\cos\theta=\cos\theta$$

PTS: 2   REF: 011634a2   STA: A2.A.67   TOP: Proving Trigonometric Identities

35 ANS:

$$\frac{2}{3}x^3+\frac{11}{8}x^2-\frac{7}{9}x-\frac{2}{9}$$

PTS: 2   REF: 011635a2   STA: A2.N.3   TOP: Operations with Polynomials
KEY: subtraction

36 ANS:

$$x^2+10x+25=8+25$$

$$(x+5)^2=33$$

$$x+5=\pm\sqrt{33}$$

$$x=-5\pm\sqrt{33}$$

PTS: 4   REF: 011636a2   STA: A2.A.24   TOP: Completing the Square

37 ANS:

$$y=2.19(3.23)^x\quad 426.21=2.19(3.23)^x$$

$$\frac{426.21}{2.19}=(3.23)^x$$

$$\log\frac{426.21}{2.19}=x\log(3.23)$$

$$\frac{\log\dfrac{426.21}{2.19}}{\log(3.23)}=x$$

$$x\approx4.5$$

PTS: 4   REF: 011637a2   STA: A2.S.7   TOP: Exponential Regression

38 ANS:

$$2\cos^2x-1=\cos x$$

$$2\cos^2x-\cos x-1=0$$

$$(2\cos x+1)(\cos x-1)=0$$

$$\cos x=-\frac{1}{2},1$$

$$x=0,120,240$$

PTS: 4   REF: 011638a2   STA: A2.A.68   TOP: Trigonometric Equations
KEY: double angle identities

39 ANS:

$$\frac{16}{\sin A} = \frac{15}{\sin 40} \qquad \frac{10}{\sin 50} = \frac{12}{\sin C} \qquad \frac{d}{\sin 63.2} = \frac{12}{\sin 66.8}$$

$$\sin A = \frac{16 \sin 40}{15} \qquad \sin C = \frac{12 \sin 50}{10} \qquad d = \frac{12 \sin 63.2}{\sin 66.8}$$

$$A \approx 43.3 \qquad\qquad C \approx 66.8 \qquad\qquad d \approx 11.7$$

PTS: 6   REF: 011639a2   STA: A2.A.73   TOP: Law of Sines
KEY: advanced