1 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

2 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

3 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) \(\frac{\pi}{2} \leq x \leq \frac{3\pi}{2}\)

4 Express in simplest form:
\[
\frac{4 - x^2}{x^2 + 7x + 12} \quad \frac{2x - 4}{x + 3}
\]

5 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) \(y = -2\cos \frac{1}{2}x\)

6 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
7 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) \( \{y | y \in \text{real numbers}\} \)

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

9 What is the domain of the function shown below?

10 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) \( \{\} \)

11 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) \( 30P_3 \cdot 20P_2 \)
   2) \( 30C_3 \cdot 20C_2 \)
   3) \( 30P_3 + 20P_2 \)
   4) \( 30C_3 + 20C_2 \)

12 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) \( \frac{15}{4}x^4y^2 \)

13 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) \( 3 \sin^2 x \)
14 Which calculator output shows the strongest linear relationship between $x$ and $y$?

- $r = 0.8643$  
  $y = a + bx$  
  $a = 59.026$  
  $b = 6.767$
- $r = 0.8361$  
  $y = a + bx$  
  $a = 0.7$  
  $b = 24.2$
- $r = 0.6022$  
  $y = a + bx$  
  $a = -2.9$  
  $b = 24.1$
- $r = -0.8924$

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

16 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?

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

17 The expression $\log_4 m^2$ is equivalent to

- $2(\log_4 + \log m)$
- $2 \log_4 + \log m$
- $\log_4 + 2 \log m$
- $\log 16 + 2 \log m$

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

- $\frac{x^2 + x\sqrt{x}}{x^2 - x}$
- $\frac{-\sqrt{x}}{x^2}$
- $\frac{x + \sqrt{x}}{1 - x}$
- $\frac{x + \sqrt{x}}{x - 1}$

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

20 Expressed in simplest form, $\sqrt{-18} - \sqrt{-32}$ is

- $-\sqrt{2}$
- $-7\sqrt{2}$
- $-i\sqrt{2}$
- $7i\sqrt{2}$
21 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.

22 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) \( \binom{10}{6} \left( \frac{4}{5} \right)^6 \left( \frac{1}{5} \right)^4 \)

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

3) \( \binom{10}{8} \left( \frac{7}{10} \right)^8 \left( \frac{3}{10} \right)^2 \)

4) \( \binom{10}{9} \left( \frac{7}{10} \right)^9 \left( \frac{3}{10} \right)^1 \)

23 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°.

24 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) \( \frac{2b}{a + 1} \)

25 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.

26 Express the exact value of \( \csc 60^\circ \), with a rational denominator.

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

28 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) \( x^2 - 6x - 36 = 25 - 36 \)
29 If \( \log_{bp} x = 3 \log_{bp} p - \left( 2 \log_{bp} t + \frac{1}{2} \log_{bp} r \right) \), then the value of \( x \) is

1) \( \frac{p^3}{\sqrt{t^2 r}} \)
2) \( \frac{p^3}{t^2 r^2} \)
3) \( \frac{p^2 t^2}{\sqrt{r}} \)
4) \( \frac{p^3}{t^2 \sqrt{r}} \)

30 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

31 Which function is one-to-one?

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

32 Which expression, when rounded to three decimal places, is equal to \(-1.155\)?

1) \( \sec \left( \frac{5\pi}{6} \right) \)
2) \( \tan(49^\circ20') \)
3) \( \sin \left( -\frac{3\pi}{5} \right) \)
4) \( \csc(-118^\circ) \)

33 Given \( \triangle ABC \) with \( a = 9 \), \( b = 10 \), and \( m\angle B = 70^\circ \), 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

34 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

35 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) \( \frac{7}{9} \)

36 What is the sum of the first 19 terms of the sequence 3, 10, 17, 24, 31, \ldots?

1) 1188
2) 1197
3) 1254
4) 1292
37 The value of $\sin(180 + x)$ is equivalent to
1) $-\sin x$
2) $-\sin(90 - x)$
3) $\sin x$
4) $\sin(90 - x)$

38 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

39 The measures of the angles between the resultant and two applied forces are $60^\circ$ and $45^\circ$, and the magnitude of the resultant is 27 pounds. Find, to the nearest pound, the magnitude of each applied force.

40 What is the solution set of the equation $3x^5 - 48x = 0$?
1) \{0, ±2\}
2) \{0, ±2, 3\}
3) \{0, ±2, ±2i\}
4) \{±2, ±2i\}

41 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

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

43 Express $\cos \theta \sec \theta - \cos \theta$, in terms of $\sin \theta$. 
44 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) $\frac{xy^3}{3}$

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

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

47 What is the common ratio of the sequence

$\frac{1}{64} a^5b^3, -\frac{3}{32} a^3b^4, \frac{9}{16} ab^5, \ldots$?

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

48 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 $83^\circ 50'$.

49 Which graph represents the solution set of

$\left| \frac{4x - 5}{3} \right| > 1$?

1) 
2) 
3) 
4) 

50 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
51 Which diagram represents a relation that is both one-to-one and onto?

1)  

2)  

3)  

4)  

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

1) \(8a^4\)

2) \(8a^8\)

3) \(4a^5\sqrt[4]{a}\)

4) \(4a^{3/2}\sqrt[4]{a}\)

53 What are the sum and product of the roots of the equation \(6x^2 - 4x - 12 = 0\)?

1) sum \(= -\frac{2}{3}\); product \(= -2\)

2) sum \(= \frac{2}{3}\); product \(= -2\)

3) sum \(= -2\); product \(= \frac{2}{3}\)

4) sum \(= -2\); product \(= -\frac{2}{3}\)

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

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

55 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.

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

<table>
<thead>
<tr>
<th>Travel Times</th>
<th>25</th>
<th>55</th>
<th>40</th>
<th>65</th>
<th>29</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>45</td>
<td>59</td>
<td>35</td>
<td>25</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>52</td>
<td>30</td>
<td>8</td>
<td>40</td>
<td>55</td>
</tr>
</tbody>
</table>

Determine the number of employees whose travel time is within one standard deviation of the mean.
57 In \( \triangle DEF \), \( d = 5 \), \( e = 8 \), and \( m\angle D = 32 \). How many distinct triangles can be drawn given these measurements?
   
   1) 1
   2) 2
   3) 3
   4) 0

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

59 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

60 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) \( \frac{225}{512} \)

61 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

62 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

63 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) \( 4n^{-1} > (6n)^{-1} \)

64 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
65. What is the graph of the solution set of \( |2x - 1| > 5 \)?

