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) $\frac{20 - 5\sqrt{11}}{27}$

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
$$a_1 = 3xy^5$$
$$a_n = \left(\frac{2x}{y}\right)a_{n-1}?$$
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) $\sin 4.76° = \frac{h}{15}$

2) $\sin 4.76° = \frac{15}{h}$

3) $\tan 4.76° = \frac{h}{15}$

4) $\tan 4.76° = \frac{15}{h}$

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?
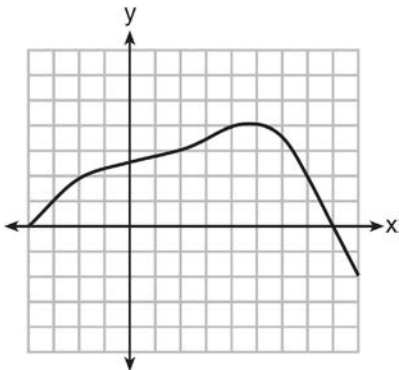
1) 0
2) 2
3) 3
4) 7

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*.

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

$$9 - x^2 < 0 \qquad\qquad \text{or } x + 3 < 0 \text{ and } x - 3 < 0$$
$$x^2 - 9 > 0 \qquad\qquad\quad x < -3 \text{ and } x < 3$$
$$(x + 3)(x - 3) > 0 \qquad\qquad x < -3$$
$$x + 3 > 0 \text{ and } x - 3 > 0$$
$$x > -3 \text{ and } x > 3$$
$$x > 3$$

   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

$$a_4 = 3xy^5 \left(\frac{2x}{y} \right)^3 = 3xy^5 \left(\frac{8x^3}{y^3} \right) = 24x^4 y^2$$

PTS: 2   REF: 061512a2   STA: A2.A.33   TOP: Sequences

13 ANS: 2
$x - 2 = 3x + 10$ -6 is extraneous. $x - 2 = -3x - 10$

$\quad -12 = 2x$ $\qquad\qquad\qquad 4x = -8$

$\quad\ \ -6 = x$ $\qquad\qquad\qquad\ \ x = -2$

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
$\log x = \log a^2 + \log b$

$\log x = \log a^2 b$

$\quad x = a^2 b$

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:

$$\frac{8}{\sin 85} = \frac{2}{\sin C} \qquad 85 + 14.4 < 180 \quad \text{1 triangle}$$

$$C = \sin^{-1}\left(\frac{2\sin 85}{8}\right) \qquad 85 + 165.6 \geq 180$$

$$C \approx 14.4$$

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