1. The value of \( \csc 138^\circ 23' \) rounded to four decimal places is
   1) \(-1.3376\)
   2) \(-1.3408\)
   3) \(1.5012\)
   4) \(1.5057\)

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

3. Which expression is equivalent to \( \frac{2x^2y^{-2}}{4y^{-5}} \)?
   1) \( \frac{y^3}{2x^2} \)
   2) \( \frac{2y^3}{x^2} \)
   3) \( \frac{2x^2}{y^3} \)
   4) \( \frac{x^2}{2y^3} \)

4. Solve \( |-4x + 5| < 13 \) algebraically for \( x \).

5. If \( m\theta = -50 \), which diagram represents \( \theta \) drawn in standard position?
6 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

7 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) \( \log 2 + 3 \log x \)

8 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

9 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.

10 Expressed in simplest form, \( \frac{3y}{2y-6} + \frac{9}{6-2y} \) is equivalent to
1) \( \frac{-6y^2 + 36y - 54}{(2y - 6)(6 - 2y)} \)  
2) \( \frac{3y - 9}{2y - 6} \)  
3) \( \frac{3}{2} \)  
4) \( -\frac{3}{2} \)

11 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

12 What is the common ratio of the sequence \( \frac{1}{64} a^5 b^3, -\frac{3}{32} a^3 b^4, \frac{9}{16} a b^5, \ldots \)?
1) \( \frac{3b}{2a^2} \)  
2) \( \frac{6b}{a^2} \)  
3) \( \frac{3a^2}{b} \)  
4) \( \frac{6a^2}{b} \)
13 Perform the indicated operations and simplify completely:
\[
\frac{x^3 - 3x^2 + 6x - 18}{x^2 - 4x} - \frac{2x - 4}{x^4 - 3x^3} + \frac{x^2 + 2x - 8}{16 - x^2}
\]

14 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

15 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 \( 47^\circ \) northeast of station \( A \) and \( 15^\circ \) 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.]

16 Express \( \cot x \sin x \) \( \sec x \) as a single trigonometric function, in simplest form, for all values of \( x \) for which it is defined.

17 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)

18 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

19 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.
20 On the axes below, for \(-2 \leq x \leq 2\), graph \(y = 2^{x+1} - 3\).

21 What is the solution set for \(2 \cos \theta - 1 = 0\) in the interval \(0^\circ \leq \theta < 360^\circ\)?
1) \(\{30^\circ, 150^\circ\}\)
2) \(\{60^\circ, 120^\circ\}\)
3) \(\{30^\circ, 330^\circ\}\)
4) \(\{60^\circ, 300^\circ\}\)

22 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) \(3 \sin^2 x\)

23 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) \(-3 \pm 2i\)

24 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.

25 Which value of \(k\) satisfies the equation \(8^{3k+4} = 4^{2k-1}\)?
1) \(-1\)
2) \(-\frac{9}{4}\)
3) \(-2\)
4) \(-\frac{14}{5}\)

26 If \(p\) varies inversely as \(q\), and \(p = 10\) when \(q = \frac{3}{2}\), what is the value of \(p\) when \(q = \frac{3}{5}\)?
1) 25
2) 15
3) 9
4) 4
27 Which expression is equivalent to \( \frac{x^{-1}y^4}{3x^{-5}y^{-1}} \)?

1) \( \frac{x^4 y^5}{3} \)
2) \( \frac{x^5 y^4}{3} \)
3) \( 3x^4 y^5 \)
4) \( \frac{y^4}{3x^5} \)

28 What is the domain of the function shown below?

![Function Graph](image)

1) \(-1 \leq x \leq 6\)
2) \(-1 \leq y \leq 6\)
3) \(-2 \leq x \leq 5\)
4) \(-2 \leq y \leq 5\)

29 Expressed in simplest form, \( \sqrt{-18} - \sqrt{-32} \) is

1) \( -\sqrt{2} \)
2) \( -7\sqrt{2} \)
3) \( -i\sqrt{2} \)
4) \( 7i\sqrt{2} \)

30 If \( \sin A = \frac{7}{25} \) and \( \angle A \) terminates in Quadrant IV, \( \tan A \) equals

1) \( \frac{7}{25} \)
2) \( -\frac{7}{25} \)
3) \( -\frac{24}{7} \)
4) \( -\frac{24}{25} \)

31 What is the graph of the solution set of \( |2x - 1| > 5 \)?

![Graph](image)

1) 
2) 
3) 
4) 

32 In the diagram below, the length of which line segment is equal to the exact value of \( \sin \theta \)?

![Diagram](image)

1) \( \overline{TO} \)
2) \( \overline{TS} \)
3) \( \overline{OR} \)
4) \( \overline{OS} \)
33 Which graph represents the function $\log_2 x = y$?

1)  

2)  

3)  

4)  

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

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

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

1) $\frac{1}{2} \log 5a$
2) $\frac{1}{2} \log 6 + \log a$
3) $\log 6 + \log a$
4) $\log 6 + 2 \log a$

37 If $\log_a x = 2.5$ and $\log_y 125 = -\frac{3}{2}$, find the numerical value of $\frac{x}{y}$, in simplest form.

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

39 When $x^{-1} + 1$ is divided by $x + 1$, the quotient equals

1) $1$
2) $\frac{1}{x}$
3) $x$
4) $-\frac{1}{x}$
40 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) \(\frac{25}{64}\)
2) \(\frac{45}{512}\)
3) \(\frac{75}{512}\)
4) \(\frac{225}{512}\)

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

42 Solve algebraically for all values of \(x\):
\[
\log_{\frac{x}{4}}(17x - 4) = 2
\]

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

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

45 If \(f(x) = \sqrt{9 - x^2}\), what are its domain and range?
1) domain: \(\{x | -3 \leq x \leq 3\}\); range: \(\{y | 0 \leq y \leq 3\}\)
2) domain: \(\{x | x \neq \pm 3\}\); range: \(\{y | 0 \leq y \leq 3\}\)
3) domain: \(\{x | x \leq -3 \text{ or } x \geq 3\}\); range: \(\{y | y \neq 0\}\)
4) domain: \(\{x | x \neq 3\}\); range: \(\{y | y \geq 0\}\)

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

47 What is the solution set of the equation \(3x^2 - 48x = 0\)?
1) \(\{0, \pm 2\}\)
2) \(\{0, \pm 2, 3\}\)
3) \(\{0, \pm 2, \pm 2i\}\)
4) \(\{\pm 2, \pm 2i\}\)
48 Evaluate: \[ \sum_{n=1}^{3} (-n^4 - n) \]

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

50 The conjugate of the complex expression \(-5x + 4i\) is
   1) \(5x - 4i\)
   2) \(5x + 4i\)
   3) \(-5x - 4i\)
   4) \(-5x + 4i\)

51 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.

52 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.

<table>
<thead>
<tr>
<th>Altitude (x)</th>
<th>Ozone Units (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.7</td>
</tr>
<tr>
<td>5</td>
<td>0.6</td>
</tr>
<tr>
<td>10</td>
<td>1.1</td>
</tr>
<tr>
<td>15</td>
<td>3.0</td>
</tr>
<tr>
<td>20</td>
<td>4.9</td>
</tr>
</tbody>
</table>

53 Which is a graph of \(y = \cot x\)?

54 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 \((e, 1)\).
55 What is the product of \( \left( \frac{2}{5}x - \frac{3}{4}y^2 \right) \) and \\
\( \left( \frac{2}{5}x + \frac{3}{4}y^2 \right) \)?

1) \( \frac{4}{25}x^2 - \frac{9}{16}y^4 \)
2) \( \frac{4}{25}x - \frac{9}{16}y^2 \)
3) \( \frac{2}{5}x^2 - \frac{3}{4}y^2 \)
4) \( \frac{4}{5}x \)

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

1) \( 12x^{2.3}\sqrt{2} \)
2) \( 12x\sqrt[3]{2x} \)
3) \( 6x^{1/3}\sqrt{2x^2} \)
4) \( 6x^{3/3}\sqrt{2} \)

58 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) \( 2x^2 - 3x + 36 \)

59 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.

<table>
<thead>
<tr>
<th>Time (hour, ( x ))</th>
<th>Population (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>1</td>
<td>330</td>
</tr>
<tr>
<td>2</td>
<td>580</td>
</tr>
<tr>
<td>3</td>
<td>800</td>
</tr>
<tr>
<td>4</td>
<td>1650</td>
</tr>
<tr>
<td>5</td>
<td>3000</td>
</tr>
</tbody>
</table>

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.

57 If \( \sin A = \frac{1}{3} \), what is the value of \( \cos 2A \)?

1) \( \frac{2}{3} \)
2) \( \frac{2}{3} \)
3) \( \frac{7}{9} \)
4) \( \frac{7}{9} \)

60 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) \( \frac{3\pi}{4} \)
2) \( \pi \)
3) \( \frac{3\pi}{2} \)
4) \( 3\pi \)
61 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

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

1)  

2)  

3)  

4)  

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

64 Solve algebraically for \(x\): \(4 - \sqrt{2x - 5} = 1\)

65 The expression \(\frac{1}{7 - \sqrt{11}}\) is equivalent to
1) \(\frac{7 + \sqrt{11}}{38}\)
2) \(\frac{7 - \sqrt{11}}{38}\)
3) \(\frac{7 + \sqrt{11}}{60}\)
4) \(\frac{7 - \sqrt{11}}{60}\)

66 What is the number of degrees in an angle whose measure is 2 radians?
1) \(\frac{360}{\pi}\)
2) \(\frac{\pi}{360}\)
3) 360
4) 90

67 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?
68. Approximately how many degrees does five radians equal?
   1) 286
   2) 900
   3) \( \frac{\pi}{36} \)
   4) \( 5\pi \)

69. Solve algebraically for all values of \( x \):
   \[ 81^{\frac{3x + 2x^2}{3}} = 27 \]

70. 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) \( \{ y | y \in \text{real numbers} \} \)

71. Given \( \Delta ABC \) 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

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

73. Multiply \( x + yi \) by its conjugate, and express the product in simplest form.

74. What is the equation of the graph shown below?

75. What is the product of \( \left( \frac{x}{4} - \frac{1}{3} \right) \) and \( \left( \frac{x}{4} + \frac{1}{3} \right) \)?
   1) \( \frac{x^2}{8} - \frac{1}{9} \)
   2) \( \frac{x^2}{16} - \frac{1}{9} \)
   3) \( \frac{x^2}{8} - \frac{x}{6} - \frac{1}{9} \)
   4) \( \frac{x^2}{16} - \frac{x}{6} - \frac{1}{9} \)
76 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.

77 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

78 What is the solution set for the equation \( \sqrt{5x + 29} = x + 3 \)?
1) \{4\}
2) \{-5\}
3) \{4, 5\}
4) \{-5, 4\}

79 Which expression represents the third term in the expansion of \((2x^4 - y)^3\)?
1) \(-y^3\)
2) \(-6x^4y^2\)
3) \(6x^4y^2\)
4) \(2x^4y^2\)

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

81 In \( \triangle PQR \), \( p \) equals
1) \( \frac{r \sin P}{\sin Q} \)
2) \( \frac{r \sin P}{\sin R} \)
3) \( \frac{r \sin R}{\sin P} \)
4) \( \frac{q \sin R}{\sin Q} \)

82 Solve algebraically for all values of \( x \):
\[
x^4 + 4x^3 + 4x^2 = -16x
\]

83 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

84 If \( \log 2 = a \) and \( \log 3 = b \), the expression \( \log \frac{9}{20} \) is equivalent to
1) \( 2b - a + 1 \)
2) \( 2b - a - 1 \)
3) \( b^2 - a + 10 \)
4) \( \frac{2b}{a + 1} \)
85 Which equation is represented by the graph below?

1) \( y = 2 \cos 3x \)
2) \( y = 2 \sin 3x \)
3) \( y = 2 \cos \frac{2\pi}{3} x \)
4) \( y = 2 \sin \frac{2\pi}{3} x \)

86 What is the number of degrees in an angle whose radian measure is \( \frac{8\pi}{5} \)?

1) 576
2) 288
3) 225
4) 113

87 How many different six-letter arrangements can be made using the letters of the word “TATTOO”?

1) 60
2) 90
3) 120
4) 720

88 Express \( 4xi + 5yi^8 + 6xi^3 + 2yi^4 \) in simplest \( a + bi \) form.

89 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.

<table>
<thead>
<tr>
<th>Time, hrs (x)</th>
<th>Number of Organisms (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>4</td>
<td>52</td>
</tr>
<tr>
<td>6</td>
<td>68</td>
</tr>
<tr>
<td>8</td>
<td>85</td>
</tr>
<tr>
<td>10</td>
<td>104</td>
</tr>
<tr>
<td>12</td>
<td>142</td>
</tr>
<tr>
<td>16</td>
<td>260</td>
</tr>
</tbody>
</table>

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.

90 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.

<table>
<thead>
<tr>
<th>Number of Pets</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students</td>
<td>4</td>
<td>6</td>
<td>10</td>
<td>0</td>
<td>k</td>
<td>2</td>
</tr>
</tbody>
</table>

What is the value of \( k \) for this table?

1) 9
2) 2
3) 8
4) 4
91 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) \((8, 3)\)

92 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) \((x + 4)(x - 4)(3x - 5)(3x - 5)\)

93 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) \(\{\}\)

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

95 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 \([0, \pi]\).

96 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) \((x + 3)^2 + (y - 1)^2 = 13\)

97 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?

98 Express the product of \(\cos 30^\circ\) and \(\sin 45^\circ\) in simplest radical form.
101 What is the period of the graph \( y = \frac{1}{2} \sin 6x \)?

1) \( \frac{\pi}{6} \)
2) \( \frac{\pi}{3} \)
3) \( \frac{\pi}{2} \)
4) \( 6\pi \)

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

1) 1
2) 2
3) 3
4) 0
107 What is the solution set of the equation \(-\sqrt{2} \sec x = 2\) when \(0^\circ \leq x < 360^\circ\)?
1) \(\{45^\circ, 135^\circ, 225^\circ, 315^\circ\}\)
2) \(\{45^\circ, 315^\circ\}\)
3) \(\{135^\circ, 225^\circ\}\)
4) \(\{225^\circ, 315^\circ\}\)

108 Which graph represents the solution set of \(\left| \frac{4x - 5}{3} \right| > 1\)?
1) 
2) 
3) 
4) 

109 A sequence has the following terms: \(a_1 = 4, a_2 = 10, a_3 = 25, a_4 = 62.5\). Which formula represents the \(n\)th 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) \(a_n = 4(2.5)^{n-1}\)

110 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 \(50^\circ\).

111 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) \((-6, -2)\)

112 Which sketch shows the inverse of \(y = a^x\), where \(a > 1\)?
1) 
2) 
3) 
4)
113 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) $5808.08$

114 Find, to the nearest tenth, the radian measure of $216^\circ$.

115 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

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

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

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

1) $-\frac{\pi}{2} < x < \frac{\pi}{2}$
2) $-\frac{\pi}{2} \leq x \leq \frac{\pi}{2}$
3) $0 \leq x \leq \pi$
4) $\frac{\pi}{2} \leq x \leq \frac{3\pi}{2}$

118 Which graph represents the solution set of

$$\frac{x+16}{x-2} \leq 7?$$

1) 
2) 
3) 
4) 

119 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) $8C_5$

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


121 Which equation represents the graph below?

1) \( y = -2 \sin 2x \)
2) \( y = -2 \sin \frac{1}{2} x \)
3) \( y = -2 \cos 2x \)
4) \( y = -2 \cos \frac{1}{2} x \)

122 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%.

123 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.

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

125 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.

126 Show that \( \sec \theta \sin \theta \cot \theta = 1 \) is an identity.

127 What is the common difference of the arithmetic sequence below?
\(-7x, -4x, -x, 2x, 5x, \ldots\)

1) \(-3\)
2) \(-3x\)
3) \(3\)
4) \(3x\)

128 Which function is one-to-one?

1) \( k(x) = x^2 + 2 \)
2) \( g(x) = x^3 + 2 \)
3) \( f(x) = |x| + 2 \)
4) \( j(x) = x^4 + 2 \)

129 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) \( x^2 - 6x - 36 = 25 - 36 \)
130 Find the number of possible different 10-letter arrangements using the letters of the word “STATISTICS.”

131 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

132 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

133 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

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

135 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

136 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) $1.99 \leq y \leq 2.07$
   2) $1.99 \leq y \leq 2.38$
   3) $0.97 \leq y \leq 2.38$
   4) $1.27 \leq y \leq 2.38$

137 How many negative solutions to the equation $2x^3 - 4x^2 + 3x - 1 = 0$ exist?
   1) 1
   2) 2
   3) 3
   4) 0
138 The function \( f(x) \) is graphed on the set of axes below. On the same set of axes, graph \( f(x+1)+2 \).

139 Express in simplest form:

\[
\frac{4-x^2}{x^2+7x+12} - \frac{2x-4}{x+3}
\]

140 The expression \( \frac{a+b}{d-b} \) is equivalent to

1) \( \frac{c+1}{d-1} \)
2) \( \frac{a+b}{d-b} \)
3) \( \frac{ac+b}{cd-b} \)
4) \( \frac{ac+1}{cd-1} \)

141 The expression \( 4+\sum_{k=2}^{5} 3(k-x) \) is equal to

1) \( 58-4x \)
2) \( 46-4x \)
3) \( 58-12x \)
4) \( 46-12x \)

142 Which summation represents \( 5+7+9+11+\ldots+43 \)?

1) \( \sum_{n=1}^{43} n \)
2) \( \sum_{n=1}^{20}(2n+3) \)
3) \( \sum_{n=4}^{24}(2n-3) \)
4) \( \sum_{n=3}^{23}(3n-4) \)

143 Solve algebraically for \( x \):

\[ \sqrt{x^2+x-1} + 11x = 7x + 3 \]

144 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) \( 4a^2 - 20a + 30 \)
145 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.

<table>
<thead>
<tr>
<th>Time in Minutes (x)</th>
<th>Temperature in °F (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>180.2</td>
</tr>
<tr>
<td>2</td>
<td>165.8</td>
</tr>
<tr>
<td>4</td>
<td>146.3</td>
</tr>
<tr>
<td>6</td>
<td>135.4</td>
</tr>
<tr>
<td>8</td>
<td>127.7</td>
</tr>
<tr>
<td>10</td>
<td>110.5</td>
</tr>
</tbody>
</table>

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

146 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) \(10 \binom{6}{4} \left(\frac{4}{5}\right)^6 \left(\frac{1}{5}\right)^4\)
2) \(10 \binom{7}{5} \left(\frac{4}{5}\right)^{10} \left(\frac{1}{5}\right)^7\)
3) \(10 \binom{8}{7} \left(\frac{7}{10}\right)^{10} \left(\frac{3}{10}\right)^2\)
4) \(10 \binom{9}{7} \left(\frac{7}{10}\right)^9 \left(\frac{3}{10}\right)^1\)

147 The area of triangle ABC is 42. If \(AB = 8\) and \(\angle B = 61\), the length of \(BC\) is approximately

1) 5.1
2) 9.2
3) 12.0
4) 21.7

148 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) \(\frac{20}{19}\)
3) \(-5\) and 4
4) \(\frac{1}{4}\)

149 In the right triangle shown below, what is the measure of angle \(S\), to the nearest minute?

[Diagram of a right triangle]

1) 28° 1'
2) 28° 4'
3) 61° 56'
4) 61° 93'

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

1) \(20x^3y^3\)
2) \(-\frac{15}{4}x^4y^2\)
3) \(-20x^3y^3\)
4) \(\frac{15}{4}x^4y^2\)

21
151 Which equation has roots with the sum equal to \( \frac{9}{4} \) and the product equal to \( \frac{3}{4} \)?

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

152 For \( y = \frac{3}{\sqrt{x-4}} \), what are the domain and range?

1) \( \{x | x > 4 \} \) and \( \{y | y > 0 \} \)
2) \( \{x | x \geq 4 \} \) and \( \{y | y > 0 \} \)
3) \( \{x | x > 4 \} \) and \( \{y | y \geq 0 \} \)
4) \( \{x | x \geq 4 \} \) and \( \{y | y \geq 0 \} \)

153 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) \( \log 16 + 2 \log m \)

154 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) \( A = 18,000e^{1.25 \times 2} \)
2) \( A = 18,000e^{1.25 \times 24} \)
3) \( A = 18,000e^{0.0125 \times 2} \)
4) \( A = 18,000e^{0.0125 \times 24} \)

155 Which calculator output shows the strongest linear relationship between \( x \) and \( y \)?

- Lin Reg
- \( y = a + bx \)
- \( a = 59.026 \)
- \( b = 6.767 \)

1) \( r = .8643 \)
2) \( r = .8361 \)
3) \( r = .6022 \)
4) \( r = -.5924 \)

156 In the interval \( 0^\circ \leq x < 360^\circ \), \( \tan x \) is undefined when \( x \) equals

1) \( 0^\circ \) and \( 90^\circ \)
2) \( 90^\circ \) and \( 180^\circ \)
3) \( 180^\circ \) and \( 270^\circ \)
4) \( 90^\circ \) and \( 270^\circ \)

157 Solve algebraically for \( x \): \( \log_{5x-1}4 = \frac{1}{3} \)

158 Determine the sum and the product of the roots of the equation \( 12x^2 + x - 6 = 0 \).
159 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

160 If $n$ is a negative integer, then which statement is always true?

1) $6n^{-2} < 4n^{-1}$
2) $\frac{n}{4} > -6n^{-1}$
3) $6n^{-1} < 4n^{-1}$
4) $4n^{-1} > (6n)^{-1}$

161 In an arithmetic sequence, $a_4 = 19$ and $a_7 = 31$. Determine a formula for $a_n$, the $n^{th}$ term of this sequence.

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

163 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.