1)  
2)  
3)  
4)  

66. 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  

67. 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  

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

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

69. Which expression is equivalent to \( \left( 3x^2 \right)^{-1} \)?

1) \( \frac{1}{3x^2} \)  
2) \(-3x^2\)  
3) \( \frac{1}{9x^2} \)  
4) \(-9x^2\)  

70. 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) \((8,3)\)  

71. 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) \( 2b + 2a \)  

72. If \( \log_4 x = 2.5 \) and \( \log_y 125 = -\frac{3}{2} \), find the numerical value of \( \frac{x}{y} \), in simplest form.

73. Find, algebraically, the measure of the obtuse angle, to the nearest degree, that satisfies the equation \( 5 \csc \theta = 8 \).
74 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

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

76 Find the solution of the inequality \(x^2 - 4x > 5\), algebraically.

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

78 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) \(2x^4y^2\)

79 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.

80 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

81 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
82 If \( g(x) = \left( a\sqrt{x-1} \right)^2 \), express \( g(10) \) in simplest form.

83 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)

84 Solve \( x^3 + 5x^2 = 4x + 20 \) algebraically.

85 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

86 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) \( −\frac{1}{4} \)

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

88 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.

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

90 The expression \( \frac{a + b}{c} \) is equivalent to \( \frac{d - \frac{b}{c}}{d - b} \)
1) \( \frac{c + 1}{d - 1} \)
2) \( \frac{a + b}{d - b} \)
3) \( \frac{ac + b}{cd - b} \)
4) \( \frac{ac + 1}{cd - \frac{1}{4}} \)
91 When \(x^{-1} + 1\) is divided by \(x + 1\), the quotient equals
1) 1
2) \(\frac{1}{x}\)
3) \(x\)
4) \(-\frac{1}{x}\)

92 Which graph represents the solution set of \(\frac{x+16}{x-2} \leq 7\)?
1) ![Graph 1]
2) ![Graph 2]
3) ![Graph 3]
4) ![Graph 4]

93 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 \([0, \pi]\).

94 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) \(\frac{11!}{2! \cdot 2! \cdot 2!}\)

95 If \(\tan\left(\arccos \frac{\sqrt{3}}{3}\right) = \frac{\sqrt{3}}{3}\), then \(k\) is
1) 1
2) 2
3) \(\sqrt{2}\)
4) \(3\sqrt{2}\)

96 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) \(y = 3 \sin 4x\)

97 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) \(-2a + 5\)

98 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
99 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) \( \frac{2}{5} x^2 - \frac{3}{4} y^4 \)
4) \( \frac{4}{5} x \)

100 The simplest form of \( \frac{1 - 4}{x} \) is

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

101 The expression \((x + i)^2 - (x - i)^2\) is equivalent to

1) 0
2) \(-2\)
3) \(-2 + 4xi\)
4) \(4xi\)

102 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

103 Which equation is graphed in the diagram below?

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

104 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
105 Which sketch shows the inverse of \( y = a^x \), where \( a > 1 \)?

1) 

2) 

3) 

4) 

106 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.

107 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) \( \frac{12P_{12}}{8} \)

4) \( \frac{12P_{12}}{6!} \)

108 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) \( \frac{7 - \sqrt{11}}{60} \)

109 Write an equation for the graph of the trigonometric function shown below.
110 Solve algebraically for all values of \( x \):
\[
\log_{x+3}(2x + 3) + \log_{x+3}(x + 5) = 2
\]

111 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

112 The formula to determine continuously compounded interest is \( A = Pe^{rt} \), where \( A \) is the amount of money in the account, \( P \) is the initial investment, \( r \) is the interest rate, and \( t \) is the time, in years. Which equation could be used to determine the value of an account with an $18,000 initial investment, at an interest rate of 1.25% for 24 months?
1) \( A = 18,000e^{1.25 \cdot 24} \)
2) \( A = 18,000e^{1.25 \cdot 2} \)
3) \( A = 18,000e^{0.0125 \cdot 2} \)
4) \( A = 18,000e^{0.0125 \cdot 24} \)

113 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) \( _8C_5 \)

114 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

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

116 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) \( 2x^2 - 3x + 36 \)

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

118 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%.
119 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.

120 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) \( \frac{x^2}{16} - \frac{x}{6} - \frac{1}{9} \)

121 Solve the equation \( 6x^2 - 2x - 3 = 0 \) and express the answer in simplest radical form.

122 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) \( 4x^2 - 9x - 3 = 0 \)

123 The conjugate of the complex expression \(-5x + 4i\) is

1) \( 5x - 4i \)
2) \( 5x + 4i \)
3) \(-5x - 4i \)
4) \(-5x + 4i \)

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

1) \( \sum_{n=5}^{43} n \)
2) \( \sum_{n=1}^{20} (2n + 3) \)
3) \( \sum_{n=4}^{24} (2n - 3) \)
4) \( \sum_{n=3}^{33} (3n - 4) \)
125 Which graph represents a function?

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

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

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

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

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

131 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.

132 The graph below shows the average price of
gasoline, in dollars, for the years 1997 to 2007.

What is the approximate range of this graph?
1) \(1997 \leq x \leq 2007\)
2) \(1999 \leq x \leq 2007\)
3) \(0.97 \leq y \leq 2.38\)
4) \(1.27 \leq y \leq 2.38\)

133 If \( m\angle \theta = -50 \), which diagram represents \( \theta \)
drawn in standard position?

1) \([Diagram 1]\)
2) \([Diagram 2]\)
3) \([Diagram 3]\)
4) \([Diagram 4]\)

134 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.
135 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

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

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

138 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%

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

140 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.
141 The expression \( \frac{x^2 + 9x - 22}{x^2 - 121} \div (2 - x) \) is equivalent to

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

142 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

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

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

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

145 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) \( -x^3 - 2x^2 + 5x + 4 \)

146 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) \( \frac{q \sin R}{\sin Q} \)

147 In parallelogram \( BFLO \), \( \overline{OL} = 3.8, \overline{LF} = 7.4 \), 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

148 Solve \( |2x - 3| > 5 \) algebraically.

149 Multiply \( x + yi \) by its conjugate, and express the product in simplest form.
150 If \( \sec(a + 15)\degree = \csc(2a)\degree \), find the smallest positive value of \( a \), in degrees.

151 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 \( \sec P > 0 \)

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

153 Determine algebraically the \( x \)-coordinate of all points where the graphs of \( xy = 10 \) and \( y = x + 3 \) intersect.

154 In the interval \( 0\degree \leq x < 360\degree \), \( \tan x \) is undefined when \( x \) equals
1) \( 0\degree \) and \( 90\degree \)
2) \( 90\degree \) and \( 180\degree \)
3) \( 180\degree \) and \( 270\degree \)
4) \( 90\degree \) and \( 270\degree \)

155 The expression \( \sin(\theta + 90)\degree \) is equivalent to
1) \( -\sin \theta \)
2) \( -\cos \theta \)
3) \( \sin \theta \)
4) \( \cos \theta \)

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

157 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) \( -3 \pm 2i \)

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

159 Which value of \( k \) satisfies the equation \( 8^{3k + 4} = 4^{2k - 1} \)?
1) \( -1 \)
2) \( -\frac{9}{4} \)
3) \( -2 \)
4) \( -\frac{14}{5} \)
160 What is the product of the roots of the quadratic equation $2x^2 - 7x = 5$?

