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) $\sum_{n=4}^{7} 2^n - 10$
2) $\sum_{n=3}^{6} \frac{2n^2}{3}$
3) $\sum_{n=2}^{5} 5n - 4$
4) $\sum_{n=2}^{5} n^2 + n$

1

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)
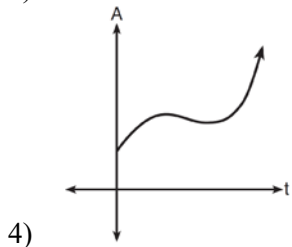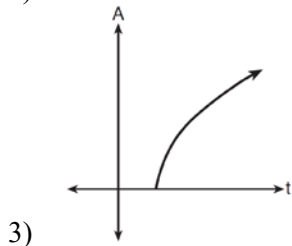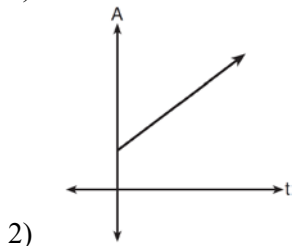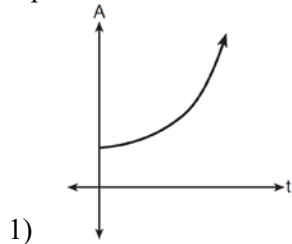
6 Which equation has real, rational, and unequal roots?
1) $x^2 + 10x + 25 = 0$
2) $x^2 - 5x + 4 = 0$
3) $x^2 - 3x + 1 = 0$
4) $x^2 - 2x + 5 = 0$

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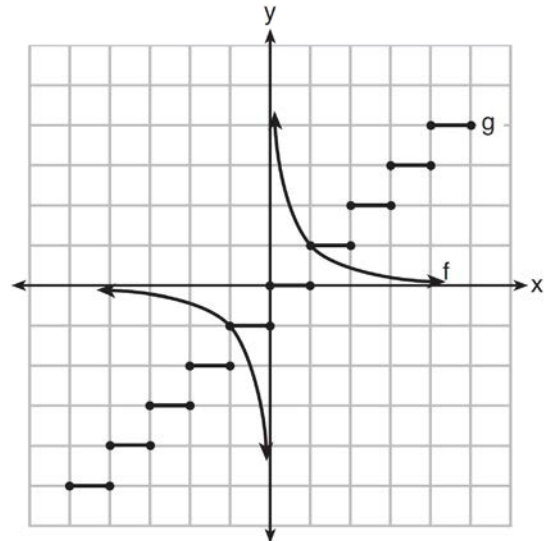
1) f is a relation and g is a function.
2) f is a function and g is a relation.
3) Both f and g are functions.
4) Neither f nor g is a function.

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

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.
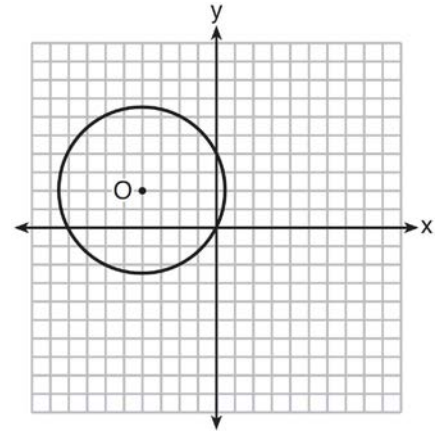
What is the equation of circle O?
1) $x^2 + y^2 = 2\sqrt{5}$
2) $x^2 + y^2 = 20$
3) $(x + 4)^2 + (y - 2)^2 = 2\sqrt{5}$
4) $(x + 4)^2 + (y - 2)^2 = 20$

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

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) $x^2 - 6x + 6 = 0$

4

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

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

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

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 $\frac{2\pi}{5}$ radians?
1) 45
2) 23
3) 13
4) 11

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) $4a^2 + 7a + 4$

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 $\frac{5}{11}\pi$ 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.
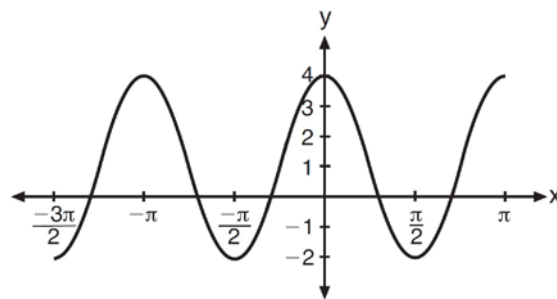
State the values of a, b, and c, and write an equation for the graph.

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.]

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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: 011505a2   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

$\sin^2 x \left(1 + \dfrac{\cos^2 x}{\sin^2 x} \right) = \sin^2 x + \cos^2 x = 1$ $\dfrac{1}{\cos^2 x} (\cos^2 x) = 1$ $\cos^2 x \left(\dfrac{\sin^2 x}{\cos^2 x} - 1 \right) = \sin^2 x - \cos^2 x \neq 1$

$\dfrac{\cos^2 x}{\sin^2 x} \left(\dfrac{1}{\cos^2 x} - 1 \right) = \dfrac{1}{\sin^2 x} - \dfrac{\cos^2 x}{\sin^2 x} = \csc^2 x - \cot x = 1$

PTS: 2   REF: 011515a2   STA: A2.A.67   TOP: Proving Trigonometric Identities

16 ANS: 1

$\sqrt[3]{64 a^5 b^6} = \sqrt[3]{4^3 a^3 a^2 b^6} = 4ab^2 \sqrt[3]{a^2}$

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

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:

$$sd = \frac{81 - 57}{3} = 8$$

$$57 + 8 = 65$$

$$81 - 2(8) = 65$$

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:

$$y = 733.646(0.786)^x \quad 733.646(0.786)^{12} \approx 41$$

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:

$$a = 3, b = 2, c = 1 \quad y = 3\cos 2x + 1.$$

PTS: 2   REF: 011538a2   STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

39 ANS:

$$(x + 14)(x + 22) = 800 \quad x = \frac{-36 \pm \sqrt{(-36)^2 - 4(1)(-492)}}{2(1)} = \frac{-36 + \sqrt{3264}}{2} \approx 10.6 \quad \text{10 feet increase.}$$

$$x^2 + 36x + 308 = 800$$

$$x^2 + 36x - 492 = 0$$

PTS: 6   REF: 011539a2   STA: A2.A.25   TOP: Quadratics with Irrational Solutions