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

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

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Target Heart Rate (beats per minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>135</td>
</tr>
<tr>
<td>25</td>
<td>132</td>
</tr>
<tr>
<td>30</td>
<td>129</td>
</tr>
<tr>
<td>35</td>
<td>125</td>
</tr>
<tr>
<td>40</td>
<td>122</td>
</tr>
<tr>
<td>45</td>
<td>119</td>
</tr>
<tr>
<td>50</td>
<td>115</td>
</tr>
</tbody>
</table>

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

166 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) $2b + 2a$

167 Solve $x^3 + 5x^2 = 4x + 20$ algebraically.
168 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) \(-65,535\)

169 Solve algebraically for \(x\):
\[\log_27(2x - 1) = \frac{4}{3}\]

170 If \(\sec(a + 15)^\circ = \csc(2a)^\circ\), find the smallest positive value of \(a\), in degrees.

171 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) \(\frac{63}{65}\)

172 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) \((x + 1)(x - 1)(x + 2)\)

173 Which expression is equivalent to \(\left(9x^2y^6\right)^{\frac{1}{2}}\)?
1) \(\frac{1}{3xy^3}\)
2) \(3xy^3\)
3) \(\frac{3}{xy^3}\)
4) \(\frac{xy^3}{3}\)

174 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) \(\binom{30}{3} \cdot \binom{20}{2}\)
2) \(\binom{30}{3} \cdot \binom{20}{2}\)
3) \(\binom{30}{3} + \binom{20}{2}\)
4) \(\binom{30}{3} + \binom{20}{2}\)

175 The expression \(\frac{\cot x}{\csc x}\) is equivalent to
1) \(\sin x\)
2) \(\cos x\)
3) \(\tan x\)
4) \(\sec x\)

176 If \(x = 3i\), \(y = 2i\), and \(z = m + i\), the expression \(xy^2z\) equals
1) \(-12 - 12mi\)
2) \(-6 - 6mi\)
3) \(12 - 12mi\)
4) \(6 - 6mi\)
177 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

178 Express in simplest form: \( \sqrt[3]{\frac{a^6b^9}{-64}} \)

179 The number of possible different 12-letter arrangements of the letters in the word “TRIGONOMETRY” is represented by
1) \( \frac{12!}{3!} \)
2) \( \frac{12!}{6!} \)
3) \( \frac{12P_{12}}{6!} \)
4) \( \frac{12P_{12}}{8} \)

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

181 Find the third term in the recursive sequence \( a_{k+1} = 2a_k - 1 \), where \( a_1 = 3 \).

182 Which equation is graphed in the diagram below?

1) \( y = 3 \cos \left( \frac{\pi}{30} x \right) + 8 \)
2) \( y = 3 \cos \left( \frac{\pi}{15} x \right) + 5 \)
3) \( y = -3 \cos \left( \frac{\pi}{30} x \right) + 8 \)
4) \( y = -3 \cos \left( \frac{\pi}{15} x \right) + 5 \)

183 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) \( (x - 3)^2 + (y + 4)^2 = 90 \)

184 Express \( \cos \theta \sec \theta - \cos \theta \), in terms of \( \sin \theta \).
185 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) $\sum_{d=1}^{7} \frac{1}{3} (2)^{d-1}$
2) $\sum_{d=1}^{7} \frac{1}{3} (2)^d$
3) $\sum_{d=1}^{7} 2 \left(\frac{1}{3}\right)^{d-1}$
4) $\sum_{d=1}^{7} 2 \left(\frac{1}{3}\right)^d$

186 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.

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

1) 11.4
2) 14.1
3) 22.7
4) 28.1

188 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.

189 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.

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

191 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
192 Determine the sum of the first twenty terms of the sequence whose first five terms are 5, 14, 23, 32, 41.

193 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) $\cos x + \sin x$

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

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

196 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 $\sec P > 0$

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

198 Write an equation of the circle shown in the diagram below.

199 What is the range of the function shown below?
1) $x \leq 0$
2) $x \geq 0$
3) $y \leq 0$
4) $y \geq 0$
200 Which relation is both one-to-one and onto?

1)  

2)  

3)  

4)  

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

202 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

203 Which graph represents a function?

1)  

2)  

3)  

4)  

204 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
205 What is the product of the roots of the quadratic equation $2x^2 - 7x = 5$?
1) 5
2) $\frac{5}{2}$
3) $-5$
4) $-\frac{5}{2}$

206 The expression $\sin(\theta + 90)^\circ$ is equivalent to
1) $-\sin \theta$
2) $-\cos \theta$
3) $\sin \theta$
4) $\cos \theta$

207 Solve algebraically for all exact values of $x$ in the interval $0 \leq x < 2\pi$: $2\sin^2 x + 5\sin x = 3$

208 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 $83^\circ 50'$.

209 Express the exact value of $\csc 60^\circ$, with a rational denominator.

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

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

212 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
213 Solve \( \sec x - \sqrt{2} = 0 \) algebraically for all values of \( x \) in \( 0^\circ \leq x < 360^\circ \).

214 The expression \( \sqrt[3]{64a^{16}} \) is equivalent to

1) \( 8a^4 \)
2) \( 8a^8 \)
3) \( 4a^5 \sqrt[3]{a} \)
4) \( 4a^{\frac{3}{5}} \sqrt[3]{a}^5 \)

215 Express in simplest terms:

\[
\frac{1 + \frac{3}{x}}{1 - \frac{5}{x} - \frac{24}{x^2}}
\]

216 The expression \( \frac{x^2 + 9x - 22}{x^2 - 121} + (2 - x) \) is equivalent to

1) \( x - 11 \)
2) \( \frac{1}{x - 11} \)
3) \( 11 - x \)
4) \( \frac{1}{11 - x} \)

217 The expression \( (2 - 3\sqrt{x})^2 \) is equivalent to

1) \( 4 - 9x \)
2) \( 4 - 3x \)
3) \( 4 - 12\sqrt{x} + 9x \)
4) \( 4 - 12\sqrt{x} + 6x \)

218 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.

219 The points \((2,3), (4, \frac{3}{4})\), 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) \( \frac{1}{3} \)
3) \( 3 \)
4) \( 27 \)

220 Solve algebraically for all values of \( x \):

\[
\log_{(x+3)}(2x + 3) + \log_{(x+3)}(x + 5) = 2
\]

221 Expressed with a rational denominator and in simplest form, \( \frac{x}{x - \sqrt{x}} \) is

1) \( \frac{x^2 + x\sqrt{x}}{x^2 - x} \)
2) \( -\sqrt{x} \)
3) \( \frac{x + \sqrt{x}}{1 - x} \)
4) \( \frac{x + \sqrt{x}}{x - 1} \)
222 What is the fourth term in the binomial expansion \((x - 2)^8\)?
1) \(448x^5\)
2) \(448x^4\)
3) \(-448x^5\)
4) \(-448x^4\)

223 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) \((x^2 - 4)(x - 3)\)

224 Determine the sum and the product of the roots of \(3x^2 = 11x - 6\).

225 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) \(-\frac{1}{2} - \frac{3}{2}i\)

226 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%

227 What is a positive value of \(\tan \frac{1}{2}x\), when \(\sin x = 0.8\)?
1) 0.5
2) 0.4
3) 0.33
4) 0.25

228 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.

229 Which equation represents a graph that has a period of \(4\pi\)?
1) \(y = 3 \sin \frac{1}{2}x\)
2) \(y = 3 \sin 2x\)
3) \(y = 3 \sin \frac{1}{4}x\)
4) \(y = 3 \sin 4x\)
230 Which function is one-to-one?
1) \( f(x) = |x| \)
2) \( f(x) = 2^x \)
3) \( f(x) = x^2 \)
4) \( f(x) = \sin(x) \)

231 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

232 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) \( -2a + 5 \)

233 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

234 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

235 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.

236 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
Algebra 2/Trigonometry Regents at Random
Answer Section

1 ANS: 4

PTS: 2 REF: 061217a2 STA: A2.A.66 TOP: Determining Trigonometric Functions

2 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

3 ANS: 1 PTS: 2 REF: 061324a2 STA: A2.A.9 TOP: Negative Exponents

4 ANS:
\[ -4x + 5 < 13 \quad -4x + 5 > -13 \quad -2 < x < 4.5 \]
\[ -4x < 8 \quad -4x > -18 \]
\[ x > -2 \quad x < 4.5 \]

PTS: 2 REF: 011432a2 STA: A2.A.1 TOP: Absolute Value Inequalities

5 ANS: 4 PTS: 2 REF: 061206a2 STA: A2.A.60 TOP: Unit Circle
6 ANS: 2 
\[ \frac{r}{60} = \frac{320}{10(2)} \]
\[ \frac{r}{60} = \frac{32}{2} \]
\[ \log 32 = \log \left( \frac{r}{60} \right) \]
\[ \log 32 = \frac{t \log 2}{60} \]
\[ 60 \log 32 = t \log 2 \]
\[ 300 = t \]

PTS: 2  REF: 011205a2  STA: A2.A.6  TOP: Exponential Growth

7 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

8 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

9 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

10 ANS: 3 
\[ \frac{3y}{2y-6} + \frac{9}{6-2y} = \frac{3y}{2y-6} - \frac{9}{2y-6} = \frac{3y - 9}{2y-6} = \frac{3(y - 3)}{2(y - 3)} = \frac{3}{2} \]


11 ANS: 2 
Since the coefficient of \( t \) is greater than 0, \( r > 0 \).

PTS: 2  REF: 011303a2  STA: A2.S.8  TOP: Correlation Coefficient
12 ANS: \(2\)
\[
\frac{-3}{32} a^3 b^4 = \frac{-6b}{a^2}
\]
PTS: 2 REF: 061326a2 STA: A2.A.31 TOP: Sequences

13 ANS:
\[
\frac{-2(x^2 + 6)}{x^4} \cdot \frac{x^2 (x-3) + 6(x-3)}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} + \frac{x^2 + 2x - 8}{16 - x^2}
\]
\[
\frac{(x^2 + 6)(x-3)}{x(x-4)} \cdot \frac{2(x-2)}{x^3 (x-3)} \cdot \frac{(4+x)(4-x)}{(x+4)(x-2)}
\]
\[
\frac{-2(x^2 + 6)}{x^4}
\]
PTS: 6 REF: 011239a2 STA: A2.A.16 TOP: Multiplication and Division of Rationals
KEY: division

14 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

15 ANS:
\[
\frac{100}{\sin 32} = \frac{b}{\sin 105}, \quad \frac{100}{\sin 32} = \frac{a}{\sin 43}
\]
\[
b \approx 182.3, \quad a \approx 128.7
\]
PTS: 4 REF: 011338a2 STA: A2.A.73 TOP: Law of Sines
KEY: basic

16 ANS:
\[
\frac{\cot x \sin x}{\sec x} = \frac{\cos x \sin x}{\sec x} = \frac{1}{\cos x} = \cos^2 x
\]
PTS: 2 REF: 061334a2 STA: A2.A.58 TOP: Reciprocal Trigonometric Relationships
17 ANS: 3
\[ x + y = 5 \quad \text{and} \quad -5 + y = 5 \]
\[ y = -x + 5 \quad \text{and} \quad y = 10 \]
\[ (x + 3)^2 + (-x + 5 - 3)^2 = 53 \]
\[ x^2 + 6x + 9 + x^2 - 4x + 4 = 53 \]
\[ 2x^2 + 2x - 40 = 0 \]
\[ x^2 + x - 20 = 0 \]
\[ (x + 5)(x - 4) = 0 \]
\[ x = -5, 4 \]

PTS: 2  REF: 011302a2  STA: A2.A.3  TOP: Quadratic-Linear Systems
KEY: equations

18 ANS: 2
Top 6.7\% = 1.5 \text{s.d.} \quad + \sigma = 1.5(104) + 576 = 732

PTS: 2  REF: 011420a2  STA: A2.S.5  TOP: Normal Distributions
KEY: predict

19 ANS:
\[ \frac{100}{\sin 33} = \frac{x}{\sin 32} \cdot \sin 66 \approx \frac{T}{97.3} \]
\[ x \approx 97.3 \quad t \approx 88 \]

KEY: advanced

20 ANS:

PTS: 2  REF: 011234a2  STA: A2.A.53  TOP: Graphing Exponential Functions
21 ANS: 4

\[2 \cos \theta = 1\]

\[\cos \theta = \frac{1}{2}\]

\[\theta = \cos^{-1} \frac{1}{2} = 60, 300\]

PTS: 2 REF: 061203a2 STA: A2.A.68 TOP: Trigonometric Equations
KEY: basic

22 ANS: 2 PTS: 2 REF: 061216a2 STA: A2.A.42 TOP: Compositions of Functions
KEY: variables

23 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

24 ANS:

\[Q_1 = 3.5 \text{ and } Q_3 = 10.5. \quad 10.5 - 3.5 = 7.\]

PTS: 2 REF: 011430a2 STA: A2.S.4 TOP: Dispersion
KEY: range, quartiles, interquartile range, variance

25 ANS: 4

\[8^{3k+4} = 4^{2k-1}\]

\[(2^3)^{3k+4} = (2^2)^{2k-1}\]

\[2^{9k+12} = 2^{4k-2}\]

\[9k + 12 = 4k - 2\]

\[5k = -14\]

\[k = -\frac{14}{5}\]

PTS: 2 REF: 011309a2 STA: A2.A.27 TOP: Exponential Equations
KEY: common base not shown
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: 1 PTS: 2 REF: 061210a2 STA: A2.A.9 TOP: Negative Exponents

28 ANS: 1 PTS: 2 REF: 061202a2 STA: A2.A.51 TOP: Domain and Range

29 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

30 ANS: 2

If \( \sin A = -\frac{7}{25} \), \( \cos A = \frac{24}{25} \), and \( \tan A = -\frac{7}{24} \), then
\[ \frac{\sin A}{\cos A} = -\frac{7}{24} \]

PTS: 2 REF: 011413a2 STA: A2.A.64 TOP: Using Inverse Trigonometric Functions KEY: advanced

31 ANS: 1
\[ 2x - 1 > 5 \quad 2x - 1 < -5 \]
\[ 2x > 6 \quad 2x > -4 \]
\[ x > 3 \quad x > -2 \]

PTS: 2 REF: 061307a2 STA: A2.A.1 TOP: Absolute Value Inequalities KEY: graph

32 ANS: 2 PTS: 2 REF: 011315a2 STA: A2.A.55 TOP: Trigonometric Ratios

33 ANS: 1 PTS: 2 REF: 061211a2 STA: A2.A.54 TOP: Graphing Logarithmic Functions

34 ANS:
\[ x < -1 \text{ or } x > 5 \]
\[ x^2 - 4x - 5 > 0 \quad x - 5 > 0 \text{ and } x + 1 > 0 \text{ or } x - 5 < 0 \text{ and } x + 1 < 0 \]
\[ (x - 5)(x + 1) > 0 \quad x > 5 \text{ and } x > -1 \quad x < 5 \text{ and } x < -1 \]
\[ x > 5 \quad x < -1 \]

PTS: 2 REF: 011228a2 STA: A2.A.4 TOP: Quadratic Inequalities KEY: one variable
35 ANS:
\[ g(10) = \left( a(10)\sqrt{1-10} \right)^2 = 100a^2(-9) = -900a^2 \]

PTS: 2 REF: 061333a2 STA: A2.A.41 TOP: Functional Notation

36 ANS: 2
\[ \log x^2 = \log 3a + \log 2a \]
\[ 2 \log x = \log 6a^2 \]
\[ \log x = \frac{\log 6}{2} + \frac{\log a^2}{2} \]
\[ \log x = \frac{1}{2} \log 6 + \frac{2 \log a}{2} \]
\[ \log x = \frac{1}{2} \log 6 + \log a \]

KEY: splitting logs

37 ANS:
\[ 800. \quad x = 4^{2.5} = 32. \quad y^{\frac{3}{2}} = 125, \quad \frac{x}{y} = \frac{32}{125} = 0.8 \]
\[ y = 125^{\frac{2}{3}} = \frac{1}{25} \]

PTS: 4 REF: 011237a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: advanced

38 ANS:
\[ \frac{2 \pm \sqrt{(-2)^2 - 4(6)(-3)}}{2(6)} = \frac{2 \pm \sqrt{76}}{12} = \frac{2 \pm \sqrt{4 \cdot 19}}{12} = \frac{2 \pm 2 \sqrt{19}}{6} = 1 \pm \sqrt{19} \]

PTS: 2 REF: 011332a2 STA: A2.A.25 TOP: Quadratics with Irrational Solutions

39 ANS: 2
\[ \frac{x^{-1} + 1}{x + 1} = \frac{1}{x} + \frac{1}{x + 1} = \frac{1 + x}{x(x + 1)} = \frac{1}{x} \]

PTS: 2 REF: 011211a2 STA: A2.A.9 TOP: Negative Exponents

40 ANS: 4
\[ \binom{3}{2} \left( \frac{5}{8} \right)^2 \left( \frac{3}{8} \right)^1 = \frac{225}{512} \]

PTS: 2 REF: 011221a2 STA: A2.S.15 TOP: Binomial Probability
KEY: spinner
41 ANS: 4
\[
g\left(\frac{1}{2}\right) = \frac{1}{\frac{1}{2}} = 2. \quad f(2) = 4(2) - 2^2 = 4
\]

PTS: 2  REF: 011204a2  STA: A2.A.42  TOP: Compositions of Functions
KEY: numbers

42 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

43 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

44 ANS: 2
\[
\text{sum: } \frac{-b}{a} = \frac{4}{6} = \frac{2}{3}, \quad \text{product: } \frac{c}{a} = \frac{-12}{6} = -2
\]

PTS: 2  REF: 011209a2  STA: A2.A.20  TOP: Roots of Quadratics

45 ANS: 1  PTS: 2  REF: 011313a2  STA: A2.A.39
TOP: Domain and Range  KEY: real domain

46 ANS: 3
\[
h(-8) = \frac{1}{2}(-8) - 2 = -4 - 2 = -6. \quad g(-6) = \frac{1}{2}(-6) + 8 = -3 + 8 = 5
\]

PTS: 2  REF: 011403a2  STA: A2.A.42  TOP: Compositions of Functions
KEY: numbers

47 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
48 ANS:
$$\sum_{\alpha=1}^{4} (-\alpha) = -104.$$ 
PTS: 2  REF: 011230a2  STA: A2.N.10  TOP: Sigma Notation  
KEY: basic

49 ANS:
$$3 \times \frac{180}{\pi} \approx 171.89^\circ \approx 171^\circ 53'.$$

PTS: 2  REF: 011335a2  STA: A2.M.2  TOP: Radian Measure  
KEY: degrees

50 ANS: 3  PTS: 2  REF: 061219a2  STA: A2.N.8  TOP: Conjugates of Complex Numbers

51 ANS:
$$5 C_0 \cdot 0.57^0 \cdot 0.43^5 + 5 C_1 \cdot 0.57^1 \cdot 0.43^4 + 5 C_2 \cdot 0.57^2 \cdot 0.43^3 \approx 0.37$$

KEY: at least or at most

52 ANS:
$$y = 0.488(1.116)^x$$

PTS: 2  REF: 061429a2  STA: A2.S.7  TOP: Exponential Regression

53 ANS: 3

PTS: 2  REF: 011207a2  STA: A2.A.71  TOP: Graphing Trigonometric Functions  
KEY: basic


55 ANS: 1
The binomials are conjugates, so use FL.

PTS: 2  REF: 061201a2  STA: A2.N.3  TOP: Operations with Polynomials
\[
\left(3\sqrt[3]{27x^2}\right)\left(3\sqrt[4]{16x^4}\right) = 3\sqrt[3]{3^3 \cdot 2^4 \cdot x^6} = 3 \cdot 2 \cdot x^2 \sqrt[3]{2} = 6x^2 \sqrt[3]{2}
\]

PTS: 2  REF: 011421a2   STA: A2.N.2   TOP: Operations with Radicals

57 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

58 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

59 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

60 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

61 ANS: 3  PTS: 2  REF: 011305a2   STA: A2.A.37   TOP: Defining Functions

62 ANS: 4  PTS: 2  REF: 061303a2   STA: A2.A.43   TOP: Defining Functions

63 ANS: 1

\[
\cos\left(\frac{5\pi}{6}\right) = -1.54700539
\]

PTS: 2  REF: 011203a2   STA: A2.A.66   TOP: Determining Trigonometric Functions
64 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

65 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

66 ANS: 1
\[2 \cdot \frac{180}{\pi} = \frac{360}{\pi}\]

PTS: 2        REF: 011220a2        STA: A2.M.2        TOP: Radian Measure
KEY: degrees

67 ANS:
\[\sigma_x \approx 6.2. 6 \text{ scores are within a population standard deviation of the mean.} \]
\[Q_3 - Q_1 = 41 - 37 = 4\]
\[x \approx 38.2\]

PTS: 4        REF: 061338a2        STA: A2.S.4        TOP: Dispersion
KEY: advanced

68 ANS: 1
\[5 \cdot \frac{180}{\pi} \approx 286\]

PTS: 2        REF: 011427a2        STA: A2.M.2        TOP: Radian Measure
KEY: degrees
69 ANS:

\[ 81^{x^3 + 2x^2} = 27 \]

\[ \left(3^4\right)^{x^3 + 2x^2} = \left(3^3\right)^{\frac{5x}{3}} \]

\[ 3^{4x^3 + 8x^2} = 3^{5x} \]

\[ 4x^3 + 8x^2 - 5x = 0 \]

\[ x(4x^2 + 8x - 5) = 0 \]

\[ x(2x - 1)(2x + 5) = 0 \]

\[ x = 0, \frac{1}{2}, \frac{-5}{2} \]

PTS: 6 REF: 061239a2 STA: A2.A.27 TOP: Exponential Equations
KEY: common base not shown

70 ANS: 2 PTS: 2 REF: 011222a2 STA: A2.A.39
TOP: Domain and Range KEY: real domain

71 ANS: 1

\[ \frac{9}{\sin A} = \frac{10}{\sin 70^\circ} \] 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

72 ANS: 3 PTS: 2 REF: 061412a2 STA: A2.A.60
TOP: Finding the Terminal Side of an Angle

73 ANS:

\[ (x + yi)(x - yi) = x^2 - y^2 \cdot i^2 = x^2 + y^2 \]

PTS: 2 REF: 061432a2 STA: A2.N.9 TOP: Multiplication and Division of Complex Numbers

74 ANS: 2 PTS: 2 REF: 011301a2 STA: A2.A.52
TOP: Identifying the Equation of a Graph

75 ANS: 2

The binomials are conjugates, so use FL.