1) $5$
2) $\frac{5}{2}$
3) $-5$
4) $-\frac{5}{2}$

161 What is the equation of the graph shown below?

![Graph](image)

1) $y = 2^x$
2) $y = 2^{-x}$
3) $x = 2^y$
4) $x = 2^{-y}$

162 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.

163 Two sides of a triangular-shaped sandbox measure 22 feet and 13 feet. If the angle between these two sides measures $55^\circ$, what is the area of the sandbox, to the nearest square foot?

1) 82
2) 117
3) 143
4) 234

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

165 Determine the value of $n$ in simplest form:

$$i^{13} + i^{18} + i^{31} + n = 0$$

166 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

167 What is the common ratio of the geometric sequence shown below?

$-2, 4, -8, 16, \ldots$

1) $\frac{-1}{2}$
2) 2
3) -2
4) -6
168 If \( f(x) = \sqrt{9 - x^2} \), what are its domain and range?
1) domain: \( \{ x \mid -3 \leq x \leq 3 \} \); range: \( \{ y \mid 0 \leq y \leq 3 \} \)
2) domain: \( \{ x \mid x \neq \pm 3 \} \); range: \( \{ y \mid 0 \leq y \leq 3 \} \)
3) domain: \( \{ x \mid x \leq -3 \text{ or } x \geq 3 \} \); range: \( \{ y \mid y \neq 0 \} \)
4) domain: \( \{ x \mid x \neq 3 \} \); range: \( \{ y \mid y \geq 0 \} \)

169 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) \((-6, -2)\)

170 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) \( 4 \)

171 Solve algebraically for \( x \):
\[
\sqrt{x^2 + x - 1} + 11x = 7x + 3
\]

172 Express in simplest terms:
\[
\frac{1 + \frac{3}{x}}{1 - \frac{5}{x} - \frac{24}{x^2}}
\]

173 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) \( \sum_{d=1}^{7} \left( \frac{1}{3} \right)^{d-1} \)
4) \( \sum_{d=1}^{7} \left( \frac{1}{3} \right)^d \)

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

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

Express the product of $\cos 30^\circ$ and $\sin 45^\circ$ in simplest radical form.

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) $(x + 4)(x - 4)(3x - 5)(3x - 5)$

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

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.

Determine the solution of the inequality $|3 - 2x| \geq 7$. [The use of the grid below is optional.]
182 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

183 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>Concentration of Ozone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude ((x))</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>20</td>
</tr>
</tbody>
</table>

184 What is the range of the function shown below?

1) \(x \leq 0\)
2) \(x \geq 0\)
3) \(y \leq 0\)
4) \(y \geq 0\)

185 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) \(y = 2 \sin \frac{2\pi}{3} x\)

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

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

187 Evaluate: \(\sum_{n=1}^{3} (n^4 - n)\)

188 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.
189 Determine the sum of the first twenty terms of the sequence whose first five terms are 5, 14, 23, 32, 41.

190 The function $f(x)$ is graphed on the set of axes below. On the same set of axes, graph $f(x + 1) + 2$.

191 Which problem involves evaluating $P_4$?
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?

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

193 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) $6\pi$

194 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) $\{60^\circ, 300^\circ\}$

195 Write an equation of the circle shown in the diagram below.
196 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) \(4a^2 - 20a + 30\)

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

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

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

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

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

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

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

1) \(\overline{TO}\)
2) \(\overline{TS}\)
3) \(\overline{OR}\)
4) \(\overline{OS}\)

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

203 Which function is one-to-one?

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

204 Convert 2.5 radians to degrees, and express the answer to the nearest minute.
205 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) \(\{225^\circ, 315^\circ\}\)

206 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) \(-\frac{63}{65}\)

207 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) \(-65,535\)

208 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?

209 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

210 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) \(3\pi\)

211 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

212 Solve algebraically for all values of \(x\):
\[x^4 + 4x^3 + 4x^2 = -16x\]
213 What is the common difference of the arithmetic sequence below?

\(-7x, -4x, -x, 2x, 5x, \ldots\)

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

214 Solve algebraically for \(x\):

\[\log_{5x-1} 4 = \frac{1}{3}\]

215 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

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

217 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.

218 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

219 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) \(\log 6 + 2 \log a\)

220 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

221 The expression \(\left(\frac{1}{3}\sqrt{27x^2}\right) \left(\frac{1}{3}\sqrt{16x^4}\right)\) is equivalent to

1) 12x^{\frac{3}{2}}
2) 12x^{\frac{3}{2}}\sqrt{2}
3) 6x^{\frac{3}{2}}\sqrt{2x^2}
4) 6x^{\frac{3}{2}}\sqrt{2}
222 Expressed in simplest form, \( \frac{3y}{2y - 6} + \frac{9}{6 - 2y} \) is equivalent to

1) \( -6y^2 + 36y - 54 \)
\((2y - 6)(6 - 2y)\)

2) \( \frac{3y - 9}{2y - 6} \)

3) \( \frac{3}{2} \)

4) \( -\frac{3}{2} \)

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

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

225 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 \((e, 1)\).

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

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

228 The expression \((2a)^{-4}\) is equivalent to
1) \(-8a^4\)

2) \(\frac{16}{a^4}\)

3) \(-\frac{2}{a^4}\)

4) \(\frac{1}{16a^4}\)

229 Find the number of possible different 10-letter arrangements using the letters of the word “STATISTICS.”
230 In the right triangle shown below, what is the measure of angle \( S \), to the nearest minute?

\[
\begin{align*}
M & \quad 17 \\
8 & \quad S \\
\end{align*}
\]

1) 28°1'
2) 28°4'
3) 61°56'
4) 61°93'

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

1) 448x^5
2) 448x^4
3) -448x^5
4) -448x^4

232 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

233 The solution set of the equation \( \sqrt{2x - 4} = x - 2 \) is

1) \{-2, -4\}
2) \{2, 4\}
3) \{4\}
4) \{ \}

234 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.

235 Which graph does not represent a function?

1)
2)
3)
4)

236 Find, to the nearest minute, the angle whose measure is 3.45 radians.
237 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.

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

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

240 Find the first four terms of the recursive sequence defined below.
\[a_1 = -3\]
\[a_n = a_{(n-1)} - n\]

241 Solve for $x$: $\frac{4x}{x-3} = 2 + \frac{12}{x-3}$

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

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

244 Solve the equation $2\tan C - 3 = 3\tan C - 4$ algebraically for all values of $C$ in the interval $0^\circ \leq C < 360^\circ$.