PTS: 2 REF: 011206a2 STA: A2.N.3 TOP: Operations with Polynomials
76 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

77 ANS: 3
\[20 \cdot 2 = -5t\]
\[-8 = t\]

PTS: 2  REF: 011412a2  STA: A2.A.5  TOP: Inverse Variation

78 ANS: 1
\[5x + 29 = (x + 3)^2\]
\[\text{.} (-5) + 3 \text{ shows an extraneous solution.}\]
\[5x + 29 = x^2 + 6x + 9\]
\[0 = x^2 + x - 20\]
\[0 = (x + 5)(x - 4)\]
\[x = -5, 4\]

PTS: 2  REF: 061213a2  STA: A2.A.22  TOP: Solving Radicals
KEY: extraneous solutions

79 ANS: 3
\[3C_2(2x^4)^1(-y)^2 = 6x^4y^2\]

PTS: 2  REF: 011215a2  STA: A2.A.36  TOP: Binomial Expansions

80 ANS:
\[\frac{13}{x} = 10 - x\]
\[x = \frac{10 \pm \sqrt{100 - 4(1)(13)}}{2(1)} = \frac{10 \pm \sqrt{48}}{2} = \frac{10 \pm 4\sqrt{3}}{2} = 5 \pm 2\sqrt{3}\]
\[13 = 10x - x^2\]
\[x^2 - 10x + 13 = 0\]

PTS: 4  REF: 061336a2  STA: A2.A.23  TOP: Solving Rationals
KEY: irrational and complex solutions

81 ANS: 2  PTS: 2  REF: 061322a2  STA: A2.A.73
TOP: Law of Sines  KEY: modeling
82 ANS:
\[ x^4 + 4x^3 + 4x^2 + 16x = 0 \]
\[ x(x^3 + 4x^2 + 4x + 16) = 0 \]
\[ x(x^2(x + 4) + 4(x + 4)) = 0 \]
\[ x(x^2 + 4)(x + 4) = 0 \]
\[ x = 0, \pm 2i, -4 \]


83 ANS: 2
\[ 60 = -16r^2 + 5t + 105 \]
\[ t = \frac{-5 \pm \sqrt{5^2 - 4(-16)(45)}}{2(-16)} \approx \frac{-5 \pm 53.89}{-32} \approx 1.84 \]
\[ 0 = -16r^2 + 5t + 45 \]

PTS: 2 REF: 061424a2 STA: A2.A.25 TOP: Quadratics with Irrational Solutions

84 ANS: 2
\[ \log 9 - \log 20 \]
\[ \log 3^2 - \log(10 \cdot 2) \]
\[ 2 \log 3 - (\log 10 + \log 2) \]
\[ 2b - (1 + a) \]
\[ 2b - a - 1 \]

KEY: expressing logs algebraically

85 ANS: 1 PTS: 2 REF: 011320a2 STA: A2.A.72
TOP: Identifying the Equation of a Trigonometric Graph

86 ANS: 2
\[ \frac{8\pi}{5} \cdot \frac{180}{\pi} = 288 \]

PTS: 2 REF: 061302a2 STA: A2.M.2 TOP: Radian Measure
KEY: degrees

87 ANS: 1
\[ \frac{sP_6}{3!2!} = \frac{720}{12} = 60 \]

PTS: 2 REF: 011324a2 STA: A2.S.10 TOP: Permutations

88 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
ANS: 
\[ y = 27.2025(1.1509)^x, \quad y = 27.2025(1.1509)^{18} \approx 341 \]

PTS: 4  REF: 011238a2  STA: A2.S.7  TOP: Exponential Regression

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

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

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

ANS: 2
\[ \frac{30}{(x+3)(x-3)} + \frac{(x+3)(x-3)}{(x+3)(x-3)} = \frac{5(x+3)}{(x-3)(x+3)} \]

3 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
94 ANS: 
\[2.5 \cdot \frac{180}{\pi} \approx 143^\circ 14'\] 
PTS: 2 REF: 061431a2 STA: A2.M.2 TOP: Radian Measure KEY: degrees

95 ANS: 4 PTS: 2 REF: 061427a2 STA: A2.A.63 TOP: Domain and Range


97 ANS: 1 PTS: 2 REF: 061317a2 STA: A2.S.9 TOP: Differentiating Permutations and Combinations

98 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

99 ANS: 4 PTS: 2 REF: 061402a2 STA: A2.A.8 TOP: Negative and Fractional Exponents

100 ANS: 
\[\sigma_x = 14.9, \ x = 40. \text{ There are 8 scores between 25.1 and 54.9.}\] 
PTS: 4 REF: 061237a2 STA: A2.S.4 TOP: Dispersion KEY: advanced

101 ANS: 2 
\[\frac{2\pi}{6} = \frac{\pi}{3}\] 

102 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
103 ANS: 3
\[ \sqrt[3]{6a^4b} + \sqrt[3]{(27 \cdot 6)a^4b^2} \]
\[ a^3\sqrt{6ab^2} + 3a\sqrt[3]{6ab^2} \]
\[ 4a^3\sqrt{6ab^2} \]

PTS: 2 REF: 011319a2 STA: A2.N.2 TOP: Operations with Radicals

104 ANS:
\[ y = -3 \sin 2x. \] The period of the function is \( \pi \), 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

105 ANS:
\[ R = \sqrt{28^2 + 40^2 - 2(28)(40) \cos 115} \approx 58 \]
\[ \frac{58}{\sin 115} = \frac{40}{\sin x} \]
\[ x \approx 39 \]

PTS: 6 REF: 061439a2 STA: A2.A.73 TOP: Vectors

106 ANS: 2
\[ \frac{5}{\sin 32} = \frac{8}{\sin E} \]
\[ 57.98 + 32 < 180 \]
\[ E \approx 57.98 \]
\[ (180 - 57.98) + 32 < 180 \]

PTS: 2 REF: 011419a2 STA: A2.A.75 TOP: Law of Sines - The Ambiguous Case

107 ANS: 3
\[ -\sqrt{2} \sec x = 2 \]
\[ \sec x = -\frac{2}{\sqrt{2}} \]
\[ \cos x = -\frac{\sqrt{2}}{2} \]
\[ x = 135, 225 \]

PTS: 2 REF: 011322a2 STA: A2.A.68 TOP: Trigonometric Equations

KEY: reciprocal functions
108 ANS: 3
\[
\frac{4x - 5}{3} > 1 \text{ or } \frac{4x - 5}{3} < -1
\]
\[
4x - 5 > 3 \quad 4x - 5 < -3
\]
\[
x > 2 \quad 4x < 2
\]
\[
x > 2 \quad x < \frac{1}{2}
\]

PTS: 2 REF: 061209a2 STA: A2.A.1 TOP: Absolute Value Inequalities

KEY: graph

109 ANS: 4
\[
\frac{10}{4} = 2.5
\]

PTS: 2 REF: 011217a2 STA: A2.A.29 TOP: Sequences

110 ANS: 
\[
K = absinC = 6 \cdot 6 \sin 50 \approx 27.6
\]

PTS: 2 REF: 011429a2 STA: A2.A.74 TOP: Using Trigonometry to Find Area

KEY: Parallelograms

111 ANS: 4
\[
x = 2y. \quad y^2 - (3y)^2 + 32 = 0 \quad x = 3(-2) = -6
\]
\[
y^2 - 9y^2 = -32
\]
\[
-8y^2 = -32
\]
\[
y^2 = 4
\]
\[
y = \pm 2
\]

PTS: 2 REF: 061312a2 STA: A2.A.3 TOP: Quadratic-Linear Systems

KEY: equations

112 ANS: 3 PTS: 2 REF: 011422a2 STA: A2.A.54 TOP: Graphing Logarithmic Functions

113 ANS: 3
\[
5000 \left(1 + \frac{0.03}{4}\right)^{4 \cdot 5} = 5000(1.0075)^{20} \approx 5805.92
\]

PTS: 2 REF: 011410a2 STA: A2.A.12 TOP: Evaluating Exponential Expressions

114 ANS: 
\[
216 \left(\frac{\pi}{180}\right) \approx 3.8
\]

PTS: 2 REF: 061232a2 STA: A2.M.2 TOP: Radian Measure

KEY: radians
115 ANS: 3
\[ \frac{-b}{a} = \frac{-(4)}{1} = 4. \] 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


117 ANS: 3 PTS: 2 REF: 061224a2 STA: A2.A.63 TOP: Domain and Range

118 ANS: 3

\[ \frac{x + 16}{x - 2} - \frac{7(x - 2)}{x - 2} \leq 0 \quad -6x + 30 = 0 \quad x - 2 = 0. \] Check points such that \( x < 2, 2 < x < 5, \text{ and } x > 5. \) If \( x = 1, \)

\[ \frac{-6x + 30}{x - 2} \leq 0 \quad -6x = -30 \quad x = 2 \]

\[ \frac{-6(1) + 30}{1 - 2} = \frac{24}{-1} = -24, \text{ which is less than 0. If } x = 3, \quad \frac{-6(3) + 30}{3 - 2} = \frac{12}{1} = 12, \text{ which is greater than 0. If } x = 6, \]

\[ \frac{-6(6) + 30}{6 - 2} = \frac{-6}{4} = \frac{3}{2}, \text{ which is less than 0.} \]

PTS: 2 REF: 011424a2 STA: A2.A.23 TOP: Rational Inequalities

119 ANS: 1 PTS: 2 REF: 011310a2 STA: A2.S.9 TOP: Differentiating Permutations and Combinations

120 ANS:
\[ 5 \csc \theta = 8 \]
\[ \csc \theta = \frac{8}{5} \]
\[ \sin \theta = \frac{5}{8} \]
\[ \theta \approx 41.1 \]

PTS: 2 REF: 061332a2 STA: A2.A.68 TOP: Trigonometric Equations KEY: reciprocal functions

121 ANS: 3 PTS: 2 REF: 061306a2 STA: A2.A.72 TOP: Identifying the Equation of a Trigonometric Graph

122 ANS:
\[ A = 750e^{0.03(8)} \approx 953 \]

PTS: 2 REF: 061229a2 STA: A2.A.12 TOP: Evaluating Exponential Expressions
\[
\frac{15}{\sin 103} = \frac{a}{\sin 42} \cdot \frac{1}{2} (15)(10.3) \sin 35 \approx 44
\]

\[
a \approx 10.3
\]

PTS: 4  REF: 061337a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area  KEY: advanced

124 ANS:
\[
K = ab \sin C = 18 \cdot 22 \sin 60 = 396 \cdot \frac{\sqrt{3}}{2} = 198 \sqrt{3}
\]

PTS: 2  REF: 061234a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area  KEY: Parallelograms

125 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

126 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.67  TOP: Proving Trigonometric Identities

127 ANS: 4  PTS: 2  REF: 061411a2  STA: A2.A.30  TOP: Sequences

128 ANS: 2  PTS: 2  REF: 061218a2  STA: A2.A.43  TOP: Defining Functions

129 ANS: 1  PTS: 2  REF: 061408a2  STA: A2.A.24  TOP: Completing the Square

130 ANS:
\[
\frac{10! P_{10}^{10}}{3! \cdot 3! \cdot 2!} = \frac{3,628,800}{72} = 50,400
\]

PTS: 2  REF: 061330a2  STA: A2.S.10  TOP: Permutations

131 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

132 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
\[ \binom{15}{5} = 3,003, \quad \binom{25}{5} = 25,\!130, \quad \binom{25}{15} = 3,\!268,\!760. \]

**PTS:** 2  
**REF:** 061227a2  
**STA:** A2.S.11  
**TOP:** Combinations

\[ S_n = \frac{n}{2} \left[ 2a + (n - 1)d \right] = \frac{19}{2} \left[ 2(3) + (19 - 1)7 \right] = 1254 \]

**PTS:** 2  
**REF:** 011202a2  
**STA:** A2.A.35  
**TOP:** Summations

**KEY:** arithmetic

**ANS:** 4  
**PTS:** 2  
**REF:** 011406a2  
**STA:** A2.S.1  
**TOP:** Analysis of Data

**ANS:** 3  
**PTS:** 2  
**REF:** 061418a2  
**STA:** A2.A.51  
**TOP:** Domain and Range

**ANS:** 4

**PTS:** 2  
**REF:** 061222a2  
**STA:** A2.A.50  
**TOP:** Solving Polynomial Equations

\[ \frac{-x^2 - 4}{(x + 4)(x + 3)} \times \frac{x + 3}{2(x - 2)} = \frac{-(x + 2)(x - 2)}{x + 4} \times \frac{1}{2(x - 2)} = \frac{-(x + 2)}{2(x + 4)} \]

**PTS:** 4  
**REF:** 061236a2  
**STA:** A2.A.16  
**TOP:** Multiplication and Division of Rationals

**KEY:** division
\[ \frac{a + \frac{b}{c}}{d - \frac{b}{c}} = \frac{ac + b}{cd - b} = \frac{ac + b}{c} \cdot \frac{c - b}{cd - b} = \frac{ac + b}{cd - b} \]

141 \ ANS: 4
\[ 4 + 3(2 - x) + 3(3 - x) + 3(4 - x) + 3(5 - x) \]
\[ = 4 + 6 - 3x + 9 - 3x + 12 - 3x + 15 - 3x \]
\[ = 46 - 12x \]

142 \ ANS: 2
\[ x^2 + x - 1 = -4x + 3 \]
\[ -4 \left( \frac{2}{3} \right) + 3 \geq 0 \]
\[ x^2 + x - 1 = 16x^2 - 24x + 9 \]
\[ 0 = 15x^2 - 25x + 10 \]
\[ 0 = 3x^2 - 5x + 2 \]
\[ -4(1) + 3 < 0 \]
\[ 0 = (3x - 2)(x - 1) \]
\[ 1 \text{ is extraneous} \]
\[ x = \frac{2}{3}, x \neq 1 \]

143 \ ANS:
\[ y = 180.377(0.954)^x \]

144 \ ANS: 4
\[ (a - 1)^2 + (a - 2)^2 + (a - 3)^2 + (a - 4)^2 \]
\[ (a^2 - 2a + 1) + (a^2 - 4a + 4) + (a^2 - 6a + 9) + (a^2 - 8a + 16) \]
\[ 4a^2 - 20a + 30 \]

145 \ ANS:
\[ y = 180.377(0.954)^x \]

146 \ ANS: 1
147 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

148 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

149 ANS: 2
\[
\sin^{-1}\left(\frac{8}{17}\right) \cdot DMS
\]
\[ 28^\circ 4' 20.953'' \]

\[ \sin S = \frac{8}{17} \]
\[ S = \sin^{-1}\frac{8}{17} \]
\[ S \approx 28^\circ 4' \]

PTS: 2  REF: 061311a2  STA: A2.A.55  TOP: Trigonometric Ratios

150 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

151 ANS: 3
sum of the roots, \[ \frac{-b}{a} = \frac{-(-9)}{4} = \frac{9}{4} \]
product of the roots, \[ \frac{c}{a} = \frac{3}{4} \]

PTS: 2  REF: 061208a2  STA: A2.A.21  TOP: Roots of Quadratics
KEY: basic
\[
\log 4m^2 = \log 4 + \log m^2 = \log 4 + 2 \log m
\]

PTS: 2  
REF: 061321a2  
STA: A2.A.19  
TOP: Properties of Logarithms

KEY: splitting logs

154 ANS: 3  
PTS: 2  
REF: 061416a2  
STA: A2.A.12  
TOP: Evaluating Exponential Expressions

(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

155 ANS: 4  
PTS: 1  
REF: 011312a2  
STA: A2.A.56  
TOP: Determining Trigonometric Functions

KEY: degrees, common angles

156 ANS: 1  
PTS: 2  
REF: 011223a2  
STA: A2.A.39  
TOP: Domain and Range

KEY: real domain

\[
\begin{align*}
(5x - 1)^{\frac{1}{3}} &= 4 \\
5x - 1 &= 64 \\
5x &= 65 \\
x &= 13
\end{align*}
\]

PTS: 2  
REF: 061433a2  
STA: A2.A.28  
TOP: Logarithmic Equations

KEY: advanced

157 ANS: 

\[
\begin{align*}
\frac{b}{a} &= -\frac{1}{12} \\
c &= \frac{1}{2}
\end{align*}
\]

PTS: 2  
REF: 061328a2  
STA: A2.A.20  
TOP: Roots of Quadratics

158 ANS: 1  
PTS: 2  
REF: 061316a2  
STA: A2.S.8  
TOP: Correlation Coefficient

159 ANS: 3  
PTS: 2  
REF: 061314a2  
STA: A2.N.1  
TOP: Negative and Fractional Exponents

\[
6n^{-1} < 4n^{-1} \quad \text{Flip sign when multiplying each side of the inequality by } n, \text{ since a negative number.}
\]

\[
\begin{align*}
\frac{6}{n} &< \frac{4}{n} \\
6 &> 4
\end{align*}
\]
161 ANS:
\[
\frac{31 - 19}{7 - 4} = \frac{12}{3} = 4 \quad x + (4 - 1)4 = 19 \quad a_n = 7 + (n - 1)4
\]
\[
x + 12 = 19
\]
\[
x = 7
\]

PTS: 2 REF: 011434a2 STA: A2.A.29 TOP: Sequences

162 ANS: 1 PTS: 2 REF: 011314a2 STA: A2.N.3
TOP: Operations with Polynomials

163 ANS:

\[
\frac{27}{\sin 75} = \frac{F_1}{\sin 60} \quad \frac{27}{\sin 75} = \frac{F_2}{\sin 45}.
\]

\[
F_1 \approx 24 \quad F_2 \approx 20.
\]

PTS: 4 REF: 061238a2 STA: A2.A.73 TOP: Vectors

164 ANS:

\[
2x - 3 > 5 \quad 2x - 3 < -5
\]

\[
2x > 8 \quad 2x < -2
\]

\[
x > 4 \quad x < -1
\]

PTS: 2 REF: 061430a2 STA: A2.A.1 TOP: Absolute Value Inequalities

165 ANS: 1

PTS: 2 REF: 061225a2 STA: A2.S.8 TOP: Correlation Coefficient

166 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
167 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

168 ANS: 3
\[ S_n = \frac{3(1 - (-4)^8)}{1 - (-4)} = \frac{196,605}{5} = -39,321 \]

PTS: 2 REF: 061304a2 STA: A2.A.35 TOP: Summations
KEY: geometric

169 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

170 ANS:
\[ a + 15 + 2a = 90 \]
\[ 3a + 15 = 90 \]
\[ 3a = 75 \]
\[ a = 25 \]

PTS: 2 REF: 011330a2 STA: A2.A.58 TOP: Cofunction Trigonometric Relationships

171 ANS: 1
\[ \cos(A - B) = \left( \frac{5}{13} \right) \left( -\frac{3}{5} \right) + \left( \frac{12}{13} \right) \left( \frac{4}{5} \right) = -\frac{15}{65} + \frac{48}{65} = \frac{33}{65} \]

PTS: 2 REF: 011214a2 STA: A2.A.76 TOP: Angle Sum and Difference Identities
KEY: evaluating
\[ x^2(x + 2) - (x + 2) \]
\[ (x^2 - 1)(x + 2) \]
\[ (x + 1)(x - 1)(x + 2) \]

PTS: 2  REF: 011426a2  STA: A2.A.7  TOP: Factoring by Grouping

173  ANS: 1  PTS: 2  REF: 011306a2  STA: A2.A.8  TOP: Negative and Fractional Exponents

174  ANS: 2  PTS: 2  REF: 011417a2  STA: A2.S.9  TOP: Differentiating Permutations and Combinations

175  ANS: 2
\[ \cot x \frac{\cos x}{\sin x} = \cos x \]
\[ \csc x = \frac{1}{\sin x} \]

PTS: 2  REF: 061410a2  STA: A2.A.58  TOP: Reciprocal Trigonometric Relationships

176  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

177  ANS: 3
\[ 1000 = 500e^{.05t} \]
\[ 2 = e^{.05t} \]
\[ \ln 2 = \ln e^{.05t} \]
\[ \ln 2 = .05t \cdot \ln e \]
\[ \ln 2 = .05t \]
\[ 13.9 \approx t \]

PTS: 2  REF: 061313a2  STA: A2.A.6  TOP: Exponential Growth
178 ANS: \[ a^2 b^3 \]
\[
\frac{4}{a^2 b^3}
\]
PTS: 2 REF: 011231a2 STA: A2.A.13 TOP: Simplifying Radicals
KEY: index > 2

179 ANS: 3
2! \cdot 2! \cdot 2! = 8
PTS: 2 REF: 061425a2 STA: A2.S.10 TOP: Permutations

180 ANS: 2
\[
tan 30 = \sqrt{3} \cdot 3. \quad Arc \cos \frac{\sqrt{3}}{k} = 30
\]
\[
\frac{\sqrt{3}}{k} = \cos 30
\]
\[
k = 2
\]
PTS: 2 REF: 061323a2 STA: A2.A.64 TOP: Using Inverse Trigonometric Functions
KEY: advanced

181 ANS: 
\[ a_1 = 3. \quad a_2 = 2(3) - 1 = 5. \quad a_3 = 2(5) - 1 = 9. \]
PTS: 2 REF: 061233a2 STA: A2.A.33 TOP: Recursive Sequences

182 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

183 ANS: 4
\[
r = \sqrt{(6 - 3)^2 + (5 - (-4))^2} = \sqrt{9 + 81} = \sqrt{90}
\]

184 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

185 ANS: 1
PTS: 2 REF: 061420a2 STA: A2.A.34 TOP: Sigma Notation
186 ANS: 
\[ 25C_{20} = 53,130 \] 

PTS: 2  REF: 011232a2  STA: A2.S.11  TOP: Combinations

187 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

188 ANS: 
\[ \sqrt{27^2 + 32^2 - 2(27)(32) \cos 123} \approx 54 \]

KEY: applied

189 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

190 ANS: 
\[ 3 - 2x \geq 7 \quad \text{or} \quad 3 - 2x \leq -7 \]
\[ -2x \geq 4 \quad -2x \leq -10 \]
\[ x \leq -2 \quad x \geq 5 \]

PTS: 2  REF: 011334a2  STA: A2.A.1  TOP: Absolute Value Inequalities
KEY: graph

191 ANS: 2  PTS: 2  REF: 011201a2  STA: A2.S.2  TOP: Analysis of Data

192 ANS: 
\[ a_n = 9n - 4 \]
\[ S_n = \frac{20(5 + 176)}{2} = 1810 \]
\[ a_1 = 9(1) - 4 = 5 \]
\[ a_{20} = 9(20) - 4 = 176 \]

PTS: 2  REF: 011328a2  STA: A2.A.35  TOP: Summations
KEY: arithmetic


194 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
If \( \csc P > 0 \) and \( \sin P > 0 \), \( \cot P < 0 \) and \( \sin P > 0 \), \( \cos P < 0 \).

\[ r = \sqrt{2^2 + 3^2} = \sqrt{13}. \quad (x + 5)^2 + (y - 2)^2 = 13 \]

\[ x(x + 3) = 10 \]
\[ x^2 + 3x - 10 = 0 \]
\[ (x + 5)(x - 2) = 0 \]
\[ x = -5, 2 \]

\[ 2x^2 - 7x - 5 = 0 \]
\[ \frac{c}{a} = \frac{-5}{2} \]
\[
\sin(\theta + 90) = \sin \theta \cdot \cos 90 + \cos \theta \cdot \sin 90 = \sin \theta \cdot (0) + \cos \theta \cdot (1) = \cos \theta
\]

PTS: 2  
REF: 061309a2  
STA: A2.A.76  
TOP: Angle Sum and Difference Identities

KEY: identities

207 ANS:

\[2 \sin^2 x + 5 \sin x - 3 = 0\]

\[(2 \sin x - 1)(\sin x + 3) = 0\]

\[\sin x = \frac{1}{2}\]

\[x = \frac{\pi}{6}, \frac{5\pi}{6}\]

PTS: 4  
REF: 011436a2  
STA: A2.A.68  
TOP: Trigonometric Equations

KEY: quadratics

208 ANS:

\[83^\circ 50' \cdot \frac{\pi}{180} \approx 1.463 \text{ radians } s = \theta r = 1.463 \cdot 12 \approx 17.6\]

PTS: 2  
REF: 011435a2  
STA: A2.A.61  
TOP: Arc Length

KEY: arc length

209 ANS:

\[2\sqrt{3} \cdot \frac{3}{3}. \text{ If } \sin 60 = \frac{\sqrt{3}}{2}, \text{ then } \csc 60 = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}\]

PTS: 2  
REF: 011235a2  
STA: A2.A.59  
TOP: Reciprocal Trigonometric Relationships

210 ANS: 2

\[
1 - \frac{4}{x} \times \frac{x^2}{x^2} = \frac{x^2 - 4x}{x^2 - 2x - 8} = \frac{x(x - 4)}{(x - 4)(x + 2)} = \frac{x}{x + 2}
\]

PTS: 2  
REF: 061305a2  
STA: A2.A.17  
TOP: Complex Fractions

211 ANS: 3

\[
\frac{4}{-2} = -2
\]

PTS: 2  
REF: 011304a2  
STA: A2.A.31  
TOP: Sequences
\[
\frac{6}{\sin 35} = \frac{10}{\sin N}
\]

\[N \approx 73\]

\[73 + 35 < 180\]

\[(180 - 73) + 35 < 180\]

PTS: 2  
REF: 061226a2  
STA: A2.A.75  
TOP: Law of Sines - The Ambiguous Case

\[
\sec x = \sqrt{2}
\]

\[
\cos x = \frac{1}{\sqrt{2}}
\]

\[
\cos x = \frac{\sqrt{2}}{2}
\]

\[x = 45^\circ, 315^\circ\]

PTS: 2  
REF: 061434a2  
STA: A2.A.68  
TOP: Trigonometric Equations

KEY: reciprocal functions

\[
\frac{3\sqrt[3]{4^2a^{15}}}{a^3} = 4a^5 \cdot \sqrt[3]{a}
\]

PTS: 2  
REF: 061204a2  
STA: A2.A.13  
TOP: Simplifying Radicals

KEY: index > 2

\[
\frac{1 + \frac{3}{x}}{\frac{5}{x} - \frac{24}{x^2}} \cdot \frac{x^2}{x^2 + 3x} = \frac{x^2 + 3x}{x^2 - 5x - 24} = \frac{x(x + 3)}{(x - 8)(x + 3)} = \frac{x}{x - 8}
\]

PTS: 4  
REF: 061436a2  
STA: A2.A.17  
TOP: Complex Fractions

\[
\frac{x^2 + 9x - 22}{x^2 - 121} \cdot (2 - x) = \frac{(x + 11)(x - 2)}{(x + 11)(x - 11)} \cdot \frac{-1}{x - 2} = \frac{-1}{x - 11}
\]

PTS: 2  
REF: 011423a2  
STA: A2.A.16  
TOP: Multiplication and Division of Rationals

KEY: Division

\[
\frac{1 + x^2 + 9x - 22}{x^2 - 121} \cdot (2 - x) = \frac{(x + 11)(x - 2)}{(x + 11)(x - 11)} \cdot \frac{-1}{x - 2} = \frac{-1}{x - 11}
\]

PTS: 3  
REF: 061407a2  
STA: A2.N.3  
TOP: Operations with Polynomials
218 ANS:
\[ C_3 \left( \frac{1}{4} \right)^3 \left( \frac{3}{4} \right)^4 = 35 \left( \frac{1}{64} \right) \left( \frac{81}{256} \right) = \frac{2835}{16384} \approx 0.173 \]

PTS: 2 REF: 061335a2 STA: A2.S.15 TOP: Binomial Probability
KEY: exactly

219 ANS: 2
\[ 2^2 \cdot 3 = 12 \cdot 6^2d = 12 \]
\[ 4^2 \cdot \frac{3}{4} = 12 \quad 36d = 12 \]
\[ d = \frac{1}{3} \]

PTS: 2 REF: 061301a2 STA: A2.A.5 TOP: Inverse Variation

220 ANS:
\[ \log_{(x + 3)}(2x + 3)(x + 5) = 2 \quad -6 \text{ is extraneous} \]
\[ (x + 3)^2 = (2x + 3)(x + 5) \]
\[ x^2 + 6x + 9 = 2x^2 + 13x + 15 \]
\[ x^2 + 7x + 6 = 0 \]
\[ (x + 6)(x + 1) = 0 \]
\[ x = -1 \]

KEY: applying properties of logarithms

221 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

222 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

223 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
224 ANS:

\[3x^2 - 11x + 6 = 0. \quad \text{Sum } \frac{-b}{a} = \frac{11}{3}. \quad \text{Product } \frac{c}{a} = \frac{6}{3} = 2\]

PTS: 2 REF: 011329a2 STA: A2.A.20 TOP: Roots of Quadratics

225 ANS: 2 PTS: 2 REF: 011213a2 STA: A2.N.8

TOP: Conjugates of Complex Numbers

226 ANS: 3

34.1% + 19.1% = 53.2%

PTS: 2 REF: 011212a2 STA: A2.S.5 TOP: Normal Distributions

KEY: probability

227 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

228 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

229 ANS: 1

\(\frac{2\pi}{b} = 4\pi\)

\(b = \frac{1}{2}\)


230 ANS: 2 PTS: 2 REF: 011225a2 STA: A2.A.43

TOP: Defining Functions

231 ANS: 1 PTS: 2 REF: 061401a2 STA: A2.S.2

TOP: Analysis of Data

232 ANS: 1

\((4a + 4) - (2a + 1) = 2a + 3\)

PTS: 2 REF: 011401a2 STA: A2.A.30 TOP: Sequences

233 ANS: 2 PTS: 2 REF: 061301a2 STA: A2.S.1

TOP: Analysis of Data

234 ANS: 3

\(\binom{3}{1} \cdot \binom{5}{2} = 3 \cdot 10 = 30\)

PTS: 2 REF: 061422a2 STA: A2.S.12 TOP: Combinations

235 ANS: 2 PTS: 2 REF: 011507a2 STA: A2.A.38

TOP: Defining Functions KEY: graphs
\[ _{20}C_4 = 4,845 \]

PTS: 2 \hspace{1cm} REF: 011509a2 \hspace{1cm} STA: A2.S.11 \hspace{1cm} TOP: Combinations
Algebra 2/Trigonometry Regents Exam Questions at Random

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Algebra 2/Trigonometry Regents at Random

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

1) $h^2 = 6^2 + g^2 - 2(9)(h) \cos 57^\circ$
2) $h^2 = 6^2 + g^2 - 2(6)(9) \cos 57^\circ$
3) $6^2 = 9^2 + h^2 - 2(9)(h) \cos 57^\circ$
4) $9^2 = 6^2 + h^2 - 2(6)(h) \cos 57^\circ$

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

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>5</td>
</tr>
<tr>
<td>-1</td>
<td>4</td>
</tr>
<tr>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

1) $f(x) = |x + 3|$  
2) $f(x) = |x| + 3$  
3) $f(y) = |y + 3|$  
4) $f(y) = |y| + 3$

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

1) $x^y = a$  
2) $y^a = x$  
3) $a^x = x$  
4) $a^y = y$

240 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?
241 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) \(x^2 - 2x + 5 = 0\)

242 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) \(\frac{1}{4}\)

243 If \(\sin A = \frac{3}{8}\), what is the value of \(\cos 2A\)?

1) \(-\frac{9}{64}\)
2) \(\frac{1}{4}\)
3) \(\frac{23}{32}\)
4) \(\frac{55}{64}\)

244 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) \((x - 3)^2(x - 2)\)

245 When \(-3 - 2i\) is multiplied by its conjugate, the result is

1) \(-13\)
2) \(-5\)
3) \(5\)
4) \(13\)

246 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) \((x + 4)^2 + (y - 2)^2 = 20\)

247 What is the product of the roots of \(4x^2 - 5x = 3\)?

1) \(\frac{3}{4}\)
2) \(\frac{5}{4}\)
3) \(-\frac{3}{4}\)
4) \(-\frac{5}{4}\)
248 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) \( \sum_{n=2}^{5} n^2 + n \)

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

1) \( \frac{10b^4}{a^3} \)

2) \( \frac{25b^4}{a^3} \)

3) \( \frac{a^3}{25b^4} \)

4) \( \frac{a^2}{125b^5} \)

250 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) \( \cot^2 x(\sec^2 x - 1) \)

251 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) \( 8a^2b^3 \sqrt[3]{a} \)

252 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

253 What is the third term in the expansion of \((2x - 3)^5\)?

1) \( 720x^3 \)

2) \( 180x^3 \)

3) \( -540x^2 \)

4) \( -1080x^2 \)

254 Angle \( \theta \) is in standard position and \((-4,0)\) is a point on the terminal side of \( \theta \). What is the value of \( \sec \theta \)?

1) -4

2) -1

3) 0

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

256 Which equation could be used to solve
\[ \frac{5}{x-3} - \frac{2}{x} = 1? \]
1) \( x^2 - 6x - 3 = 0 \)
2) \( x^2 - 6x + 3 = 0 \)
3) \( x^2 - 6x - 6 = 0 \)
4) \( x^2 - 6x + 6 = 0 \)

257 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

258 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) \( 3x - 2 \)

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

<table>
<thead>
<tr>
<th>Number</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>14</td>
<td>8</td>
</tr>
</tbody>
</table>


260 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

261 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) \( 4a^2 + 7a + 4 \)

262 If \( p \) and \( q \) vary inversely and \( p \) is 25 when \( q \) is 6, determine \( q \) when \( p \) is equal to 30.
263 Express in simplest form: \[
\frac{36 - x^2}{(x + 6)^2} \cdot \frac{x - 3}{x^2 + 3x - 18}
\]

264 Solve \(e^{4x} = 12\) algebraically for \(x\), rounded to the nearest hundredth.

265 Determine, to the nearest minute, the degree measure of an angle of \(\frac{5}{11}\pi\) radians.

266 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.

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

268 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.

269 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.

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

<table>
<thead>
<tr>
<th>Years After 1990 (x)</th>
<th>0</th>
<th>2</th>
<th>5</th>
<th>9</th>
<th>14</th>
<th>17</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount (y)</td>
<td>750</td>
<td>451</td>
<td>219</td>
<td>94</td>
<td>25</td>
<td>12</td>
<td>8</td>
</tr>
</tbody>
</table>

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.

271 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.
272 Use the recursive sequence defined below to express the next three terms as fractions reduced to lowest terms.

\[ a_1 = 2 \]
\[ a_n = 3\left(a_{n-1}\right)^{-2} \]

273 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.]

274 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) \((1, 5), (2, 4), (3, 1), (4, 0)\)

275 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) \(\frac{y^6}{x^3}\)

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

277 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) \(129\)

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

279 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) \((x + 6)^2 = 29\)

280 Given the equation \(3x^2 + 2x + k = 0\), state the sum and product of the roots.
281 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) \(\{x | x < -3\}\)

282 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) \(96\sqrt{3}\)

283 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) \(\frac{20 - 5\sqrt{11}}{27}\)

284 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) \(-2\)

285 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

286 What is the fourth term of the sequence defined by \(a_1 = 3xy^5\)
\[a_n = \left(\frac{2x}{y}\right)^n a_{n-1} \text{?}\]
1) \(12x^3y^3\)
2) \(24x^2y^4\)
3) \(24x^4y^2\)
4) \(48x^5y\)

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

288 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) \(\frac{1}{4}x^2 - \frac{1}{2}x - 2\)
289 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) $\sin 4.76^\circ = \frac{h}{15}$
2) $\sin 4.76^\circ = \frac{15}{h}$
3) $\tan 4.76^\circ = \frac{h}{15}$
4) $\tan 4.76^\circ = \frac{15}{h}$

290 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) $y = f(x - 7) + 3$

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

292 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 $n$th row?
1) $35 + (n + 4)$
2) $35 + 4n$
3) $35 + (n + 1)(4)$
4) $35 + (n - 1)(4)$

293 Which value is in the domain of the function graphed below, but is not in its range?

294 How many full cycles of the function $y = 3 \sin 2x$ appear in $\pi$ radians?
1) 1
2) 2
3) 3
4) 4

295 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) $^6C_4 + 4C_2$
296 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) $f^{-1}(x) = \log_4 x$
4) $f^{-1}(x) = -\log_4 x$

297 The expression $\frac{1 + \cos 2A}{\sin 2A}$ is equivalent to
1) $\cot A$
2) $\tan A$
3) $\sec A$
4) $1 + \cot 2A$

298 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

299 Circle $O$ has a radius of 2 units. An angle with a measure of $\frac{\pi}{6}$ 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) $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
2) $\left(\sqrt{3}, 1\right)$
3) $\left(\frac{1}{2}, \sqrt{3}\right)$
4) $\left(1, \sqrt{3}\right)$

300 What is the value of $\sum_{x=0}^{2} (3 - 2a)^x$?
1) $4a^2 - 2a + 12$
2) $4a^2 - 2a + 13$
3) $4a^2 - 14a + 12$
4) $4a^2 - 14a + 13$

301 A population, $p(x)$, of wild turkeys in a certain area is represented by the function $p(x) = 17(1.15)^x$, 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

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

303 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.

304 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?

305 If $\log_{(x+1)} 64 = 3$, find the value of $x$. 
306  The table below shows the final examination scores for Mr. Spear’s class last year.

<table>
<thead>
<tr>
<th>Test Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>1</td>
</tr>
<tr>
<td>76</td>
<td>1</td>
</tr>
<tr>
<td>79</td>
<td>4</td>
</tr>
<tr>
<td>83</td>
<td>5</td>
</tr>
<tr>
<td>85</td>
<td>7</td>
</tr>
<tr>
<td>88</td>
<td>5</td>
</tr>
<tr>
<td>94</td>
<td>3</td>
</tr>
</tbody>
</table>

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.

307  Factor completely: \(x^3 - 6x^2 - 25x + 150\)

308  Express \(xi^8 - yi^6\) in simplest form.

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

<table>
<thead>
<tr>
<th>Set A</th>
<th>(x)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(y)</td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>51</td>
<td>70</td>
<td>80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set B</th>
<th>(x)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(y)</td>
<td>81</td>
<td>64</td>
<td>49</td>
<td>36</td>
<td>25</td>
<td>18</td>
</tr>
</tbody>
</table>

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

311  Solve algebraically for \(x\):
\[
\frac{3}{x} + \frac{x}{x + 2} = -\frac{2}{x + 2}
\]

312  In the interval \(0^\circ \leq \theta < 360^\circ\), solve the equation \(5\cos \theta = 2\sec \theta - 3\) algebraically for all values of \(\theta\), to the nearest tenth of a degree.

313  What are the zeros of the polynomial function graphed below?

1) \((-3, -1, 2)\)
2) \((3, 1, -2)\)
3) \((4, -8)\)
4) \((-6)\)

314  Determine, to the nearest minute, the number of degrees in an angle whose measure is 2.5 radians.
315 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.

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

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

318 The exact value of \(\csc 120^\circ\) is
1) \(\frac{2\sqrt{3}}{3}\)
2) \(2\)
3) \(\frac{2\sqrt{3}}{3}\)
4) \(-2\)

319 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 \(-9\).

320 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

321 What is the value of \(\tan \left(\arccos \frac{15}{17}\right)\)?
1) \(\frac{8}{15}\)
2) \(\frac{8}{17}\)
3) \(\frac{15}{8}\)
4) \(\frac{17}{8}\)
322 The table below displays the number of siblings of each of the 20 students in a class.

<table>
<thead>
<tr>
<th>Number of Siblings</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

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

323 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

$A = P \left( 1 + \frac{r}{n} \right)^{nt}$,

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) $619.74$

324 Solve for $x$: $\frac{1}{16} = 2^{3x-1}$

325 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

326 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

327 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

328 Which values of $x$ in the interval $0^\circ \leq x < 360^\circ$ satisfy the equation $2 \sin^2 x + \sin x - 1 = 0$?
1) $\{30^\circ, 270^\circ\}$
2) $\{30^\circ, 150^\circ, 270^\circ\}$
3) $\{90^\circ, 210^\circ, 330^\circ\}$
4) $\{90^\circ, 210^\circ, 270^\circ, 330^\circ\}$
329  Expressed as a function of a positive acute angle, 
\( \sin 230^\circ \) is equal to 
1) \(-\sin 40^\circ\)  
2) \(-\sin 50^\circ\)  
3) \(\sin 40^\circ\)  
4) \(\sin 50^\circ\)  

330  Which equation represents a circle with its center at \((2,-3)\) and that passes through the point \((6,2)\)? 
1) \((x - 2)^2 + (y + 3)^2 = 41\)  
2) \((x + 2)^2 + (y - 3)^2 = 41\)  
3) \((x - 2)^2 + (y + 3)^2 = 41\)  
4) \((x + 2)^2 + (y - 3)^2 = 41\)  

331  What is the domain of the function \(g(x) = 3^x - 1\)? 
1) \((−∞, 3]\)  
2) \((−∞, 3)\)  
3) \((−∞, ∞)\)  
4) \((-1, ∞)\)  

332  The expression \(\frac{3 - \sqrt{8}}{\sqrt{3}}\) is equivalent to 
1) \(\sqrt{3} - 2\sqrt{6}\)  
2) \(-\sqrt{3} + \frac{2}{3}\sqrt{6}\)  
3) \(\frac{3 - \sqrt{24}}{3}\)  
4) \(\sqrt{3} - \frac{2}{3}\sqrt{6}\)  

333  What is the period of the graph of the equation 
\(y = \frac{1}{3}\sin 2x\)? 
1) \(\frac{1}{3}\)  
2) \(2\)  
3) \(\pi\)  
4) \(6\pi\)  

334  The first four terms of the sequence defined by 
\[a_1 = \frac{1}{2}\ \text{and } a_{n+1} = 1 - a_n\] are 
1) \(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}\)  
2) \(\frac{1}{2}, 1, 1, \frac{1}{2}\)  
3) \(\frac{1}{2}, 2, 4, 8, 16\)  
4) \(\frac{1}{2}, 2, \frac{1}{2}, 2, 3, \frac{1}{2}\)  

335  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  

336  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.
337 If $\cos \theta = \frac{3}{4}$, then what is $\cos 2\theta$?

1) \( \frac{1}{8} \)
2) \( \frac{9}{16} \)
3) \( \frac{1}{8} \)
4) \( \frac{3}{2} \)

338 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) $6x^8 i \sqrt{5}$

339 The ninth term of the expansion of $(3x + 2y)^{15}$ is

1) $\binom{15}{9} (3x)^9 (2y)^6$
2) $\binom{15}{9} (3x)^8 (2y)^7$
3) $\binom{15}{9} (3x)^7 (2y)^8$
4) $\binom{15}{9} (3x)^6 (2y)^9$

340 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) $\frac{6!}{2!}$
4) $\frac{6!}{4! \cdot 2!}$

341 Which value of $k$ will make $x^2 - \frac{1}{4}x + k$ a perfect square trinomial?

1) \( \frac{1}{64} \)
2) \( \frac{1}{16} \)
3) \( \frac{1}{8} \)
4) \( \frac{1}{4} \)

342 If $f(x) = x^2 - x$ and $g(x) = x + 1$, determine $f(g(x))$ in simplest form.

343 The probability of winning a game is $\frac{2}{3}$.

Determine the probability, expressed as a fraction, of winning exactly four games if seven games are played.