245 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) $16384\sqrt{10}$

246 Express $5\sqrt{3x^3} - 2\sqrt{27x^3}$ in simplest radical form.
247 The value of $x$ in the equation $4^{2x+5} = 8^{3x}$ is
1) 1
2) 2
3) 5
4) −10

251 Express in simplest form: \[ \frac{1}{2} - \frac{4}{d} \]
\[ \frac{1}{d} + \frac{3}{2d} \]

248 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

252 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>
</tr>
<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.

249 Written in simplest form, the expression \[ \frac{x}{4} - \frac{1}{x} \]
\[ \frac{1}{2x} + \frac{1}{4} \]

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

253 In \( \triangle ABC \), \( a = 3 \), \( b = 5 \), and \( c = 7 \). What is \( \measuredangle C \)?
1) 22
2) 38
3) 60
4) 120

250 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) $\binom{20}{3}$
4) $\binom{20}{3}$

254 The equation \( y - 2 \sin \theta = 3 \) may be rewritten as
1) \( f(y) = 2 \sin x + 3 \)
2) \( f(y) = 2 \sin \theta + 3 \)
3) \( f(x) = 2 \sin \theta + 3 \)
4) \( f(\theta) = 2 \sin \theta + 3 \)
255 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

256 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.

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

258 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

259 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.]

260 What is the formula for the \( n \)th 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) \( a_n = 54 \left( \frac{1}{3} \right)^{n-1} \)

261 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
262 Solve the following systems of equations algebraically:
\begin{align*}
5 &= y - x \\
4x^2 &= -17x + y + 4
\end{align*}

263 The expression \( \frac{x^2}{\sqrt{5}} \) is equivalent to

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

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

265 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) \( \cot(90° - A) = \frac{2}{3} \)
4) \( \cot(90° - A) = \frac{1}{3} \)

266 Which function is \textit{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) \}

267 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

268 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) \( 17 = \frac{446 + 16x}{26 + x} \)
269 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) \(2x^2 - 6x + 4 = 0\)

270 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 \(\sin 240^\circ\).

271 If \(r = \sqrt[3]{\frac{A^2B}{C}}\), 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) \(\frac{2}{3} \log A + \frac{1}{3} \log B - \frac{1}{3} \log C\)

272 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.

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

274 Solve the equation \(8x^3 + 4x^2 - 18x - 9 = 0\) algebraically for all values of \(x\).
275 The solution set of the equation $\sqrt{x + 3} = 3 - x$ is
1) \{1\}
2) \{0\}
3) \{1, 6\}
4) \{2, 3\}

276 Which equation is sketched in the diagram below?

![Diagram of a trigonometric function]

1) $y = \csc x$
2) $y = \sec x$
3) $y = \cot x$
4) $y = \tan x$

277 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) $2\sqrt{x + 2}$

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

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

280 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) $\frac{17 + 5\sqrt{3}}{14}$

281 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) $\frac{4}{3}$
282 Which graph represents the equation \( y = \cos^{-1}x \)?

1) 

2) 

3) 

4) 

283 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) \((-6, -3)\)

284 Which relation is not a function?

1) \((x - 2)^2 + y^2 = 4\)

2) \(x^2 + 4x + y = 4\)

3) \(x + y = 4\)

4) \(xy = 4\)

285 Which graph represents the solution set of \(|6x - 7| \leq 5\)?

1) 

2) 

3) 

4) 

286 Write an equation of the circle shown in the graph below.
287 What is the range of \( f(x) = (x + 4)^2 + 7 \)?

1) \( y \geq -4 \)
2) \( y \geq 4 \)
3) \( y = 7 \)
4) \( y \geq 7 \)

288 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.

289 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) \( \frac{15 C_2 \cdot 5 C_1}{30 C_3} \)
2) \( \frac{15 P_2 \cdot 5 P_1}{30 C_3} \)
3) \( \frac{15 C_2 \cdot 5 C_1}{30 P_3} \)
4) \( \frac{15 P_2 \cdot 5 P_1}{30 P_3} \)

290 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) \( w^{14} \)

291 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) \( \csc^2 \theta \)

292 In the diagram below of right triangle \( JTM \), \( JT = 12 \), \( JM = 6 \), and \( \angle JMT = 90 \).

What is the value of \( \cot J \)?

1) \( \frac{\sqrt{3}}{3} \)
2) \( \frac{2}{\sqrt{3}} \)
3) \( \frac{\sqrt{3}}{2} \)
4) \( \frac{2\sqrt{3}}{3} \)
293 The solution set of $\sqrt{3x + 16} = x + 2$ is
1) $\{-3, 4\}$
2) $\{-4, 3\}$
3) $\{3\}$
4) $\{-4\}$

294 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) $\frac{\sqrt{3}}{a}$

295 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

296 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 $g(x) = -\frac{1}{2}x + 4$

297 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.

298 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) $\frac{2}{3}$
299 What is the value of $x$ in the equation $\log_5 x = 4$?
1) 1.16  
2) 20  
3) 625  
4) 1,024

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

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

302 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?
303 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) \( 2\pi \)

304 What is the solution set of the equation \( |4a + 6| - 4a = -10 \)?

1) \( \emptyset \)
2) \( \{0\} \)
3) \( \left\{ \frac{1}{2} \right\} \)
4) \( \left\{ 0, \frac{1}{2} \right\} \)

305 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

306 The solutions of the equation \( y^2 - 3y = 9 \) are

1) \( \frac{3 \pm 3i \sqrt{3}}{2} \)
2) \( \frac{3 \pm 3i \sqrt{5}}{2} \)
3) \( \frac{-3 \pm 3 \sqrt{5}}{2} \)
4) \( \frac{3 \pm 3 \sqrt{5}}{2} \)

307 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

308 Which ratio represents \( \csc A \) in the diagram below?

309 The expression \( 2i^2 + 3i^3 \) is equivalent to

1) \( -2 - 3i \)
2) \( 2 - 3i \)
3) \( -2 + 3i \)
4) \( 2 + 3i \)
310 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.

311 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.

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

313 Solve algebraically for \( x \): \( 16^{2x^3} = 64^{x^2} \)

314 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) \( \frac{5}{18} \)

315 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.

316 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.

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

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

1) \(-30°\)
2) \(60°\)
3) \(150°\)
4) \(240°\)
319 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

320 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

321 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?

322 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) $\frac{7\pi}{6}$

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

324 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.

325 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) $\frac{7\pi}{3}$
326 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.