344 In a circle, an arc length of 6.6 is intercepted by a central angle of $\frac{2}{3}$ radians. Determine the length of the radius.

345 In a triangle, two sides that measure 8 centimeters and 11 centimeters form an angle that measures $82^\circ$. To the nearest tenth of a degree, determine the measure of the smallest angle in the triangle.
346 Which graph does not represent a function?

1)  

2)  

3)  

4)  

347 Show that $\frac{\sec^2 x - 1}{\sec^2 x}$ is equivalent to $\sin^2 x$.

348 Solve algebraically for the exact values of $x$:

$$\frac{5x}{2} = \frac{1}{x} + \frac{x}{4}$$

349 Simplify: $\sum_{a=1}^{4} \left( x - a^2 \right)$.

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

351 Solve algebraically for $x$: $|3x - 5| - x < 17$

352 Solve algebraically, to the nearest hundredth, for all values of $x$:

$$\log_2(x^2 - 7x + 12) - \log_2(2x - 10) = 3$$

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

<table>
<thead>
<tr>
<th>Statistics Class Averages</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>99</td>
<td>1</td>
</tr>
<tr>
<td>97</td>
<td>5</td>
</tr>
<tr>
<td>95</td>
<td>4</td>
</tr>
<tr>
<td>92</td>
<td>4</td>
</tr>
<tr>
<td>90</td>
<td>7</td>
</tr>
<tr>
<td>87</td>
<td>2</td>
</tr>
<tr>
<td>84</td>
<td>6</td>
</tr>
<tr>
<td>81</td>
<td>2</td>
</tr>
<tr>
<td>75</td>
<td>1</td>
</tr>
<tr>
<td>70</td>
<td>2</td>
</tr>
<tr>
<td>65</td>
<td>1</td>
</tr>
</tbody>
</table>

What is the population variance for this set of data?

1)  8.2
2)  8.3
3)  67.3
4)  69.3
Algebra 2/Trigonometry Regents at Random
Answer Section


238 ANS: 2 PTS: 2 REF: 011502a2 STA: A2.A.52 TOP: Identifying the Equation of a Graph

239 ANS: 3 PTS: 2 REF: 011503a2 STA: A2.A.28 TOP: Logarithmic Equations KEY: basic

240 ANS: 1 PTS: 2 REF: 011506a2 STA: A2.A.53 TOP: Graphing Exponential Functions

241 ANS: 2
\((-5)^2 - 4(1)(4) = 9\)

PTS: 2 REF: 011506a2 STA: A2.A.2 TOP: Using the Discriminant

242 ANS: 1
\(\frac{3}{4} \div \frac{1}{2} = \frac{3}{2}\)

PTS: 2 REF: 011508a2 STA: A2.A.31 TOP: Sequences

243 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

244 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

245 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

247 ANS: 3
\[
\frac{c}{a} = -\frac{3}{4}
\]

PTS: 2
REF: 011517a2
STA: A2.A.20
TOP: Roots of Quadratics

248 ANS: 4
PTS: 2
REF: 011504a2
STA: A2.A.34
TOP: Sigma Notation

249 ANS: 2
\[
5^2 a^{-3} b^4 = \frac{25 b^4}{a^3}
\]

PTS: 2
REF: 011514a2
STA: A2.A.9
TOP: Negative Exponents

250 ANS: 3
\[
\sin^2 x \left( 1 + \frac{\cos^2 x}{\sin^2 x} \right) = \sin^2 x + \cos^2 x = 1 - \frac{1}{\cos^2 x} (\cos^2 x) = 1 \cos^2 x \left( \frac{\sin^2 x}{\cos^2 x} - 1 \right) = \sin^2 x - \cos^2 x \neq 1
\]
\[
\cos^2 x \left( \frac{1}{\cos^2 x} - 1 \right) = \frac{1}{\sin^2 x} - \frac{\cos^2 x}{\sin^2 x} = \csc^2 x - \cot x = 1
\]

PTS: 2
REF: 011515a2
STA: A2.A.58
TOP: Reciprocal Trigonometric Relationships

251 ANS: 1
\[
\sqrt[3]{64 a^5 b^6} = \sqrt[3]{4^3 a^3 a^2 b^6} = 4a b^2 \sqrt[3]{a^2}
\]

PTS: 2
REF: 011516a2
STA: A2.N.2
TOP: Operations with Radicals

252 ANS: 1
\[
\frac{P_{11}}{2!2!2!} = \frac{39,916,800}{16} = 2,494,800
\]

PTS: 2
REF: 011518a2
STA: A2.S.10
TOP: Permutations

253 ANS: 1
\[
\binom{5}{2}(2x)^{5-2}(-3)^2 = 720x^3
\]

PTS: 2
REF: 011519a2
STA: A2.A.36
TOP: Binomial Expansions

254 ANS: 2
\[
\sec \theta = \frac{\sqrt{x^2 + y^2}}{x} = \frac{\sqrt{(-4)^2 + 0^2}}{-4} = \frac{4}{-4} = -1
\]

PTS: 2
REF: 011520a2
STA: A2.A.62
TOP: Determining Trigonometric Functions

255 ANS: 2
PTS: 2
REF: 011521a2
STA: A2.A.39
TOP: Domain and Range
KEY: real domain
\[
\frac{5x}{x(x-3)} - \frac{2(x-3)}{x(x-3)} = \frac{x(x-3)}{x(x-3)} \\
5x - 2x + 6 = x^2 - 3x \\
0 = x^2 - 6x - 6
\]

PTS: 2  REF: 011522a2  STA: A2.A.23  TOP: Solving Rationals

KEY: irrational and complex solutions

\[
\frac{\sqrt{34}}{\sin 30} = \frac{12}{\sin B} \\
B = \sin^{-1} \left( \frac{12 \sin 30}{\sqrt{34}} \right) \\
\approx \sin^{-1} \frac{6}{5.8}
\]

PTS: 2  REF: 011523a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

\[
\left( \frac{3}{2}x - 1 \right) \left( \frac{3}{2}x + 1 \right) - \left( \frac{3}{2}x - 1 \right) = \left( \frac{3}{2}x - 1 \right)(2) = 3x - 2
\]

PTS: 2  REF: 011524a2  STA: A2.N.3  TOP: Operations with Polynomials

\[
12 - 7 = 5
\]

PTS: 2  REF: 011525a2  STA: A2.S.4  TOP: Dispersion

KEY: range, quartiles, interquartile range, variance

\[
s = \theta r = \frac{2\pi}{5} \cdot 18 \approx 23
\]

PTS: 2  REF: 011526a2  STA: A2.A.61  TOP: Arc Length

KEY: arc length

\[
f(a + 1) = 4(a + 1)^2 - (a + 1) + 1 \\
= 4(a^2 + 2a + 1) - a \\
= 4a^2 + 8a + 4 - a \\
= 4a^2 + 7a + 4
\]

PTS: 2  REF: 011527a2  STA: A2.A.41  TOP: Functional Notation
262 ANS: 
\[25 \cdot 6 = 30q\]
\[5 = q\]

PTS: 2 REF: 011528a2 STA: A2.A.5 TOP: Inverse Variation

263 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

264 ANS: 
\[\ln e^{4x} = \ln 12\]
\[4x = \ln 12\]
\[x = \frac{\ln 12}{4}\]
\[\approx 0.62\]

PTS: 2 REF: 011530a2 STA: A2.A.27 TOP: Exponential Equations

KEY: without common base

265 ANS: 
\[\frac{5}{11} \pi \left\{ \frac{180}{\pi} \right\} = 81^\circ 49'\]

PTS: 2 REF: 011531a2 STA: A2.M.2 TOP: Radian Measure

KEY: degrees

266 ANS: 
\[\binom{2}{5}^5 \left(\frac{3}{5}\right) = 6 \left(\frac{32}{3125}\right) \left(\frac{3}{5}\right) = \frac{576}{15,625}\]

PTS: 2 REF: 011532a2 STA: A2.S.15 TOP: Binomial Probability

KEY: exactly

267 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
\[ \text{ANS:} \quad \text{sd} = \frac{81 - 57}{3} = 8 \]

\[ 57 + 8 = 65 \]

\[ 81 - 2(8) = 65 \]

PTS: 2  REF: 011534a2  STA: A2.S.5  TOP: Normal Distributions
KEY: mean and standard deviation

\[ \text{ANS:} \quad 594 = 32 \cdot 46 \sin C \]

\[ \frac{594}{1472} = \sin C \]

\[ 23.8 \approx C \]

PTS: 2  REF: 011535a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area
KEY: Parallelograms

\[ \text{ANS:} \quad y = 733.646(0.786)^{x} \quad 733.646(0.786)^{12} \approx 41 \]

PTS: 4  REF: 011536a2  STA: A2.S.7  TOP: Exponential Regression

\[ \text{ANS:} \quad a = 3, \ b = 2, \ c = 1 \quad y = 3 \cos 2x + 1. \]

PTS: 2  REF: 011537a2  STA: A2.A.33  TOP: Recursive Sequences

\[ \text{ANS:} \quad a_{2} = 3(2)^{-2} = \frac{3}{4}, \quad a_{3} = 3\left( \frac{3}{4} \right)^{-2} = \frac{16}{3}, \quad a_{4} = 3\left( \frac{16}{3} \right)^{-2} = \frac{27}{256} \]

PTS: 4  REF: 011538a2  STA: A2.A.33  TOP: Identifying the Equation of a Trigonometric Graph

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

\[ x^2 + 36x + 308 = 800 \]

\[ x^2 + 36x - 492 = 0 \]

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

\[ \text{ANS:} 3 \quad \text{PTS:} 2 \quad \text{REF:} 061501a2 \quad \text{STA:} \ A2.A.43 \quad \text{TOP:} \ \text{Defining Functions} \]

\[ \text{ANS:} 4 \quad \text{PTS:} 2 \quad \text{REF:} 061506a2 \quad \text{STA:} \ A2.A.9 \quad \text{TOP:} \ \text{Negative Exponents} \]

\[ \text{ANS:} 2 \quad \text{PTS:} 2 \quad \text{REF:} 061502a2 \quad \text{STA:} \ A2.M.1 \quad \text{TOP:} \ \text{Radian Measure} \]
277 ANS: 4
\[ g(-2) = 3(-2) - 2 = -8 \quad f(-8) = 2(-8)^2 + 1 = 128 + 1 = 129 \]

PTS: 2 REF: 061503a2 STA: A2.A.42 TOP: Compositions of Functions
KEY: numbers

278 ANS: 1
\[ 3\sqrt{27a^3} \cdot 4\sqrt{16b^8} = 3a \cdot 2b^2 = 6ab^2 \]

KEY: with variables | index ≥ 2

279 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

280 ANS:
\[ \text{Sum } \frac{-b}{a} = -2 \quad \text{Product } \frac{c}{a} = \frac{k}{3} \]

PTS: 2 REF: 061534a2 STA: A2.A.20 TOP: Roots of Quadratics

281 ANS: 2
\[ 9 - x^2 < 0 \quad \text{or } x + 3 < 0 \text{ and } x - 3 < 0 \]
\[ x^2 - 9 > 0 \quad x < -3 \text{ and } x < 3 \]
\[ (x + 3)(x - 3) > 0 \quad x < -3 \]
\[ x + 3 > 0 \text{ and } x - 3 > 0 \]
\[ x > -3 \text{ and } x > 3 \]
\[ x > 3 \]

PTS: 2 REF: 061507a2 STA: A2.A.4 TOP: Quadratic Inequalities
KEY: one variable

282 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
\[
\frac{5}{4 - \sqrt{11}} \cdot \frac{4 + \sqrt{11}}{4 + \sqrt{11}} = \frac{5(4 + \sqrt{11})}{16 - 11} = \frac{5(4 + \sqrt{11})}{5} = 4 + \sqrt{11}
\]

PTS: 2    REF: 061509a2    STA: A2.N.5    TOP: Rationalizing Denominators

TOP: Inverse Variation

\[
\frac{9}{4! \cdot 2! \cdot 2!} = \frac{362,880}{96} = 3,780
\]

PTS: 2    REF: 061512a2    STA: A2.S.10    TOP: Permutations

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

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

\[x - 2 = 3x + 10\]
\[-6 = x\]

\[-12 = 2x, 4x = -8\]

\[-6 = x, x = -2\]

PTS: 2    REF: 061513a2    STA: A2.A.1    TOP: Absolute Value Equations

TOP: Operations with Polynomials

TOP: Trigonometric Ratios

TOP: Transformations with Functions and Relations

\[\log x = \log a^2 + \log b\]
\[\log x = \log a^2 b\]
\[x = a^2 b\]

PTS: 2    REF: 061517a2    STA: A2.A.19    TOP: Properties of Logarithms

KEY: antilogarithms

TOP: Sequences

TOP: Domain and Range
\[
\frac{2\pi}{2} = \pi \\
\frac{\pi}{\pi} = 1
\]


\[
\frac{1 + \cos 2A}{\sin 2A} = \frac{1 + 2 \cos^2 A - 1}{2 \sin A \cos A} = \frac{\cos A}{\sin A} = \cot A
\]

PTS: 2  REF: 061522a2  STA: A2.A.77  TOP: Double Angle Identities  KEY: simplifying

\[3x^2 + x - 14 = 0 \quad 1^2 - 4(3)(-14) = 1 + 168 = 169 = 13^2\]

PTS: 2  REF: 061524a2  STA: A2.A.2  TOP: Using the Discriminant  KEY: determine nature of roots given equation

\[x = 2 \cdot \frac{\sqrt{3}}{2} = \sqrt{3} \quad y = 2 \cdot \frac{1}{2} = 1\]

PTS: 2  REF: 061525a2  STA: A2.A.62  TOP: Determining Trigonometric Functions

\[(3 - 2a)^0 + (3 - 2a)^1 + (3 - 2a)^2 = 1 + 3 - 2a + 9 - 12a + 4a^2 = 4a^2 - 14a + 13\]

PTS: 2  REF: 061526a2  STA: A2.N.10  TOP: Sigma Notation  KEY: advanced

\[p(5) - p(0) = 17(1.15)^{2(5)} - 17(1.15)^{2(0)} \approx 68.8 - 17 \approx 51\]

PTS: 2  REF: 061527a2  STA: A2.A.12  TOP: Evaluating Exponential Expressions

\[5^{4x} = \left(5^3\right)^{x-1}\]

\[4x = 3x - 3\]

\[x = -3\]

PTS: 2  REF: 061528a2  STA: A2.A.27  TOP: Exponential Equations  KEY: common base shown
303 ANS: 
\[
\frac{8}{\sin 85} = \frac{2}{\sin C} \quad 85 + 14.4 < 180 \quad 1 \text{ triangle} \\
C = \sin^{-1}\left(\frac{2 \sin 85}{8}\right) \\
C \approx 14.4
\]

PTS: 2  REF: 061529a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

304 ANS: 
\[
3C\left(\frac{1}{4}\right)^{\frac{1}{2}}\left(\frac{3}{4}\right)^{\frac{3}{2}} = 3 \cdot \frac{1}{4} \cdot \frac{9}{16} = \frac{27}{64}
\]

PTS: 2  REF: 061530a2  STA: A2.S.15  TOP: Binomial Probability

305 ANS: 
\[
(x + 1)^3 = 64 \\
x + 1 = 4 \\
x = 3
\]

PTS: 2  REF: 061531a2  STA: A2.A.28  TOP: Logarithmic Equations

306 ANS: 
\[
5.17 \quad 84.46 \pm 5.17 \\
79.29 - 89.63 \\
5 + 7 + 5 = 17
\]

PTS: 4  REF: 061538a2  STA: A2.S.4  TOP: Dispersion

307 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

308 ANS: 
\[
xi^8 - yi^6 = x(1) - y(-1) = x + y
\]

PTS: 2  REF: 061533a2  STA: A2.N.7  TOP: Imaginary Numbers

309 ANS: 
\[
r_A \approx 0.976 \quad r_B \approx 0.994 \quad \text{Set } B \text{ has the stronger linear relationship since } r \text{ is higher.}
\]

PTS: 2  REF: 061535a2  STA: A2.S.8  TOP: Correlation Coefficient
310 ANS:
\[ 28^2 = 47^2 + 34^2 - 2(47)(34) \cos A \]
\[ 784 = 3365 - 3196 \cos A \]
\[ -2581 = -3196 \cos A \]
\[ \frac{2581}{3196} = \cos A \]
\[ 36 \approx A \]

KEY: find angle

311 ANS:
\[ \frac{3}{x} + \frac{x}{x+2} = \frac{2}{x+2} \]
\[ \frac{x+2}{x+2} = \frac{3}{x} \]
\[ 1 = \frac{3}{x} \]
\[ x = -3 \]

PTS: 4 REF: 061537a2 STA: A2.A.23 TOP: Solving Rationals
KEY: rational solutions

312 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

313 ANS: 1 PTS: 2 REF: 081501a2 STA: A2.A.50 TOP: Solving Polynomial Equations

314 ANS:
\[ 2.5 \left( \frac{180}{\pi} \right) = 143^\circ 14' \]

PTS: 2 REF: 081528a2 STA: A2.M.2 TOP: Radian Measure
KEY: degrees
Correlation Coefficient

\[ f(16) = 4(16)^{\frac{1}{3}} + 16^0 + 16^{\frac{-1}{4}} \]

\[ = 4(4) + 1 + \frac{1}{2} \]

\[ = 17\frac{1}{2} \]

Negative and Fractional Exponents

\[ 4\sqrt[4]{81x^2y^5} = 81^{\frac{1}{4}}x^{\frac{2}{4}}y^{\frac{5}{4}} = 3x^{\frac{1}{2}}y^{\frac{5}{4}} \]

Radicals as Fractional Exponents

\[ \sin 120 = \frac{\sqrt{3}}{2} \]
\[ \csc 120 = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{3} = \frac{2\sqrt{3}}{3} \]

Reciprocal Trigonometric Relationships

\[ P = \frac{c}{a} = -\frac{12}{3} = -4 \]

Roots of Quadratics

\[ 3 \cdot 400 = 8x \]
\[ 150 = x \]

Inverse Variation

If \( \sin \theta = \frac{15}{17} \), then \( \cos \theta = \frac{8}{17} \), \( \tan \theta = \frac{15}{17} = \frac{8}{15} \)
\[ A = 50 \left( 1 + \frac{.0325}{4} \right)^{48} \approx 73.73 \]

PTS: 2     REF: 081511a2     STA: A2.A.12     TOP: Evaluating Exponential Expressions

\[ 2^{-4} = 2^{3x-1} \]
\[-4 = 3x - 1 \]
\[-3 = 3x \]
\[-1 = x \]

PTS: 2     REF: 081529a2     STA: A2.A.27     TOP: Exponential Equations

\[ \frac{40 - 10}{6 - 1} = \frac{30}{5} = 6 \quad a_n = 6n + 4 \]
\[ a_{20} = 6(20) + 4 = 124 \]

PTS: 2     REF: 081510a2     STA: A2.A.32     TOP: Sequences

\[ \frac{11!}{3!2!2!2!} = \frac{39,916,800}{48} = 831,600 \]

PTS: 2     REF: 081512a2     STA: A2.S.10     TOP: Permutations

\[ \binom{9}{3} = 84 \]

PTS: 2     REF: 081513a2     STA: A2.S.11     TOP: Combinations

\[ (2 \sin x - 1)(\sin x + 1) = 0 \]
\[ \sin x = \frac{1}{2}, -1 \]
\[ x = 30, 150, 270 \]

PTS: 2     REF: 081514a2     STA: A2.A.68     TOP: Trigonometric Equations

\[ r = \sqrt{(6 - 2)^2 + (2 - 3)^2} = \sqrt{16 + 25} = \sqrt{41} \]

331 ANS: 3 | PTS: 2 | REF: 081517a2 | STA: A2.A.39
TOP: Domain and Range | KEY: real domain

332 ANS: 4
\[ \frac{3 - \sqrt{8}}{\sqrt{3}} \cdot \sqrt{3} = \frac{3\sqrt{3} - \sqrt{24}}{3} = \frac{3\sqrt{3} - 2\sqrt{6}}{3} = \sqrt{3} - \frac{2}{3}\sqrt{6} \]

333 ANS: 4
\[ \frac{2\pi}{2} = \pi \]

334 ANS: 3
\[ \frac{91 - 82}{3.6} = 2.5 \text{sd} \]

335 ANS: 1
\[ \cos 2\theta = 2\left(\frac{3}{4}\right)^2 - 1 = 2\left(\frac{9}{16}\right) - 1 = \frac{9}{8} - \frac{8}{8} = \frac{1}{8} \]

336 ANS: 4
\[ \sqrt{-180x^{16}} = 6x^8i\sqrt{5} \]

337 ANS: 3
\[ \left(\frac{1}{2}\left(\frac{1}{4}\right)\right)^2 = \frac{1}{64} \]

338 ANS: 4
\[ \sqrt{-180x^{16}} = 6x^8i\sqrt{5} \]

339 ANS: 2
\[ \left(\frac{1}{2}\left(\frac{1}{4}\right)\right)^2 = \frac{1}{64} \]

340 ANS: 4
\[ \left(\frac{1}{2}\left(\frac{1}{4}\right)\right)^2 = \frac{1}{64} \]

341 ANS: 1
\[ \left(\frac{1}{2}\left(\frac{1}{4}\right)\right)^2 = \frac{1}{64} \]
342 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

343 ANS:

\[\binom{2}{3} \left( \frac{1}{3} \right)^3 = 35 \left( \frac{16}{81} \right) \left( \frac{1}{27} \right) = \frac{560}{2187}\]

PTS: 2  REF: 081531a2  STA: A2.S.15  TOP: Binomial Probability

KEY: exactly

344 ANS:

\[r = \frac{6.6}{\frac{2}{3}} = 9.9\]

PTS: 2  REF: 081532a2  STA: A2.A.61  TOP: Arc Length

KEY: radius

345 ANS:

\[a = \sqrt{8^2 + 11^2 - 2(8)(11) \cos 82} \approx 12.67. \text{ The angle opposite the shortest side: } \frac{8}{\sin x} = \frac{12.67}{\sin 82} \Rightarrow x \approx 38.7\]


KEY: advanced

346 ANS: 4  PTS: 2  REF: fall0908a2  STA: A2.A.38  TOP: Defining Functions

KEY: graphs

347 ANS:

\[\frac{1}{\cos^2 x} - 1 \cdot \cos^2 x = \frac{1 - \cos^2 x}{\cos^2 x} = \sin^2 x\]

PTS: 2  REF: 081533a2  STA: A2.A.58  TOP: Reciprocal Trigonometric Relationships
348 ANS:
\[
\frac{10x}{4} = \frac{1}{4} + \frac{x}{4}
\]
\[
\frac{9x}{4} = \frac{1}{x}
\]
\[
9x^2 = 4
\]
\[
x^2 = \frac{4}{9}
\]
\[
x = \pm \frac{2}{3}
\]

PTS: 2
KEY: rational solutions
REF: 081534a2
STA: A2.A.23
TOP: Solving Rationals

349 ANS:
\[
x - 1 + x - 4 + x - 9 + x - 16 = 4x - 30
\]
\[
x = 1 + x - 4 + x - 9 + x - 16 = 4x - 30
\]

PTS: 2
KEY: advanced
REF: 081535a2
STA: A2.N.10
TOP: Sigma Notation

350 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
KEY: advanced
REF: 081537a2
STA: A2.A.26
TOP: Solving Polynomial Equations

351 ANS:
\[
|3x - 5| < x + 17 \text{ and } 3x - 5 < x + 17 \Rightarrow x - 17 < 11
\]
\[
2x < 22 \quad 4x > -12
\]
\[
x < 11 \quad x > -3
\]

PTS: 4
KEY: advanced
REF: 081538a2
STA: A2.A.1
TOP: Absolute Value Inequalities
ANS: 

\[
\log_2 \left( \frac{x^2 - 7x + 12}{2x - 10} \right) = 3
\]

\[
x = \frac{23 \pm \sqrt{(-23)^2 - 4(1)(92)}}{2(1)} \approx 17.84, 5.16
\]

\[
x^2 - 7x + 12 = 8
\]

\[
x^2 - 7x + 12 = 16x - 80
\]

\[
x^2 - 23x + 92 = 0
\]

PTS: 6    REF: 081539a2    STA: A2.A.28    TOP: Logarithmic Equations
KEY: applying properties of logarithms

353 ANS: 3

\[
\begin{array}{c|c|c}
\text{I-War Stats L1, L2} & \text{\textit{sx}^2} & 67.31102041 \\
\end{array}
\]

PTS: 2    REF: fall0924a2    STA: A2.S.4    TOP: Dispersion
KEY: range, quartiles, interquartile range, variance
Algebra 2/Trigonometry Regents Exam Questions at Random

Algebra 2/Trigonometry Regents at Random

354 The expression $\sqrt[4]{16x^2y^7}$ is equivalent to

1) $2x\frac{7}{4}y^4$
2) $2x^8y^{28}$
3) $4x\frac{7}{4}y^4$
4) $4x^8y^{28}$

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

356 What is the number of degrees in an angle whose radian measure is $\frac{11\pi}{12}$?

1) 150
2) 165
3) 330
4) 518

357 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.

358 Which relation is not a function?

1) $(x - 2)^2 + y^2 = 4$
2) $x^2 + 4x + y = 4$
3) $x + y = 4$
4) $xy = 4$

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

360 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) $\{(0,1),(1,0),(2,0),(3,2)\}$

361 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.

362 Factor completely: $10ax^2 - 23ax - 5a$
363 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) \( f(x) = 2 \sin \theta + 3 \)

364 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.

365 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.

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

367 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) \( (x + 1)^2 + (y + 3)^2 = 10 \)

368 Which graph represents the equation \( y = \cos^{-1} x \)?

369 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
370 Which values of \( x \) are in the solution set of the following system of equations?

\[
\begin{align*}
y &= 3x - 6 \\
y &= x^2 - x - 6
\end{align*}
\]

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

371 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.

372 The expression \( \frac{4}{5 - \sqrt{13}} \) is equivalent to

1) \( \frac{4 \sqrt{13}}{5 \sqrt{13} - 13} \)  
2) \( \frac{4(5 - \sqrt{13})}{38} \)  
3) \( \frac{5 + \sqrt{13}}{3} \)  
4) \( \frac{4(5 + \sqrt{13})}{38} \)

373 The graph below shows the function \( f(x) \).

374 The product of \( i^7 \) and \( i^5 \) is equivalent to

1) 1  
2) -1  
3) \( i \)  
4) \( -i \)
375 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 \( \frac{2\pi}{3} \).

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) \( \frac{1}{6} \)
2) \( \frac{1}{3} \)
3) \( \frac{1}{2} \)
4) \( \frac{2}{3} \)

376 The expression \( \frac{a^2b^{-3}}{a^{-4}b^2} \) is equivalent to

1) \( \frac{a^6}{b^5} \)
2) \( \frac{b^5}{a^6} \)
3) \( \frac{a^2}{b} \)
4) \( a^{-2}b^{-1} \)

377 What is the radian measure of an angle whose measure is \(-420^\circ\)?

1) \( \frac{7\pi}{3} \)
2) \( \frac{7\pi}{6} \)
3) \( \frac{7\pi}{6} \)
4) \( \frac{7\pi}{3} \)

378 The graph below represents the function \( y = f(x) \).

State the domain and range of this function.

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

1) \(-30^\circ\)
2) \(60^\circ\)
3) \(150^\circ\)
4) \(240^\circ\)
380 Which ratio represents \( \csc A \) in the diagram below?

1) \( \frac{25}{24} \)
2) \( \frac{25}{7} \)
3) \( \frac{24}{7} \)
4) \( \frac{7}{24} \)

381 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) \( -5ab \sqrt{2b} + 7ab \sqrt{6b} \)

382 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) \( 0, -1, -2 \)

383 Solve for \( x \):
\[
4x = 2 + \frac{12}{x - 3}
\]

384 What are the domain and the range of the function shown in the graph below?

1) \( \{x \mid x > -4\}; \{y \mid y > 2\} \)
2) \( \{x \mid x \geq -4\}; \{y \mid y > 2\} \)
3) \( \{x \mid x > 2\}; \{y \mid y > -4\} \)
4) \( \{x \mid x \geq 2\}; \{y \mid y \geq -4\} \)

385 Solve \( 2x^2 - 12x + 4 = 0 \) by completing the square, expressing the result in simplest radical form.

386 If \( \sin^{-1} \left( \frac{5}{8} \right) = A \), then

1) \( \sin A = \frac{5}{8} \)
2) \( \sin A = \frac{8}{5} \)
3) \( \cos A = \frac{5}{8} \)
4) \( \cos A = \frac{8}{5} \)
387 What is the common difference of the arithmetic sequence 5, 8, 11, 14?

1) \(\frac{8}{5}\)
2) -3
3) 3
4) 9

388 Which graph does not represent a function?

1)
2)
3)
4)

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

390 In which graph is \(\theta\) coterminal with an angle of \(-70^\circ\)?

1)
2)
3)
4)

391 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
392 Solve algebraically for $x$: \( \frac{1}{x+3} - \frac{2}{3-x} = \frac{4}{x^2-9} \)

393 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) \( \binom{15}{2} \cdot \binom{5}{1} \)
2) \( \frac{15 \cdot 10 \cdot 5}{30 \cdot 29} \)
3) \( \binom{15}{2} \cdot \binom{5}{1} \)
4) \( \frac{15 \cdot 10 \cdot 5}{30 \cdot 29} \)

394 Find the sum and product of the roots of the equation \( 5x^2 + 11x - 3 = 0 \).

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

1) \( \frac{\pi}{2} \)
2) \( \frac{2\pi}{3} \)
3) \( \frac{5\pi}{6} \)
4) \( \frac{7\pi}{6} \)

396 The solution set of the equation \( \sqrt{x+3} = 3-x \) is

1) \{1\}
2) \{0\}
3) \{1, 6\}
4) \{2, 3\}

397 The expression \( \frac{2x+4}{\sqrt{x+2}} \) is equivalent to

1) \( \frac{(2x+4)\sqrt{x-2}}{x-2} \)
2) \( \frac{(2x+4)\sqrt{x-2}}{x-4} \)
3) \( 2\sqrt{x-2} \)
4) \( 2\sqrt{x+2} \)

398 The expression \( (3-7i)^2 \) is equivalent to

1) \(-40 + 0i\)
2) \(-40 - 42i\)
3) \(58 + 0i\)
4) \(58 - 42i\)

399 What is the fifteenth term of the sequence \( 5, -10, 20, -40, 80, \ldots \)?

1) \(-163, 840\)
2) \(-81, 920\)
3) \(81, 920\)
4) \(327, 680\)

400 Solve algebraically for \( x \): \( \log_{x+3} \frac{x^3 + x - 2}{x} = 2 \)
401 The roots of the equation \(2x^2 + 7x - 3 = 0\) are
1) \(\frac{1}{2}\) and \(-3\)
2) \(\frac{1}{2}\) and 3
3) \(-\frac{7 \pm \sqrt{73}}{4}\)
4) \(\frac{7 \pm \sqrt{73}}{4}\)

402 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.

403 Express in simplest form:
\[\frac{1}{\frac{3}{2} + \frac{3}{2d}}\]

404 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.

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

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

407 What is the value of \(x\) in the equation \(9^{3x+1} = 27^{x+2}\)?
1) 1
2) \(\frac{1}{3}\)
3) \(\frac{1}{2}\)
4) \(\frac{4}{3}\)

408 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
409 When \( \frac{3}{2}x^2 - \frac{1}{4}x - 4 \) is subtracted from \( \frac{5}{2}x^2 - \frac{3}{4}x + 1 \), the difference is

1) \(-x^2 + \frac{1}{2}x - 5\)
2) \(x^2 - \frac{1}{2}x + 5\)
3) \(-x^2 - x - 3\)
4) \(x^2 - x - 3\)

410 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\}

411 Which equation represents the circle shown in the graph below that passes through the point \((0, -1)\)?

\[
(x - 3)^2 + (y + 4)^2 = 16
\]

412 If \( \angle A \) is acute and \( \tan A = \frac{2}{3} \), then

1) \( \cot A = \frac{2}{3} \)
2) \( \cot A = \frac{1}{3} \)
3) \( \cot(90^\circ - A) = \frac{2}{3} \)
4) \( \cot(90^\circ - A) = \frac{1}{3} \)

413 If \( \theta \) is an angle in standard position and its terminal side passes through the point \((-3, 2)\), find the exact value of \( \csc \theta \).
414 The expression \( \cos 4x \cos 3x + \sin 4x \sin 3x \) is equivalent to
1) \( \sin x \)
2) \( \sin 7x \)
3) \( \cos x \)
4) \( \cos 7x \)

415 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

416 Solve the following systems of equations algebraically:
\[
\begin{align*}
5 &= y - x \\
4x^2 &= -17x + y + 4
\end{align*}
\]

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

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

419 The solutions of the equation \( y^2 - 3y = 9 \) are
1) \( \frac{3 \pm 3\sqrt{3}}{2} \)
2) \( \frac{3 \pm 3\sqrt{5}}{2} \)
3) \( -\frac{3 \pm 3\sqrt{5}}{2} \)
4) \( \frac{3 \pm 3\sqrt{5}}{2} \)

420 Which equation is sketched in the diagram below?

1) \( y = \csc x \)
2) \( y = \sec x \)
3) \( y = \cot x \)
4) \( y = \tan x \)

421 Solve the equation \( 8x^3 + 4x^2 - 18x - 9 = 0 \) algebraically for all values of \( x \).
422 Which equation is represented by the graph below?

1) \( y = \cot x \)
2) \( y = \csc x \)
3) \( y = \sec x \)
4) \( y = \tan x \)

423 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.

424 The conjugate of \( 7 - 5i \) is

1) \( -7 - 5i \)
2) \( -7 + 5i \)
3) \( 7 - 5i \)
4) \( 7 + 5i \)

425 What are the values of \( \theta \) in the interval \( 0^\circ \leq \theta < 360^\circ \) that satisfy the equation \( \tan \theta - \sqrt{3} = 0 \)?

1) \( 60^\circ, 240^\circ \)
2) \( 72^\circ, 252^\circ \)
3) \( 72^\circ, 108^\circ, 252^\circ, 288^\circ \)
4) \( 60^\circ, 120^\circ, 240^\circ, 300^\circ \)

426 In a triangle, two sides that measure 6 cm and 10 cm form an angle that measures 80\(^\circ\). Find, to the nearest degree, the measure of the smallest angle in the triangle.

427 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 \( g(x) = -\frac{1}{2}x + 4 \)

428 Express \( \left( \frac{2}{3} x - 1 \right)^2 \) as a trinomial.

429 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) \( f(x) = \log_2 x \)
430  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

431  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

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

<table>
<thead>
<tr>
<th>Test Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>96</td>
<td>1</td>
</tr>
<tr>
<td>92</td>
<td>2</td>
</tr>
<tr>
<td>84</td>
<td>5</td>
</tr>
<tr>
<td>80</td>
<td>3</td>
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<tr>
<td>76</td>
<td>6</td>
</tr>
<tr>
<td>72</td>
<td>3</td>
</tr>
<tr>
<td>68</td>
<td>2</td>
</tr>
</tbody>
</table>

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

433  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) \( x^2 + 6x - 5 \)

434  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) \(4\)

435  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) \( -\cos^2 \theta - 1 \)
436 The expression \( \log_5 \left( \frac{1}{25} \right) \) is equivalent to
1) \( \frac{1}{2} \)
2) \( 2 \)
3) \( -\frac{1}{2} \)
4) \( -2 \)

437 If \( r = \sqrt[3]{\frac{A^2 B}{C}} \), then \( \log r \) can be represented by
1) \( \frac{1}{6} \log A + \frac{1}{3} \log B - \log C \)
2) \( 3(\log A^2 + \log B - \log C) \)
3) \( \frac{1}{3} \log(A^2 + B) - C \)
4) \( \frac{2}{3} \log A + \frac{1}{3} \log B - \frac{1}{3} \log C \)

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

<table>
<thead>
<tr>
<th>Minutes</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Students</td>
<td>5</td>
<td>3</td>
<td>x</td>
<td>5</td>
<td>2</td>
<td>10</td>
<td>1</td>
</tr>
</tbody>
</table>

If the mean number of minutes was 17, which equation could be used to calculate the value of \( x \)?
1) \( 17 = \frac{119 + x}{x} \)
2) \( 17 = \frac{119 + 16x}{x} \)
3) \( 17 = \frac{446 + x}{26 + x} \)
4) \( 17 = \frac{446 + 16x}{26 + x} \)

439 If a function is defined by the equation \( f(x) = 4^x \), which graph represents the inverse of this function?
440 Which graph shows $y = \cos^{-1}x$?

1) ![Graph 1]

2) ![Graph 2]

3) ![Graph 3]

4) ![Graph 4]

441 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) $\{x | 0 \leq x \leq \pi\}$

2) $\{x | 0 \leq x \leq 2\pi\}$

3) $\left\{x \mid -\frac{\pi}{2} < x < \frac{\pi}{2}\right\}$

4) $\left\{x \mid -\frac{\pi}{2} < x < \frac{3\pi}{2}\right\}$

442 If $a = 3$ and $b = -2$, what is the value of the expression $\frac{a^{-2}}{b^{-3}}$?

1) $\frac{9}{8}$

2) $-1$

3) $-\frac{8}{9}$

4) $\frac{8}{9}$

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

444 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
445 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

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

447 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.

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

449 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.

450 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?

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

62
452 The solution set of the inequality \( x^2 - 3x > 10 \) is
1) \( \{x|-2 < x < 5\} \)
2) \( \{x|0 < x < 3\} \)
3) \( \{x|x < -2 \text{ or } x > 5\} \)
4) \( \{x|x < -5 \text{ or } x > 2\} \)

453 When \( x^{-1} - 1 \) is divided by \( x - 1 \), the quotient is
1) \(-1\)
2) \(\frac{1}{x}\)
3) \(\frac{1}{x^2}\)
4) \(\frac{1}{(x-1)^2}\)

454 Which equation is represented by the graph below?

1) \( y = 5^x \)
2) \( y = 0.5^x \)
3) \( y = 5^{-x} \)
4) \( y = 0.5^{-x} \)

455 Which graph represents a relation that is not a function?

1) 
2) 
3) 
4) 

456 Express \( 5\sqrt[3]{3x^3} - 2\sqrt[3]{27x^3} \) in simplest radical form.
457 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?

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

459 Express as a single fraction the exact value of $\sin 75^\circ$.

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

461 Graph the inequality $-3|6 - x| < -15$ for $x$. Graph the solution on the line below.
1) 53
2) 59
3) 67
4) 127

462 Write an equation of the circle shown in the graph below.

463 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?
464 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.]

465 Find all values of \( \theta \) in the interval \( 0^\circ \leq \theta < 360^\circ \) that satisfy the equation \( \sin 2\theta = \sin \theta \).

466 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.

467 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

468 What is the conjugate of \(-2 + 3i\)?

1) \(-3 + 2i\)
2) \(-2 - 3i\)
3) \(2 - 3i\)
4) \(3 + 2i\)

469 Written in simplest form, the expression \( \frac{x}{4} \frac{1}{2x} + \frac{1}{4} \) is equivalent to

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

470 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) \(\frac{\sqrt{3}}{3}\)
2) 2
3) \(\sqrt{3}\)
4) \(\frac{2\sqrt{3}}{3}\)

471 Express the sum \( 7 + 14 + 21 + 28 + \ldots + 105 \) using sigma notation.
472 Samantha constructs the scatter plot below from a set of data.

![Scatter Plot]

Based on her scatter plot, which regression model would be most appropriate?
1) exponential
2) linear
3) logarithmic
4) power

473 The value of the expression \( \sum_{r=3}^{5} (-r^2 + r) \) is
1) -38
2) -12
3) 26
4) 62

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

475 What is a formula for the \(n\)th 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) \(b_n = 10(2)^{n-1}\)

476 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) \(\sum_{k=1}^{20} (2k - 1)\)
2) \(\sum_{k=2}^{40} (k - 1)\)
3) \(\sum_{k=-1}^{37} (k + 2)\)
4) \(\sum_{k=1}^{39} (2k - 1)\)

477 The expression \((x^2 - 1)^{\frac{2}{3}}\) is equivalent to
1) \(\sqrt[3]{(x^2 - 1)^2}\)
2) \(\frac{1}{\sqrt[3]{(x^2 - 1)^2}}\)
3) \(\sqrt[3]{(x^2 - 1)^3}\)
4) \(\frac{1}{\sqrt[3]{(x^2 - 1)^3}}\)
478 If \( f(x) = \frac{1}{2} x - 3 \) and \( g(x) = 2x + 5 \), what is the value of \((g \circ f)(4)\)?

1) \(-13\)
2) \(3.5\)
3) \(3\)
4) \(6\)

479 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) \(-x(x + 3)(x - 2)\)

480 The expression \(\frac{2}{3}\) is equivalent to

1) \(-\frac{2}{\sqrt{x^5}}\)
2) \(-\frac{2}{\sqrt{x^2}}\)
3) \(\frac{1}{\sqrt{x^5}}\)
4) \(\frac{1}{\sqrt{x^2}}\)

481 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) \(2x^2(2x + 3)(3x - 2)\)

482 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) \(259,459,200\)

483 Which arithmetic sequence has a common difference of 4?

1) \(\{0, 4n, 8n, 12n, \ldots\}\)
2) \(\{n, 4n, 16n, 64n, \ldots\}\)
3) \(\{n + 1, n + 5, n + 9, n + 13, \ldots\}\)
4) \(\{n + 4, n + 16, n + 64, n + 256, \ldots\}\)

484 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.

485 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) \(16384\sqrt{10}\)

486 Find, to the nearest minute, the angle whose measure is 3.45 radians.
487 Which graph represents a one-to-one function?

1)  

2)  

3)  

4)  

488 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) \(\frac{20!}{3!}\)

3) \(20 C_3\)

4) \(20 P_3\)

489 The solution set of \(\sqrt{3x + 16} = x + 2\) is

1) \{-3, 4\}

2) \{-4, 3\}

3) \{3\}

4) \{-4\}

490 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) \((-6, -3)\)

491 Which graph represents the solution set of \(|6x - 7| \leq 5?\)

1)  

2)  

3)  

4)  

492 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) \(2x^2 - 6x + 4 = 0\)
493 In the diagram below of a unit circle, the ordered pair \(\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)\) represents the point where the terminal side of \(\theta\) intersects the unit circle. What is \(m\angle \theta\)?
1) 45
2) 135
3) 225
4) 240

494 Which expression is equivalent to \(\frac{\sqrt{3} + 5}{\sqrt{3} - 5}\)?
1) \(-\frac{14 + 5\sqrt{3}}{11}\)
2) \(-\frac{17 + 5\sqrt{3}}{11}\)
3) \(\frac{14 + 5\sqrt{3}}{14}\)
4) \(\frac{17 + 5\sqrt{3}}{14}\)

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

496 Expressed as a function of a positive acute angle, \(\cos(-305^\circ)\) is equal to
1) \(-\cos 55^\circ\)
2) \(\cos 55^\circ\)
3) \(-\sin 55^\circ\)
4) \(\sin 55^\circ\)

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

498 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.
499 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

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

501 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) $\frac{7}{2}$
2) $\frac{49}{4}$
3) $\frac{49}{2}$
4) 49

502 For which equation does the sum of the roots equal $\frac{3}{4}$ 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) $4x^2 + 3x - 2 = 0$

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

504 What is the solution set of the equation $\left|4a + 6\right| - 4a = -10$?
1) $\emptyset$
2) $\{0\}$
3) $\left\{\frac{1}{2}\right\}$
4) $\left\{0, \frac{1}{2}\right\}$

505 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

506 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) $(x - 6)^2 = 34$
507 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 $\sin 240^\circ$.

\[\text{Diagram of a unit circle with an angle of } 240^\circ\text{, labeled } (1,0)\]

508 If $\sin A = \frac{2}{3}$ where $0^\circ < A < 90^\circ$, what is the value of $\sin 2A$?

1) $\frac{2\sqrt{5}}{3}$
2) $\frac{2\sqrt{5}}{9}$
3) $\frac{4\sqrt{5}}{9}$
4) $\frac{4\sqrt{5}}{9}$

509 Solve the equation $2\tan C - 3 = 3\tan C - 4$ algebraically for all values of $C$ in the interval $0^\circ \leq C < 360^\circ$.