327 In the diagram below of right triangle \(KTW\), \(KW = 6\), \(KT = 5\), and \(m \angle KTW = 90\).

What is the measure of \(\angle K\), to the nearest minute?
1) 33°33'
2) 33°34'
3) 33°55'
4) 33°56'

328 The roots of the equation \(2x^2 + 7x - 3 = 0\) are
1) \(-\frac{1}{2}\) and \(-3\)
2) \(\frac{1}{2}\) and 3
3) \(-\frac{7 + \sqrt{73}}{4}\)
4) \(\frac{7 + \sqrt{73}}{4}\)

329 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

330 Find the total number of different twelve-letter arrangements that can be formed using the letters in the word \(PENNSYLVANIA\).

331 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?

332 Which graph best represents the inequality \(y + 6 \geq x^2 - x\)?
333 Which graph represents a one-to-one function?

1) 

2) 

3) 

4) 

334 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) \(\log \frac{2xz}{3y}\)
335 Express $\left(\frac{2}{3}x - 1\right)^2$ as a trinomial.

336 Which equation represents the circle shown in the graph below that passes through the point $(0, -1)$?

![Circle graph]

1) $(x - 3)^2 + (y + 4)^2 = 16$
2) $(x - 3)^2 + (y + 4)^2 = 18$
3) $(x + 3)^2 + (y - 4)^2 = 16$
4) $(x + 3)^2 + (y - 4)^2 = 18$

337 Express $\sqrt[3]{108x^5y^8}$ in simplest radical form.

339 What is the fourth term in the expansion of $(3x - 2)^5$?

1) $-720x^2$
2) $-240x$
3) $720x^2$
4) $1,080x^3$

340 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) $\sum_{k=1}^{39} (2k - 1)$

341 The value of the expression $\sum_{n=0}^{2} (n^2 + 2^n)$ is

1) 12
2) 22
3) 24
4) 26

338 Find all values of $\theta$ in the interval $0^\circ \leq \theta < 360^\circ$ that satisfy the equation $\sin 2\theta = \sin \theta$. 

48
342 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) \( \left\{ x \mid -\frac{\pi}{2} < x < \frac{3\pi}{2}\right\} \)

343 Solve algebraically for \( x \):

\[
\frac{1}{x+3} - \frac{2}{3-x} = \frac{4}{x^2 - 9}
\]

344 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) \( \sin 55^\circ \)

345 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) \( \frac{37}{3} \)

346 In simplest form, \( \sqrt{-300} \) is equivalent to

1) \( 3i\sqrt{10} \)

2) \( 5i\sqrt{12} \)

3) \( 10i\sqrt{3} \)

4) \( 12i\sqrt{5} \)

347 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

348 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
349 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

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

351 In $\triangle ABC$, $\angle A = 74$, $a = 59.2$, and $c = 60.3$. What are the two possible values for $\angle C$, 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

352 The value of the expression $\sum_{r=3}^{5} (-r^2 + r)$ is
1) −38
2) −12
3) 26
4) 62

353 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.

354 Which graph does not represent a function?

355 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) $2x^2(2x + 3)(3x - 2)$
356 In which graph is \( \theta \) coterminal with an angle of 
\(-70^\circ\)?

1)  

2)  

3)  

4)  

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

358 Which graph shows \( y = \cos^{-1}x \)?

1)  

2)  

3)  

4)  
359 Solve algebraically for $x$: \( \log_{x^3 + x - 2} x = 2 \)

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

361 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.

362 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.

363 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?

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

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

1) \( \frac{1}{3^{\sqrt[3]{(x^2 - 1)^{2}}} } \)
2) \( \frac{1}{3^{\sqrt[3]{(x^2 - 1)^2}}} \)
3) \( \sqrt[3]{(x^2 - 1)^{3}} \)
4) \( \frac{1}{3^{\sqrt[3]{(x^2 - 1)^{3}}}} \)

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 solution set of \( 4x^2 + 4x = 2^{-6} \) is

1) \( \{1, 3\} \)
2) \( \{-1, 3\} \)
3) \( \{-1, -3\} \)
4) \( \{1, -3\} \)
368 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) \( -\frac{4\sqrt{5}}{9} \)

369 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) \( -\cos^2 \theta - 1 \)

370 The expression \( \cos 4x \cos 3x + \sin 4x \sin 3x \) is equivalent to

1) \( \sin x \)
2) \( \sin 7x \)
3) \( \cos x \)
4) \( \cos 7x \)

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

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

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

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

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

374 Graph the inequality \(-3|6 - x| < -15\) for \( x \). Graph the solution on the line below.
375 The graph below represents the function \( y = f(x) \).

State the domain and range of this function.

376 The expression \( \log_5 \left( \frac{1}{25} \right) \) is equivalent to

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

377 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) \( \frac{8}{9} \)

378 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) \( 6\pi \)

379 The solution set of the inequality \( x^2 - 3x > 10 \) is

1) \( \{x \mid -2 < x < 5\} \)
2) \( \{x \mid 0 < x < 3\} \)
3) \( \{x \mid x < -2 \text{ or } x > 5\} \)
4) \( \{x \mid x < -5 \text{ or } x > 2\} \)

380 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) \( \cos A = \frac{8}{5} \)

381 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) \( b_n = 10(2)^{n-1} \)
382 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

383 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

384 The expression \( \frac{a^2 b^{-3}}{a^{-4} b^2} \) is equivalent to
1) \( \frac{a^6}{b^5} \)
2) \( \frac{b^5}{a^6} \)
3) \( \frac{a^2}{b} \)
4) \( a^{-2} b^{-1} \)

385 The product of \( i^7 \) and \( i^5 \) is equivalent to
1) 1
2) \(-1\)
3) \(i\)
4) \(-i\)

386 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) \( \{-2, 0, 3\} \)

387 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

388 Write a quadratic equation such that the sum of its roots is 6 and the product of its roots is -27.
389 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>1</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  

390 What is the fifteenth term of the sequence 5, −10, 20, −40, 80, . . .?
1) −163,840  
2) −81,920  
3) 81,920  
4) 327,680  

391 Express the sum 7 + 14 + 21 + 28 + . . . + 105 using sigma notation.

392 Which graph represents one complete cycle of the equation \( y = \sin 3\pi x \)?

393 Which arithmetic sequence has a common difference of 4?
1) \{0, 4n, 8n, 12n, . . .\}  
2) \{n, 4n, 16n, 64n, . . .\}  
3) \{n + 1, n + 5, n + 9, n + 13, . . .\}  
4) \{n + 4, n + 16, n + 64, n + 256, . . .\}
Factor the expression $12t^8 - 75t^4$ completely.

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

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

Samantha constructs the scatter plot below from a set of data.

Based on her scatter plot, which regression model would be most appropriate?

1) exponential
2) linear
3) logarithmic
4) power

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

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.

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.

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

Express as a single fraction the exact value of $\sin 75^\circ$. 

403 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.

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

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

406 The graph below shows the function $f(x)$.

Which graph represents the function $f(x + 2)$?