510 Which graph represents one complete cycle of the equation $y = \sin 3\pi x$?

1) [Graph Image]
2) [Graph Image]
3) [Graph Image]
4) [Graph Image]

511 Find the total number of different twelve-letter arrangements that can be formed using the letters in the word *PENNSYLVANIA*.
When simplified, the expression \( \left( \frac{w^5}{w^9} \right)^{\frac{1}{2}} \) is equivalent to:

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

The graph of the equation \( y = \left( \frac{1}{2} \right)^x \) has an asymptote. On the grid below, sketch the graph of \( y = \left( \frac{1}{2} \right)^x \) and write the equation of this asymptote.

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

<table>
<thead>
<tr>
<th>Time (x) (in minutes)</th>
<th>1</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Bacteria (y)</td>
<td>2</td>
<td>25</td>
<td>81</td>
<td>175</td>
<td>310</td>
<td>497</td>
</tr>
</tbody>
</table>

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.

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
518 What is the formula for the nth term of the sequence 54, 18, 6, ...?

1) \( a_n = 6 \left( \frac{1}{3} \right)^n \)
2) \( a_n = 6 \left( \frac{1}{3} \right)^{n-1} \)
3) \( a_n = 54 \left( \frac{1}{3} \right)^n \)
4) \( a_n = 54 \left( \frac{1}{3} \right)^{n-1} \)

519 In simplest form, \( \sqrt{-300} \) is equivalent to

1) \( 3i\sqrt{10} \)
2) \( 5i\sqrt{12} \)
3) \( 10i\sqrt{3} \)
4) \( 12i\sqrt{5} \)

520 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.

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

522 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

523 Evaluate \( e^{\sin y} \) when \( x = 3 \) and \( y = 2 \).

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

525 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.

526 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

527 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.

528 If \( f(x) = x^2 - 6 \) and \( g(x) = 2x - 1 \), determine the value of \( (g \circ f)(-3) \).
529 The expression $\frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta}$ is equivalent to
1) $\cos^2 \theta$
2) $\sin^2 \theta$
3) $\sec^2 \theta$
4) $\csc^2 \theta$

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

531 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) $2\pi$
2) 2
3) $8\pi$
4) 8

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

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

534 Express $\sqrt{108x^5y^8}$ in simplest radical form.

535 Find the first four terms of the recursive sequence defined below.
\[ a_1 = -3 \]
\[ a_n = a_{(n-1)} - n \]

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

537 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
538 Which graph best represents the inequality 
\[ y + 6 \geq x^2 - x? \]

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

540 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

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of New Stores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>14</td>
</tr>
<tr>
<td>1987</td>
<td>27</td>
</tr>
<tr>
<td>1988</td>
<td>48</td>
</tr>
<tr>
<td>1989</td>
<td>80</td>
</tr>
<tr>
<td>1990</td>
<td>110</td>
</tr>
<tr>
<td>1991</td>
<td>153</td>
</tr>
<tr>
<td>1992</td>
<td>261</td>
</tr>
<tr>
<td>1993</td>
<td>403</td>
</tr>
<tr>
<td>1994</td>
<td>681</td>
</tr>
</tbody>
</table>

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

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

544 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) $\frac{8!}{4!}$
3) $\frac{8!}{2! + 2!}$
4) $\frac{8!}{2! \cdot 2!}$

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

546 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
Algebra 2/Trigonometry Regents at Random
Answer Section

354 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

355 ANS:
\[ 16^{2x+3} = 64^{x+2} \]
\[ (4^3)^{2x+3} = (4^3)^{x+2} \]
\[ 4x + 6 = 3x + 6 \]
\[ x = 0 \]

PTS: 2 REF: 011128a2 STA: A2.A.27 TOP: Exponential Equations
KEY: common base not shown

356 ANS: 2
\[ \frac{11\pi}{12} \cdot \frac{180}{\pi} = 165 \]

PTS: 2 REF: 061002a2 STA: A2.M.2 TOP: Radian Measure
KEY: degrees

357 ANS:
\[ \binom{51}{243} \binom{\frac{1}{3}}{3} \left( \frac{2}{3} \right)^2 = \frac{40}{243} \]
\[ \binom{5}{1} \binom{\frac{1}{3}}{4} \left( \frac{2}{3} \right)^1 = \frac{10}{243} \]
\[ \binom{5}{2} \binom{\frac{1}{3}}{5} \left( \frac{2}{3} \right)^0 = \frac{1}{243} \]

KEY: at least or at most

358 ANS: 1 PTS: 2 REF: 061013a2 STA: A2.A.38
TOP: Defining Functions

359 ANS:
\[ \frac{5(3 + \sqrt{2})}{7} \cdot \frac{5}{3 - \sqrt{2}} \times \frac{3 + \sqrt{2}}{3 + \sqrt{2}} = \frac{5(3 + \sqrt{2})}{9 - 2} = \frac{5(3 + \sqrt{2})}{7} \]

PTS: 2 REF: fall0928a2 STA: A2.N.5 TOP: Rationalizing Denominators
(4) fails the horizontal line test. Not every element of the range corresponds to only one element of the domain.

\[(x + 5)^2 + (y - 3)^2 = 32\]

\[10ax^2 - 23ax - 5a = a(10x^2 - 23x - 5) = a(5x + 1)(2x - 5)\]

\[y - 2\sin\theta = 3\]
\[y = 2\sin\theta + 3\]
\[f(\theta) = 2\sin\theta + 3\]

\[68\% \text{ of the students are within one standard deviation of the mean.} \ 16\% \text{ of the students are more than one standard deviation above the mean.}\]

\[K = ab\sin C = 24 \cdot 30 \sin 57 \approx 604\]

\[x^2 - 2x + y^2 + 6y = -3\]
\[x^2 - 2x + 1 + y^2 + 6y + 9 = -3 + 1 + 9\]
\[(x - 1)^2 + (y + 3)^2 = 7\]
369 ANS: 4
\[ S_n = \frac{n}{2} \left[ 2a + (n - 1)d \right] = \frac{21}{2} \left[ 2(18) + (21 - 1)2 \right] = 798 \]

PTS: 2 REF: 061103a2 STA: A2.A.35 TOP: Series
KEY: arithmetic

370 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

371 ANS:
\[ 0.468. s C_6 \left( \frac{2}{3} \right)^6 \left( \frac{1}{3} \right)^2 \approx 0.27313. \]
\[ s C_7 \left( \frac{2}{3} \right)^7 \left( \frac{1}{3} \right)^1 \approx 0.15607. s C_8 \left( \frac{2}{3} \right)^8 \left( \frac{1}{3} \right)^0 \approx 0.03902. \]

KEY: at least or at most

372 ANS: 3
\[ \frac{4}{5 - \sqrt{13}} = \frac{5 + \sqrt{13}}{5 + \sqrt{13}} = \frac{4(5 + \sqrt{13})}{13 - 9} = \frac{5 + \sqrt{13}}{3} \]

PTS: 2 REF: 061116a2 STA: A2.N.5 TOP: Rationalizing Denominators

373 ANS: 2 PTS: 2 REF: fall0926a2 STA: A2.A.46 TOP: Transformations with Functions and Relations

374 ANS: 1 PTS: 2 REF: 061019a2 STA: A2.N.7 TOP: Imaginary Numbers

375 ANS: 2
\[ \pi \frac{\pi}{3} \frac{2\pi}{3} \frac{\pi}{2} \frac{2\pi}{3} \frac{\pi}{3} \]
\[ \frac{\pi}{3} + \frac{\pi}{3} = \frac{2\pi}{3} \]
\[ \frac{\pi}{2\pi} = \frac{\pi}{3} \]

PTS: 2 REF: 011108a2 STA: A2.S.13 TOP: Geometric Probability

376 ANS: 1 PTS: 2 REF: fall0914a2 STA: A2.A.9 TOP: Negative and Fractional Exponents
\[ -420 \left( \frac{\pi}{180} \right) = \frac{7\pi}{3} \]

PTS: 2  REF: 081002a2  STA: A2.M.2  TOP: Radian Measure
KEY: radians

378 ANS:
D: \(-5 \leq x \leq 8\).  R: \(-3 \leq y \leq 2\)

PTS: 2  REF: 011132a2  STA: A2.A.51  TOP: Domain and Range

379 ANS: 3  PTS: 2  REF: 081007a2  STA: A2.A.64  TOP: Using Inverse Trigonometric Functions  KEY: basic

380 ANS: 2  PTS: 2  REF: 081010a2  STA: A2.A.55  TOP: Trigonometric Ratios

381 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

382 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

383 ANS:
\[ \text{no solution.} \quad \frac{4x}{x-3} = 2 + \frac{12}{x-3} \]
\[ \frac{4x - 12}{x - 3} = 2 \]
\[ \frac{4(x - 3)}{x - 3} = 2 \]
\[ 4 \neq 2 \]

PTS: 2  REF: fall0930a2  STA: A2.A.23  TOP: Solving Rationals  KEY: rational solutions

384 ANS: 2  PTS: 2  REF: 081003a2  STA: A2.A.51  TOP: Domain and Range
385 ANS:
\[ 3 \pm \sqrt{7}. \quad 2x^2 - 12x + 4 = 0 \]
\[ x^2 - 6x + 2 = 0 \]
\[ x^2 - 6x = -2 \]
\[ x^2 - 6x + 9 = -2 + 9 \]
\[ (x - 3)^2 = 7 \]
\[ x - 3 = \pm \sqrt{7} \]
\[ x = 3 \pm \sqrt{7} \]

PTS: 4 REF: fall0936a2 STA: A2.A.24 TOP: Completing the Square

386 ANS: 1 PTS: 2 REF: 011112a2 STA: A2.A.64 TOP: Using Inverse Trigonometric Functions KEY: advanced

387 ANS: 3 PTS: 2 REF: 061001a2 STA: A2.A.30 TOP: Sequences

388 ANS: 4 PTS: 2 REF: 011101a2 STA: A2.A.38 TOP: Defining Functions KEY: graphs

389 ANS:
\[ \frac{23}{2} \cos^2 B + \sin^2 B = 1 \]
\[ \tan B = \frac{\sin B}{\cos B} = \frac{\frac{5}{\sqrt{41}}}{\frac{4}{\sqrt{41}}} = \frac{5}{4} \]
\[ \tan(A + B) = \frac{\frac{2}{3} + \frac{5}{4}}{1 - \left(\frac{2}{3}\right)\left(\frac{5}{4}\right)} = \frac{\frac{8 + 15}{12}}{\frac{12}{12} - \frac{10}{12}} = \frac{\frac{23}{12}}{\frac{2}{12}} = \frac{23}{2} \]

PTS: 4 REF: 081037a2 STA: A2.A.76 TOP: Angle Sum and Difference Identities KEY: evaluating

390 ANS: 4 PTS: 2 REF: 081005a2 STA: A2.A.60 TOP: Unit Circle

391 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
\[
\frac{1}{3} \frac{1}{x+3} - \frac{2}{3-x} = \frac{4}{x^2 - 9}
\]
\[
\frac{1}{x+3} + \frac{2}{x-3} = \frac{4}{x^2 - 9}
\]
\[
\frac{x - 3 + 2(x + 3)}{(x+3)(x-3)} = \frac{4}{(x+3)(x-3)}
\]
\[
x - 3 + 2x + 6 = 4
\]
\[
3x = 1
\]
\[
x = \frac{1}{3}
\]

PTS: 4  REF: 081036a2  STA: A2.A.23  TOP: Solving Rationals

KEY: rational solutions

393 ANS: 1  PTS: 2  REF: 011117a2  STA: A2.S.9
TOP: Differentiating Permutations and Combinations

394 ANS:
\[
\text{Sum } \frac{-b}{a} = -\frac{11}{5}. \quad \text{Product } \frac{c}{a} = -\frac{3}{5}
\]

PTS: 2  REF: 061030a2  STA: A2.A.20  TOP: Roots of Quadratics

395 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

396 ANS: 1  PTS: 2  REF: 061018a2  STA: A2.A.22
TOP: Solving Radicals  KEY: extraneous solutions

397 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

398 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
399 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

400 ANS:
\[ x = \frac{1}{3}, -1 \]
\[ \log_{x+3} \frac{x^3 + x - 2}{x} = 2 \]
\[ \frac{x^3 + x - 2}{x} = (x + 3)^2 \]
\[ \frac{x^3 + x - 2}{x} = x^2 + 6x + 9 \]
\[ x^3 + x - 2 = x^3 + 6x^2 + 9x \]
\[ 0 = 6x^2 + 8x + 2 \]
\[ 0 = 3x^2 + 4x + 1 \]
\[ 0 = (3x + 1)(x + 1) \]
\[ x = \frac{1}{3}, -1 \]


401 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: Quadratics with Irrational Solutions

402 ANS: 4  PTS: 2  REF: 011127a2  STA: A2.S.1
TOP: Analysis of Data

403 ANS:
\[ \frac{1}{2} \frac{4}{d} = \frac{d - 8}{2d} \]
\[ \frac{1}{2} + \frac{3}{2d} = \frac{d - 8}{2d} \times \frac{2d}{5} = \frac{d - 8}{5} \]

PTS: 2  REF: 061035a2  STA: A2.A.17  TOP: Complex Fractions

404 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
2 log₄(5x) = 3

\[ \log₄(5x) = \frac{3}{2} \]

\[ 5x = 4^{\frac{3}{2}} \]

\[ 5x = 8 \]

\[ x = \frac{8}{5} \]

PTS: 2  
REF: fall0921a2  
STA: A2.A.28  
TOP: Logarithmic Equations

2⁷r^{4-1} = 64

\[ r^3 = \frac{64}{27} \]

\[ r = \frac{4}{3} \]

PTS: 2  
REF: 081025a2  
STA: A2.A.31  
TOP: Sequences

9^{3x + 1} = 27^{x+2}

\[ (3^2)^{3x + 1} = (3^3)^{x+2} \]

\[ 3^{6x+2} = 3^{3x+6} \]

\[ 6x + 2 = 3x + 6 \]

\[ 3x = 4 \]

\[ x = \frac{4}{3} \]

PTS: 2  
REF: 081008a2  
STA: A2.A.27  
TOP: Exponential Equations

\[ \binom{9}{3}a^6(-4b)^3 = -5376a^6b^3 \]

PTS: 2  
REF: 061126a2  
STA: A2.A.36  
TOP: Binomial Expansions

\[ a^6 \]

PTS: 2  
REF: 01114a2  
STA: A2.N.3  
TOP: Operations with Polynomials

\[ a^6 \]

PTS: 2  
REF: 061005a2  
STA: A2.A.50  
TOP: Solving Polynomial Equations

\[ a^6 \]

PTS: 2  
REF: 011126a2  
STA: A2.A.49  
TOP: Equations of Circles
Cofunctions tangent and cotangent are complementary

\[ \sin \theta = \frac{y}{\sqrt{x^2 + y^2}} = \frac{2}{\sqrt{(-3)^2 + 2^2}} = \frac{2}{\sqrt{13}}, \quad \csc \theta = \frac{\sqrt{13}}{2}. \]

\[ \sin 74^\circ = 0.603 \]

\[ C \approx 78.3 \]

\[ \left( -\frac{9}{2}, \frac{1}{2} \right) \text{ and } \left( \frac{1}{2}, \frac{11}{2} \right) \]

\[ y = x + 5 \]

\[ 4x^2 + 17x - 4 = x + 5 \]

\[ y = 4x^2 + 17x - 4 \]

\[ 4x^2 + 16x - 9 = 0 \]

\[ (2x + 9)(2x - 1) = 0 \]

\[ x = -\frac{9}{2} \text{ and } x = \frac{1}{2} \]

\[ y = -\frac{9}{2} + 5 = \frac{1}{2} \text{ and } y = \frac{1}{2} + 5 = \frac{11}{2} \]

\[ b^2 - 4ac = 0 \]

\[ k^2 - 4(1)(4) = 0 \]

\[ k^2 - 16 = 0 \]

\[ (k + 4)(k - 4) = 0 \]

\[ k = \pm 4 \]
ID: A

418 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

419 ANS: 4
\[
3 \pm \sqrt{(-3)^2 - 4(1)(-9)} = 3 \pm \sqrt{45} = 3 \pm 3\sqrt{5}
\]

PTS: 2 REF: 061009a2 STA: A2.A.25 TOP: Quadratics with Irrational Solutions

420 ANS: 1

PTS: 2 REF: 011123a2 STA: A2.A.71 TOP: Graphing Trigonometric Functions

421 ANS:
\[
\pm \frac{3}{2}, -\frac{1}{2}
\]
\[
8x^3 + 4x^2 - 18x - 9 = 0
\]
\[
4x^2(2x + 1) - 9(2x + 1) = 0
\]
\[
(4x^2 - 9)(2x + 1) = 0
\]
\[
4x^2 - 9 = 0 \text{ or } 2x + 1 = 0
\]
\[
(2x + 3)(2x - 3) = 0 \quad x = -\frac{1}{2}
\]
\[
x = \pm \frac{3}{2}
\]

PTS: 4 REF: fall0937a2 STA: A2.A.26 TOP: Solving Polynomial Equations

422 ANS: 3

PTS: 2 REF: 061020a2 STA: A2.A.71 TOP: Graphing Trigonometric Functions
26.2\% \cdot 10C_8 \cdot 0.65^8 \cdot 0.35^2 + 10C_9 \cdot 0.65^9 \cdot 0.35^1 + 10C_{10} \cdot 0.65^{10} \cdot 0.35^0 \approx 0.262

\tan \theta - \sqrt{3} = 0

\tan \theta = \sqrt{3}

\theta = \tan^{-1} \sqrt{3}

\theta = 60, 240

a = \sqrt{10^2 + 6^2 - 2(10)(6) \cos 80} \approx 10.7. \angle C \text{ is opposite the shortest side.} \frac{6}{\sin C} = \frac{10.7}{\sin 80}

C \approx 33

\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

\binom{10}{4} = 210
75000 = 25000e^{0.0475t}

3 = e^{0.0475t}

\ln 3 = \ln e^{0.0475t}

\frac{\ln 3}{0.0475} = \frac{0.0475t \cdot \ln e}{0.0475}

23.1 \approx t

\text{PTS: 2} \quad \text{REF: 061117a2} \quad \text{STA: A2.A.6} \quad \text{TOP: Exponential Growth}

\text{ANS: 7.4}

\text{PTS: 2} \quad \text{REF: 061029a2} \quad \text{STA: A2.S.4} \quad \text{TOP: Dispersion}

\text{KEY: basic, group frequency distributions}

\text{ANS: 2}

6(x^2 - 5) = 6x^2 - 30

\text{PTS: 2} \quad \text{REF: 011109a2} \quad \text{STA: A2.A.42} \quad \text{TOP: Compositions of Functions}

\text{KEY: variables}

\text{ANS: 2}

The roots are -1, 2, 3.

\text{PTS: 2} \quad \text{REF: 081023a2} \quad \text{STA: A2.A.50} \quad \text{TOP: Solving Polynomial Equations}

\cos^2 \theta - \cos 2\theta = \cos^2 \theta - (\cos^2 \theta - \sin^2 \theta) = \sin^2 \theta

\text{PTS: 2} \quad \text{REF: 061024a2} \quad \text{STA: A2.A.77} \quad \text{TOP: Double Angle Identities}

\text{KEY: simplifying}

\text{ANS: 4}

\text{PTS: 2} \quad \text{REF: 011124a2} \quad \text{STA: A2.A.18} \quad \text{TOP: Evaluating Logarithmic Expressions}

\text{ANS: 4}

\text{PTS: 2} \quad \text{REF: 061120a2} \quad \text{STA: A2.A.19} \quad \text{TOP: Properties of Logarithms}

\text{KEY: splitting logs}

\text{ANS: 4}

\text{PTS: 2} \quad \text{REF: 061124a2} \quad \text{STA: A2.S.3} \quad \text{TOP: Average Known with Missing Data}

\text{ANS: 2}

f^{-1}(x) = \log_4 x

\text{PTS: 2} \quad \text{REF: fall0916a2} \quad \text{STA: A2.A.54} \quad \text{TOP: Graphing Logarithmic Functions}

\text{ANS: 3}

\text{PTS: 2} \quad \text{REF: 061119a2} \quad \text{STA: A2.A.65} \quad \text{TOP: Graphing Trigonometric Functions}

\text{ANS: 3}

\text{PTS: 2} \quad \text{REF: 061022a2} \quad \text{STA: A2.A.63} \quad \text{TOP: Domain and Range}
442 ANS: 3
\[
\frac{3^{-2}}{(-2)^{-3}} = \frac{1}{9} = \frac{-8}{9}
\]

PTS: 2 REF: 061003a2 STA: A2.N.1 TOP: Negative and Fractional Exponents

443 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

444 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

445 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

446 ANS: 3
\[
4x^2 + 4x = 2^{-6}, \quad 2x^2 + 8x = -6
\]
\[
(2^2)^{x^2 + 4x} = 2^{-6} \quad 2x^2 + 8x + 6 = 0
\]
\[
2^{x^2 + 8x} = 2^{-6} \quad x^2 + 4x + 3 = 0
\]
\[
(x + 3)(x + 1) = 0 \quad (x + 3)x = -1
\]
\[
x = -3 \quad x = -1
\]

PTS: 2 REF: 061015a2 STA: A2.A.27 TOP: Exponential Equations KEY: common base shown

447 ANS:
\[
6y^3 - \frac{37}{10}y^2 - \frac{1}{5}y \cdot \left( \frac{1}{2}y^2 - \frac{1}{3}y \right)(12y + \frac{3}{5}) = 6y^3 + \frac{3}{10}y^2 - 4y^2 - \frac{1}{5}y = 6y^3 - \frac{37}{10}y^2 - \frac{1}{5}y
\]

PTS: 2 REF: 061128a2 STA: A2.N.3 TOP: Operations with Polynomials
\[ 4^{2x+5} = 8^{3x} \]

\[
\left(2^2\right)^{2x+5} = \left(2^3\right)^{3x}
\]

\[ 2^{4x+10} = 2^{9x} \]

\[ 4x + 10 = 9x \]

\[ 10 = 5x \]

\[ 2 = x \]

PTS: 2  
REF: 061105a2  
STA: A2.A.27  
TOP: Exponential Equations

KEY: common base not shown

449  
ANS:  
2,298.65

PTS: 2  
REF: fall0932a2  
STA: A2.A.12  
TOP: Evaluating Exponential Expressions

450  
ANS: 3  
PTS: 2  
REF: 011119a2  
STA: A2.A.52  
TOP: Families of Functions

451  
ANS:  
\[ \frac{\sin^2 A + \cos^2 A}{\cos^2 A} = \frac{1}{\cos^2 A} \]

\[ \tan^2 A + 1 = \sec^2 A \]

PTS: 2  
REF: 011135a2  
STA: A2.A.67  
TOP: Proving Trigonometric Identities

452  
ANS: 3  
\[ x^2 - 3x - 10 > 0 \]

or

\[ (x - 5)(x + 2) > 0 \quad x - 5 < 0 \text{ and } x + 2 < 0 \]

\[ x - 5 > 0 \text{ and } x + 2 > 0 \quad x < 5 \text{ and } x < -2 \]

\[ x > 5 \text{ and } x > -2 \quad x < -2 \]

\[ x > 5 \]

PTS: 2  
REF: 011115a2  
STA: A2.A.4  
TOP: Quadratic Inequalities

KEY: one variable
\[
\frac{x^{-1} - 1}{x - 1} = \frac{\frac{1}{x} - 1}{x - 1} = \frac{1 - x}{x} \cdot \frac{x}{x - 1} = \frac{x}{x - 1} = \frac{1}{x}
\]

PTS: 2  REF: 081018a2  STA: A2.A.9  TOP: Negative Exponents

ANS: 2  PTS: 2  REF: 061108a2  STA: A2.A.52  TOP: Identifying the Equation of a Graph

ANS: 3  PTS: 2  REF: 061114a2  STA: A2.A.38  TOP: Defining Functions  KEY: graphs

\[
5\sqrt{3x^3} - 2\sqrt{27x^3} = 5\sqrt{x^2} \cdot \sqrt{3x} - 2\sqrt{9x^2} \cdot \sqrt{3x} = 5x\sqrt{3x} - 6x\sqrt{3x} = -x\sqrt{3x}
\]

PTS: 2  REF: 061032a2  STA: A2.N.2  TOP: Operations with Radicals

ANS:
\[
0.167 = 10C_8 \cdot 0.6^8 \cdot 0.4^2 + 10C_9 \cdot 0.6^9 \cdot 0.4^1 + 10C_{10} \cdot 0.6^{10} \cdot 0.4^0 \approx 0.167
\]

PTS: 4  REF: 061036a2  STA: A2.S.15  TOP: Binomial Probability  KEY: at least or at most


\[
\frac{\frac{2\pi}{b}}{\frac{2\pi}{3}} = \frac{2\pi}{b} = \frac{2\pi}{3}
\]

\[
\sin(45 + 30) = \sin 45 \cos 30 + \cos 45 \sin 30
\]
\[
= \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} + \frac{\sqrt{2}}{2} \cdot \frac{1}{2} = \frac{\sqrt{6} + \sqrt{2}}{4}
\]

PTS: 4  REF: 061136a2  STA: A2.A.76  TOP: Angle Sum and Difference Identities  KEY: evaluating


\[
7^2 = 3^2 + 5^2 - 2(3)(5)\cos A
\]
\[
49 = 34 - 30\cos A
\]
\[
15 = -30\cos A
\]
\[
\frac{1}{2} = \cos A
\]
\[
120 = A
\]
461 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

462 ANS:
\[(x + 3)^2 + (y - 4)^2 = 25\]

PTS: 2  REF: fall0929a2  STA: A2.A.49  TOP: Writing Equations of Circles

463 ANS: 1
\[13^2 = 15^2 + 14^2 - 2(15)(14)\cos C\]
\[169 = 421 - 420\cos C\]
\[-252 = -420\cos C\]
\[\frac{252}{420} = \cos C\]
\[53 \approx C\]


KEY: find angle

464 ANS:
\[\ln(T - T_0) = -kt + 4.718\]
\[\ln(T - 68) = -0.104(10) + 4.718\]
\[\ln(150 - 68) = -k(3) + 4.718\]
\[\ln(T - 68) = 3.678\]
\[4.407 \approx -3k + 4.718\]
\[T - 68 \approx 39.6\]
\[k \approx 0.104\]
\[T \approx 108\]


KEY: advanced
465 ANS: 
0, 60, 180, 300. \[\sin 2\theta = \sin \theta\]
\[\sin 2\theta - \sin \theta = 0\]
\[2 \sin \theta \cos \theta - \sin \theta = 0\]
\[\sin \theta (2 \cos \theta - 1) = 0\]
\[\sin \theta = 0 \quad 2 \cos \theta - 1 = 0\]
\[\theta = 0, 180 \quad \cos \theta = \frac{1}{2}\]
\[\theta = 60, 300\]

PTS: 4 REF: 061037a2 STA: A2.A.68 TOP: Trigonometric Equations
KEY: double angle identities

466 ANS: 
\[\frac{12}{\sin 32} = \frac{10}{\sin B}\]
\[B = \sin^{-1} \frac{10 \sin 32}{12} \approx 26.2\]
\[C \approx 180 - (32 + 26.2) \approx 121.8. \quad \frac{12}{\sin 32} = \frac{c}{\sin 121.8}\]
\[c = \frac{12 \sin 121.8}{\sin 32} \approx 19.2\]

PTS: 4 REF: 011137a2 STA: A2.A.73 TOP: Law of Sines
KEY: basic

467 ANS: 2
\[\frac{10}{\sin 35} = \frac{13}{\sin B}\]
\[B \approx 48, 132\]
\[35 + 48 < 180 \quad 35 + 132 < 180\]

PTS: 2 REF: 011113a2 STA: A2.A.75 TOP: Law of Sines - The Ambiguous Case

468 ANS: 2
\[\frac{x}{4} + \frac{1}{x} = \frac{x^2 - 4}{4x}\]
\[\frac{2x + 4}{8x} \times \frac{8x}{2(x + 2)} = x - 2\]

PTS: 2 REF: fall0920a2 STA: A2.A.17 TOP: Complex Fractions

470 ANS: 1
\[\sqrt{12^2 - 6^2} = \sqrt{108} = \sqrt{36 \times 3} = 6 \sqrt{3}.\]
\[\cot J = \frac{A}{O} = \frac{6}{6 \sqrt{3}} \quad \frac{\sqrt{3}}{3} = \frac{\sqrt{3}}{3}\]

PTS: 2 REF: 011120a2 STA: A2.A.55 TOP: Trigonometric Ratios
### Sigma Notation

\[ \sum_{n=1}^{15} 7n \]

PTS: 2  REF: 081029a2  STA: A2.A.34  TOP: Sigma Notation

### Regression

\[ \sum \]

PTS: 2  REF: 061127a2  STA: A2.S.6

### Sigma Notation

\[
\begin{array}{|c|c|c|c|c|}
\hline
n & 3 & 4 & 5 & \Sigma \\
\hline
-r^2 + r & -3^2 + 3 & -6 & 4^2 + 4 & -12 & -5^2 + 5 & -20 & -38 \\
\hline
\end{array}
\]

PTS: 2  REF: 061118a2  STA: A2.N.10  TOP: Sigma Notation

### Binomial Expansions

\[ \sum C \left(3x\right)^2 \left(-2\right)^3 = 10 \cdot 9x^2 \cdot -8 = -720x^2 \]

PTS: 2  REF: fall0919a2  STA: A2.A.36  TOP: Binomial Expansions

### Sequences

\[ b_n = x + 2n \]

\[ 10 = x + 2(1) \]

\[ 8 = x \]

PTS: 2  REF: 081014a2  STA: A2.A.29  TOP: Sequences

### Sequences

\[ b_n = x + 2n \]

PTS: 2  REF: 081014a2  STA: A2.A.29  TOP: Sequences

### Fractional Exponents as Radicals

\[ f(4) = \frac{1}{2} (4) - 3 = -1 \]

\[ g(-1) = 2(-1) + 5 = 3 \]

PTS: 2  REF: fall0902a2  STA: A2.A.42  TOP: Compositions of Functions

### Factoring Polynomials

\[ 6x - x^3 - x^2 = -x(x^2 + x - 6) = -x(x + 3)(x - 2) \]

PTS: 2  REF: fall0917a2  STA: A2.A.7  TOP: Factoring Polynomials

KEY: single variable
\[ x^{\frac{2}{5}} = \frac{1}{\sqrt[5]{x^2}} \]

PTS: 2  REF: 011118a2  STA: A2.A.10  TOP: Fractional Exponents as Radicals

\[ 12x^4 + 10x^3 - 12x^2 = 2x^2(6x^2 + 5x - 6) = 2x^2(2x + 3)(3x - 2) \]

PTS: 2  REF: 061008a2  STA: A2.A.7  TOP: Factoring Polynomials

\[ \binom{15}{6} = 6,435 \]

PTS: 2  REF: 081012a2  STA: A2.S.11  TOP: Combinations

\[ a_15 = -\sqrt[5]{(-\sqrt{2})^{15-1}} = -\sqrt[5]{(-2)^{14}} = -\sqrt[5]{5 \cdot 2^7} = -128 \sqrt{5} \]

PTS: 2  REF: 061109a2  STA: A2.A.32  TOP: Sequences
486 ANS:

\[ 3.45 \times \frac{180}{\pi} \approx 197^\circ 40' \]

PTS: 2   REF: fall0931a2   STA: A2.M.2   TOP: Radian Measure
KEY: degrees

487 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

488 ANS: 3

\[ 3x + 16 = (x + 2)^2 \]
\[ 3x + 16 = x^2 + 4x + 4 \]
\[ 0 = x^2 + x - 12 \]
\[ 0 = (x + 4)(x - 3) \]
\[ x = -4, x = 3 \]

PTS: 2   REF: 061007a2   STA: A2.S.9
TOP: Differentiating Permutations and Combinations

489 ANS: 3

\[ 3x + 16 = (x + 2)^2 \]
\[ -4 \] is an extraneous solution.

\[ 3x + 16 = x^2 + 4x + 4 \]
\[ 0 = x^2 + x - 12 \]
\[ 0 = (x + 4)(x - 3) \]
\[ x = 3 \]

PTS: 2   REF: 061121a2   STA: A2.A.22   TOP: Solving Radicals
KEY: extraneous solutions

490 ANS: 1

\[ 6x - 7 \leq 5 \]
\[ 6x \leq 12 \]
\[ x \leq 2 \]

\[ 6x - 7 \geq -5 \]
\[ 6x \geq 2 \]
\[ x \geq 3 \]

PTS: 2   REF: fall0905a2   STA: A2.A.1   TOP: Absolute Value Inequalities
KEY: graph

491 ANS: 3

\[ \frac{-b}{a} = -\frac{6}{2} = -3, \quad \frac{c}{a} = \frac{4}{2} = 2 \]

PTS: 2   REF: 011121a2   STA: A2.A.21   TOP: Roots of Quadratics
KEY: basic
493 ANS: 3  PTS: 2  REF: 011104a2  STA: A2.A.64
TOP: Using Inverse Trigonometric Functions  KEY: unit circle

494 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

495 ANS: 3

<table>
<thead>
<tr>
<th>( n^2 + 2^n )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>( \Sigma )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( n^2 + 2^n )</td>
<td>0^2 + 2^0 = 1</td>
<td>1^2 + 2^2 = 3</td>
<td>2^2 + 2^2 = 8</td>
<td>12</td>
</tr>
</tbody>
</table>

\( 2 \times 12 = 24 \)

PTS: 2  REF: fall0911a2  STA: A2.N.10  TOP: Sigma Notation  KEY: basic

496 ANS: 2
cos(\(-305^\circ + 360^\circ\)) = cos(55°)

PTS: 2  REF: 061104a2  STA: A2.A.57  TOP: Reference Angles

497 ANS: 4  PTS: 2  REF: 061112a2  STA: A2.A.39
TOP: Domain and Range  KEY: real domain

498 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

499 ANS: 2  PTS: 2  REF: 061021a2  STA: A2.S.8
TOP: Correlation Coefficient

500 ANS: 2
8^2 = 64

PTS: 2  REF: fall0909a2  STA: A2.A.18  TOP: Evaluating Logarithmic Expressions

501 ANS: 2  PTS: 2  REF: 061122a2  STA: A2.A.24
TOP: Completing the Square

502 ANS: 3
\[ S = \frac{-b}{a} = \frac{-(3)}{4} = \frac{3}{4} \cdot P = \frac{c}{a} = \frac{-8}{4} = -2 \]

PTS: 2  REF: fall0912a2  STA: A2.A.21  TOP: Roots of Quadratics  KEY: basic

503 ANS: 3
\( x = 5^4 = 625 \)

PTS: 2  REF: 061106a2  STA: A2.A.28  TOP: Logarithmic Equations  KEY: basic
504 ANS: 1
\[4a + 6 = 4a - 10. \quad 4a + 6 = -4a + 10. \quad \left| 4 \left( \frac{1}{2} \right) + 6 \right| - 4 \left( \frac{1}{2} \right) = -10 \]
\[6 \neq -10 \quad 8a = 4 \quad 8 - 2 \neq -10 \]
\[a = \frac{4}{8} = \frac{1}{2} \]

PTS: 2 REF: 011106a2 STA: A2.A.1 TOP: Absolute Value Equations

505 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

506 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

507 ANS:

\[\frac{\sqrt{3}}{2} \]

PTS: 2 REF: 061033a2 STA: A2.A.60 TOP: Unit Circle
\[
\left(\frac{2}{3}\right)^2 + \cos^2 A = 1 \quad \sin 2A = 2 \sin A \cos A
\]

\[
\cos^2 A = \frac{5}{9} \quad = 2 \left(\frac{2}{3}\right) \left(\frac{\sqrt{5}}{3}\right)
\]

\[
\cos A = +\frac{\sqrt{5}}{3}, \text{ sin } A \text{ is acute.} \quad = \frac{4\sqrt{5}}{9}
\]

PTS: 2  REF: 011107a2  STA: A2.A.77  TOP: Double Angle Identities

KEY: evaluating

509  ANS:
45, 225  \quad 2 \tan C - 3 = 3 \tan C - 4
1 = \tan C
\tan^{-1} 1 = C
\quad C = 45, 225

PTS: 2  REF: 081032a2  STA: A2.A.68  TOP: Trigonometric Equations

KEY: basic

510  ANS: 3
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

511  ANS:
39,916,800  \quad \frac{12! P_{12}}{3! 2!} = \frac{479,001,600}{12} = 39,916,800

PTS: 2  REF: 081035a2  STA: A2.S.10  TOP: Permutations

512  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
513 ANS:

\[ y = 0 \]

PTS: 2  REF: 061031a2  STA: A2.A.53  TOP: Graphing Exponential Functions

514 ANS:

\[ 230. \quad 10 + (1^3 - 1) + (2^3 - 1) + (3^3 - 1) + (4^3 - 1) + (5^3 - 1) = 10 + 0 + 7 + 26 + 63 + 124 = 230 \]

PTS: 2  REF: 011131a2  STA: A2.N.10  TOP: Sigma Notation

515 ANS: 1

\[
\cos K = \frac{5}{6} \\
K = \cos^{-1} \frac{5}{6} \\
K \approx 33^\circ33'\]

PTS: 2  REF: 061023a2  STA: A2.A.55  TOP: Trigonometric Ratios

516 ANS:

\[ y = 2.001x^{2.298}, \quad 1,009. \quad y = 2.001(15)^{2.298} \approx 1009 \]

PTS: 4  REF: fall0938a2  STA: A2.S.7  TOP: Power Regression

517 ANS: 3

\[ 68\% \times 50 = 34 \]

PTS: 2  REF: 081013a2  STA: A2.S.5  TOP: Normal Distributions

518 ANS: 4

TOP: Sequences

PTS: 2  REF: 061026a2  STA: A2.A.29
\[ \sqrt{-300} = \sqrt{100} \sqrt{-1} \sqrt{3} \]

PTS: 2  REF: 061006a2  STA: A2.N.6  TOP: Square Roots of Negative Numbers

\[ \binom{9}{n} \binom{n-1}{20} \binom{3}{n} = 41040. \]

PTS: 2  REF: fall0935a2  STA: A2.S.12  TOP: Sample Space

\[ x^2 - 6x - 27 = 0, \quad \frac{-b}{a} = 6, \quad \frac{c}{a} = -27. \quad \text{If } a = 1 \text{ then } b = -6 \text{ and } c = -27 \]

PTS: 4  REF: 061130a2  STA: A2.A.21  TOP: Roots of Quadratics

\[ b^2 - 4ac = 3^2 - 4(9)(-4) = 9 + 144 = 153 \]

PTS: 2  REF: 081016a2  STA: A2.A.2  TOP: Using the Discriminant

\[ e^{3 \ln 2} = e^{\ln 2^3} = e^{\ln 8} = 8 \]

PTS: 2  REF: 061131a2  STA: A2.A.12  TOP: Evaluating Exponential Expressions

\[ y = x^2 - 6. \quad f^{-1}(x) \text{ is not a function.} \]

PTS: 2  REF: 061132a2  STA: A2.A.44  TOP: Inverse of Functions

\[ 12 \cdot 6 = 9w \]

PTS: 2  REF: 011130a2  STA: A2.A.5  TOP: Inverse Variation

\[ 8 = w \]

PTS: 2  REF: 061101a2  STA: A2.S.1  TOP: Analysis of Data
ANS:
No. TENNESSEE: $\frac{9P_9}{4! \cdot 2! \cdot 2!} = \frac{362,880}{96} = 3,780$. VERMONT: $7P_7 = 5,040$

PTS: 4 REF: 061038a2 STA: A2.S.10 TOP: Permutations

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

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

ANS: 3
\[
\frac{3}{\sqrt{3}a^2b} = \frac{3}{a\sqrt{3}b} = \frac{\sqrt{3}b}{\sqrt{3}b} = \frac{3\sqrt{3}b}{3ab} = \frac{\sqrt{3}b}{ab}
\]

PTS: 2 REF: 081019a2 STA: A2.A.15 TOP: Rationalizing Denominators

KEY: index = 2

ANS: 4
\( s = \theta r = 2 \cdot 4 = 8 \)

PTS: 2 REF: fall0922a2 STA: A2.A.61 TOP: Arc Length

KEY: arc length

ANS: 2
\[\tan(120\degree) = -1.732050808\]

PTS: 2 REF: 061115a2 STA: A2.A.66 TOP: Determining Trigonometric Functions

ANS: 4
\[\frac{2\pi}{b} = \frac{2\pi}{1} = 6\pi\]

\[ \sqrt[3]{108x^5y^8} = \sqrt[6]{18x^4y^3} = 3x^2y\sqrt[2]{y} \]

KEY: with variables | index = 2

536 ANS:
\[-3, -5, -8, -12\]

PTS: 2  REF: fall0934a2  STA: A2.A.33  TOP: Recursive Sequences

537 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

538 ANS:
\[(3 + \sqrt{5})(3 - \sqrt{5}) = 9 - \sqrt{25} = 4\]

PTS: 2  REF: 081001a2  STA: A2.N.4  TOP: Operations with Irrational Expressions
KEY: without variables | index = 2

539 ANS:
\[2.5 \cdot \frac{180}{\pi} \approx 143.2^\circ\]

PTS: 2  REF: 011129a2  STA: A2.M.2  TOP: Radian Measure
KEY: degrees

540 ANS: 1

PTS: 2  REF: fall0915a2  STA: A2.S.5  TOP: Normal Distributions
KEY: interval
ANS: 
\[ y = 10.596(1.586)^x \]

PTS: 2  REF: 081031a2  STA: A2.S.7  TOP: Exponential Regression

ANS: 1

\[ 2i^2 + 3i^3 = 2(-1) + 3(-i) = -2 - 3i \]

PTS: 2  REF: 081004a2  STA: A2.N.7  TOP: Imaginary Numbers

ANS:

\[ 32x^5 - 80x^4 + 80x^3 - 40x^2 + 10x - 1 \]

\[ 5 \binom{2}{0}(2x)^5(-1)^0 = 32x^5. \]

\[ 5 \binom{2}{1}(2x)^4(-1)^1 = -80x^4. \]

\[ 5 \binom{2}{2}(2x)^3(-1)^2 = 80x^3. \]

\[ 5 \binom{2}{3}(2x)^2(-1)^3 = -40x^2. \]

\[ 5 \binom{2}{4}(2x)^1(-1)^4 = 10x. \]

\[ 5 \binom{2}{5}(2x)^0(-1)^5 = -1 \]

PTS: 2  REF: 081004a2  STA: A2.N.7  TOP: Imaginary Numbers

ANS:

\[ 2 \log x - (3 \log y + \log z) = \log x^2 - \log y^3 - \log z = \log \frac{x^2}{y^3z} \]

PTS: 2  REF: 061010a2  STA: A2.A.19  TOP: Properties of Logarithms

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