407 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
408 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

409 Which equation is represented by the graph below?

1) \( y = 5^x \)
2) \( y = 0.5^x \)
3) \( y = 5^{-x} \)
4) \( y = 0.5^{-x} \)

411 Evaluate \( e^{\ln y} \) when \( x = 3 \) and \( y = 2 \).

412 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) \( -5ab\sqrt{2b} + 7ab\sqrt{6b} \)

413 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.

414 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

415 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.
416 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 

417 What is the coefficient of the fourth term in the expansion of \((a - 4b)^9\)? 
1) \(-5,376\) 
2) \(-336\) 
3) \(336\) 
4) \(5,376\)

418 When \(x^{-1} - 1\) is divided by \(x - 1\), the quotient is 
1) \(-1\) 
2) \(-\frac{1}{x}\) 
3) \(\frac{1}{x^2}\) 
4) \(\frac{1}{(x - 1)^2}\)

419 What is the conjugate of \(-2 + 3i\)? 
1) \(-3 + 2i\) 
2) \(-2 - 3i\) 
3) \(2 - 3i\) 
4) \(3 + 2i\)

420 Which graph represents a relation that is not a function?

421 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 \(\tan(A + B)\).
422 If a function is defined by the equation \( f(x) = 4^x \), which graph represents the inverse of this function?

[Graphs 1, 2, 3, 4]

424 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) \(4\)

425 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) \( f(x) = \log_2 x \)

426 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
427 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

428 What is the solution of the equation $2 \log_4(5x) = 3$?

1) 6.4
2) 2.56
3) $\frac{9}{5}$
4) $\frac{8}{5}$

429 What is the common difference of the arithmetic sequence 5, 8, 11, 14?

1) $\frac{8}{5}$
2) $-3$
3) 3
4) 9
1 ANS: 4
\[
\frac{4 \cdot 0 + 6 \cdot 1 + 10 \cdot 2 + 0 \cdot 3 + 4k + 2 \cdot 5}{4 + 6 + 10 + 0 + k + 2} = 2
\]
\[
\frac{4k + 36}{k + 22} = 2
\]
\[
4k + 36 = 2k + 44
\]
\[
k = 4
\]
PTS: 2 REF: 061221a2 STA: A2.S.3 TOP: Average Known with Missing Data

2 ANS: 4
PTS: 2 REF: 011201a2 STA: A2.S.2 TOP: Analysis of Data

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

4 ANS:
\[
\frac{-(x^2 - 4)}{(x + 4)(x + 3)} \times \frac{x + 3}{2(x - 2)} = \frac{-(x + 2)(x - 2)}{x + 4} \times \frac{1}{2(x - 2)} = \frac{-(x + 2)}{2(x + 4)}
\]
PTS: 4 REF: 061236a2 STA: A2.A.16 TOP: Multiplication and Division of Rationals KEY: division

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

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

PTS: 2 REF: 011303a2 STA: A2.S.8 TOP: Correlation Coefficient

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

8 ANS: 2
PTS: 2 REF: 011208a2 STA: A2.A.67 TOP: Proving Trigonometric Identities

9 ANS: 1
PTS: 2 REF: 061202a2 STA: A2.A.51 TOP: Domain and Range
10 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

11 ANS: 2 PTS: 2 REF: 011417a2 STA: A2.S.9

TOP: Differentiating Permutations and Combinations

12 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

13 ANS: 2 PTS: 2 REF: 061216a2 STA: A2.A.42

TOP: Compositions of Functions KEY: variables

14 ANS: 1 (4) shows the strongest linear relationship, but if \( r < 0, b < 0 \). The Regents announced that a correct solution was not provided for this question and all students should be awarded credit.

PTS: 2 REF: 011223a2 STA: A2.S.8 TOP: Correlation Coefficient

15 ANS:

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

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

KEY: radians

16 ANS: 4

\[\frac{10}{4} = 2.5\]

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

17 ANS: 3

\[\log_4 m^2 = \log_4 + \log m^2 = \log_4 + 2\log m\]


KEY: splitting logs
18 ANS: 4
\[
\frac{x}{x - \sqrt{x}} \cdot \frac{x + \sqrt{x}}{x + \sqrt{x}} = \frac{x^2 + x\sqrt{x}}{x^2 - x} = \frac{x(x + \sqrt{x})}{x(x - 1)} = \frac{x + \sqrt{x}}{x - 1}
\]
PTS: 2 REF: 061325a2 STA: A2.A.15 TOP: Rationalizing Denominators
KEY: index = 2

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

20 ANS: 3
\[
\sqrt{9} \sqrt[16]{-1} \sqrt{2} - \sqrt{16} \sqrt[16]{-1} \sqrt{2} = 3i \sqrt{2} - 4i \sqrt{2} = -i \sqrt{2}
\]
PTS: 2 REF: 061404a2 STA: A2.N.6 TOP: Square Roots of Negative Numbers

21 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

KEY: modeling

23 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

24 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

25 ANS:
\[
\frac{100}{\sin 33} = \frac{x}{\sin 32} \Rightarrow \sin 66 \approx \frac{T}{97.3} \\
x \approx 97.3 \quad t \approx 88
\]
KEY: advanced
26 ANS: 
\[ \frac{2\sqrt{3}}{3} \]. If \( \sin 60^\circ = \frac{\sqrt{3}}{2} \), then \( \csc 60^\circ = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{3} = \frac{2\sqrt{3}}{3} \)

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

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

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

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


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

31 ANS: 2  PTS: 2  REF: 011225a2  STA: A2.A.43  TOP: Defining Functions

32 ANS: 1  PTS: 2  REF: 011203a2  STA: A2.A.66  TOP: Determining Trigonometric Functions

33 ANS: 1  PTS: 2  REF: 011210a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

34 ANS: 3  PTS: 2  REF: 011403a2  STA: A2.A.42  TOP: Compositions of Functions  KEY: numbers
35 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

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

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

37 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

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

39 ANS:
\[
\frac{27}{\sin 75} = \frac{F_1}{\sin 60}, \quad \frac{27}{\sin 75} = \frac{F_2}{\sin 45}, \quad F_1 \approx 24, \quad F_2 \approx 20
\]

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

40 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
41 ANS: 1
\[
\frac{6}{\sin 35} = \frac{10}{\sin N}
\]
\[N \approx 73\]
\[73 + 35 < 180\]
\[(180 - 73) + 35 < 180\]

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

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

43 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

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

45 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

46 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

47 ANS: 2
\[
-\frac{3}{32} a^3 b^4 = -\frac{6b}{a^2}
\]
\[
\frac{1}{64} a^5 b^3
\]

PTS: 2 REF: 061326a2 STA: A2.A.31 TOP: Sequences

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

PTS: 2 REF: 011435a2 STA: A2.A.61 TOP: Arc Length
KEY: arc length
49  ANS: 3
\[
\frac{4x-5}{3} > 1 \text{ or } \frac{4x-5}{3} < -1
\]
\[
4x - 5 > 3 \quad 4x - 5 < -3
\]
\[
4x > 8 \quad 4x < 2
\]
\[
x > 2 \quad x < \frac{1}{2}
\]

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

KEY: graph

50  ANS: 3  PTS: 2  REF: 011305a2  STA: A2.A.38  TOP: Defining Functions

KEY: graphs

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

52  ANS: 3
\[
\sqrt[3]{4^3a^{15}} = 4^a 3^{\frac{5}{3}}a
\]

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

KEY: index > 2

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

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

54  ANS:
\[
81x^3 + 2x^2 = 27 \quad 3^x
\]
\[
\left(3^4\right)x^3 + 2x^2 = \left(3^3\right)^{\frac{5x}{3}}
\]
\[
3^{4x^3 + 8x^2} = 3^{5x}
\]
\[
4x^3 + 8x^2 - 5x = 0
\]
\[
x(4x^2 + 8x - 5) = 0
\]
\[
x(2x - 1)(2x + 5) = 0
\]
\[
x = 0, \frac{1}{2}, -\frac{5}{2}
\]

PTS: 6  REF: 061239a2  STA: A2.A.27  TOP: Exponential Equations

KEY: common base not shown

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

PTS: 2  REF: 061231a2  STA: A2.S.7  TOP: Exponential Regression
56 ANS: 
\[ \sigma_e = 14.9. \ x = 40. \ There \ are \ 8 \ scores \ between \ 25.1 \ and \ 54.9. \]

PTS: 4   REF: 061237a2   STA: A2.S.4   TOP: Dispersion
KEY: advanced

57 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

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

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

59 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

60 ANS: 4
\[ 3 C_2 \left( \frac{5}{8} \right)^2 \left( \frac{3}{8} \right)^1 = \frac{225}{512} \]

PTS: 2   REF: 011221a2   STA: A2.S.15   TOP: Binomial Probability
KEY: spinner

61 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
62 ANS: 2

\[ 320 = 10(2)^{\frac{t}{60}} \]

\[ 32 = (2)^{\frac{t}{60}} \]

\[ \log 32 = \log (2)^{\frac{t}{60}} \]

\[ \log 32 = \frac{t \log 2}{60} \]

\[ \frac{60 \log 32}{\log 2} = t \]

\[ 300 = t \]

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

63 ANS: 3

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

\[ \frac{6}{n} < \frac{4}{n} \]

\[ 6 > 4 \]

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

64 ANS: 4

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

65 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

66 ANS: 2

\[ \frac{8\pi}{5} \cdot \frac{180}{\pi} = 288 \]

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

KEY: degrees

67 ANS: 4 PTS: 2 REF: 011406a2 STA: A2.S.1 TOP: Analysis of Data
\[ \frac{6! P_6}{3! 2!} = \frac{720}{12} = 60 \]

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

69  ANS: 1  PTS: 2  REF: 011402a2  STA: A2.A.8  TOP: Negative and Fractional Exponents

\[ x^2 + y^2 - 16x + 6y + 53 = 0 \\
\]
\[ x^2 - 16x + 64 + y^2 + 6y + 9 = -53 + 64 + 9 \\
\]
\[ (x - 8)^2 + (y + 3)^2 = 20 \]

PTS: 2  REF: 011415a2  STA: A2.A.47  TOP: Equations of Circles

71  ANS: 2  PTS: 2  REF: 061421a2  STA: A2.A.76  TOP: Angle Sum and Difference Identities

\[ \cos(x - y) = \cos x \cos y + \sin x \sin y \]
\[ = b \cdot b + a \cdot a \]
\[ = b^2 + a^2 \]

KEY: simplifying

72  ANS:

\[ 800. \ x = 4^{2.5} = 32. \ \frac{\sqrt{2}}{2} = 125 \]
\[ \frac{x}{y} = \frac{32}{1} = 800 \]
\[ y = 125 \cdot \frac{2}{3} = \frac{250}{25} \]

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

KEY: advanced

73  ANS:

\[ 5 \csc \theta = 8 \]
\[ \csc \theta = \frac{8}{5} \]
\[ \sin \theta = \frac{5}{8} \]
\[ \theta \approx 141 \]

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

KEY: reciprocal functions
74. ANS: 1

75. ANS:
\[(x + 4)^2 = 17x - 4\]
\[x^2 + 8x + 16 = 17x - 4\]
\[x^2 - 9x + 20 = 0\]
\[(x - 4)(x - 5) = 0\]
\[x = 4, 5\]

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

77. ANS:
\[\cot x \sin x \frac{\cos x}{\sec x} = \frac{\cos x \sin x}{\sin x} = \cos^2 x\]

78. ANS: 3

79. ANS:
Less than 60 inches is below 1.5 standard deviations from the mean. 0.067 \cdot 450 \approx 30

PTS: 2  REF: 061225a2  STA: A2.S.8  TOP: Correlation Coefficient
PTS: 2  REF: 061225a2  STA: A2.S.8  TOP: Correlation Coefficient
PTS: 4  REF: 011336a2  STA: A2.A.28  TOP: Logarithmic Equations
KEY: basic
PTS: 2  REF: 011228a2  STA: A2.A.4  TOP: Quadratic Inequalities
KEY: one variable
PTS: 2  REF: 061334a2  STA: A2.A.58  TOP: Reciprocal Trigonometric Relationships
PTS: 2  REF: 061428a2  STA: A2.S.5  TOP: Normal Distributions
KEY: predict
\[
\frac{13}{\sin 40} = \frac{20}{\sin M}. \quad 81 + 40 < 180. \quad (180 - 81) + 40 < 180
\]
\[M \approx 81\]

PTS: 2  REF: 061327a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

81 ANS: 2
Top 6.7% = 1.5 s.d.  + \sigma = 1.5(104) + 576 = 732

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

82 ANS:
\[g(10) = \left( a(10)\sqrt{1-x} \right)^2 = 100a^2(-9) = -900a^2\]

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

83 ANS: 3
\[x + y = 5 \quad -5 + y = 5\]
\[y = -x + 5 \quad y = 10\]
\[(x + 3)^2 + (-x + 5 - 3)^2 = 53\]
\[x^2 + 6x + 9 + x^2 - 4x + 4 = 53\]
\[2x^2 + 2x - 40 = 0\]
\[x^2 + x - 20 = 0\]
\[(x + 5)(x - 4) = 0\]
x = -5, 4

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

84 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 = \pm2, -5

PTS: 4  REF: 061437a2  STA: A2.A.26  TOP: Solving Polynomial Equations
85 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

86 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

87 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

88 ANS:
\[ 5C_0 \cdot 0.57^0 \cdot 0.43^5 + 5C_1 \cdot 0.57^1 \cdot 0.43^4 + 5C_2 \cdot 0.57^2 \cdot 0.43^3 \approx 0.37 \]

KEY: at least or at most

89 ANS: 1
\[ 5x + 29 = (x + 3)^2 \]
\[ \cdot (-5) + 3 \] 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
\[
\begin{align*}
\frac{a + b}{c} &= \frac{ac + b}{cd - b} = \frac{ac + b}{c} \cdot \frac{c}{cd - b} = \frac{ac + b}{cd - b} \\
\frac{d - b}{c} &= \frac{1}{x + 1} = \frac{1 + x}{x + 1} = \frac{1}{x} \\
\end{align*}
\]
97 ANS: 1
$(4a + 4) - (2a + 1) = 2a + 3$

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

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

TOP: Analysis of Data

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

PTS: 2 REF: 061201a2 STA: A2.N.3 TOP: Operations with Polynomials

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

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

101 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

102 ANS: 3
\[\binom{3}{1} \cdot \binom{5}{2} = 3 \cdot 10 = 30\]

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

103 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

104 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: 061310a2 STA: A2.A.5 TOP: Inverse Variation

105 ANS: 3 PTS: 2 REF: 011422a2 STA: A2.A.54 TOP: Graphing Logarithmic Functions
106 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

107 ANS: 3
\[ 2! \cdot 2! \cdot 2! = 8 \]

PTS: 2  REF: 061425a2  STA: A2.S.10  TOP: Permutations

108 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

109 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

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

KEY: applying properties of logarithms

111 ANS: 4
\[ _{15}C_5 = 3,003. \quad _{25}C_5 = _{25}C_{20} = 53,130. \quad _{25}C_{15} = 3,268,760. \]

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

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

113 ANS: 1
PTS: 2  REF: 011310a2  STA: A2.S.9  TOP: Differentiating Permutations and Combinations
114 ANS: 3
\[20 \cdot 2 = -5t\]
\[-8 = t\]

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

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

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

116 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

117 ANS: 3 PTS: 2 REF: 061407a2 STA: A2.N.3 TOP: Operations with Polynomials

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

PTS: 2 REF: 061229a2 STA: A2.A.12 TOP: Evaluating Exponential Expressions

119 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

120 ANS: 2
The binomials are conjugates, so use FL.

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

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

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

122 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
\[
\log_2 x^3 = \log_2 + \log x^3 = \log_2 + 3 \log x
\]

PTS: 2 REF: 061426a2 STA: A2.A.19 TOP: Properties of Logarithms
KEY: splitting logs

\[
\cot x = \frac{\cos x}{\sin x} = \cos x
\]

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

\[
x^3 + 3x^2 - 4x - 12
\]

\[
x^2(x + 3) - 4(x + 3)
\]

\[
(x^2 - 4)(x + 3)
\]

\[
(x + 2)(x - 2)(x + 3)
\]

PTS: 2 REF: 061214a2 STA: A2.A.7 TOP: Factoring by Grouping

\[
(3i)(2i)^2(m + i)
\]

\[
(3i)(4i^2)(m + i)
\]

\[
(3i)(-4)(m + i)
\]

\[
(-12i)(m + i)
\]

\[-12mi - 12i^2
\]

\[-12mi + 12
\]

PTS: 2 REF: 061319a2 STA: A2.N.9 TOP: Multiplication and Division of Complex Numbers

As originally written, alternatives (2) and (3) had no domain restriction, so that both were correct.
<table>
<thead>
<tr>
<th>ID: A</th>
<th>132</th>
<th>ANS: 3</th>
<th>PTS: 2</th>
<th>REF: 061418a2</th>
<th>STA: A2.A.51</th>
<th>TOP: Domain and Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>133</td>
<td>ANS: 4</td>
<td>PTS: 2</td>
<td>REF: 061206a2</td>
<td>STA: A2.A.60</td>
<td></td>
<td>TOP: Unit Circle</td>
</tr>
<tr>
<td>134</td>
<td>ANS: (<em>{25}C</em>{20} = 53, 130)</td>
<td>PTS: 2</td>
<td>REF: 011232a2</td>
<td>STA: A2.S.11</td>
<td>TOP: Combinations</td>
<td></td>
</tr>
<tr>
<td>135</td>
<td>ANS: (x \pm \sigma) (153 \pm 22) (131 - 175)</td>
<td>PTS: 2</td>
<td>REF: 011307a2</td>
<td>STA: A2.S.5</td>
<td>TOP: Normal Distributions</td>
<td></td>
</tr>
<tr>
<td>136</td>
<td>ANS: ( \sqrt[3]{6a^4b^2 + \frac{1}{3}(27 \cdot 6)a^4b^2} ) (a^3\sqrt[3]{6ab^2 + 3a^2\sqrt[3]{6ab^2}}) (4a^3\sqrt[3]{6ab^2})</td>
<td>PTS: 2</td>
<td>REF: 011319a2</td>
<td>STA: A2.N.2</td>
<td>TOP: Operations with Radicals</td>
<td></td>
</tr>
<tr>
<td>137</td>
<td>ANS: (K = ab\sin C = 18 \cdot 22\sin 60 = 396 \cdot \frac{\sqrt{3}}{2} = 198\sqrt{3})</td>
<td>PTS: 2</td>
<td>REF: 061234a2</td>
<td>STA: A2.A.74</td>
<td>TOP: Using Trigonometry to Find Area</td>
<td></td>
</tr>
<tr>
<td>138</td>
<td>ANS: 3</td>
<td>PTS: 2</td>
<td>REF: 011212a2</td>
<td>STA: A2.S.5</td>
<td>TOP: Normal Distributions</td>
<td></td>
</tr>
<tr>
<td>139</td>
<td>ANS: 3</td>
<td>PTS: 2</td>
<td>REF: 011207a2</td>
<td>STA: A2.A.71</td>
<td>TOP: Graphing Trigonometric Functions</td>
<td></td>
</tr>
</tbody>
</table>
\[
\frac{1}{4}C_3 \left( \frac{1}{4} \right)^3 \left( \frac{3}{4} \right)^4 = 35 \left( \frac{1}{64} \right) \left( \frac{81}{256} \right) = \frac{2835}{16384} \approx 0.173
\]

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

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

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

\[
1000 = 500e^{0.05t}
\]

\[
2 = e^{0.05t}
\]

\[
\ln 2 = \ln e^{0.05t}
\]

\[
\ln 2 = \frac{0.05 \cdot \ln e}{0.05}
\]

\[
13.9 \approx t
\]

PTS: 2  
REF: 061313a2  
STA: A2.A.6  
TOP: Exponential Growth

\[
\sec \theta \sin \theta \cot \theta = \frac{1}{\cos \theta} \cdot \sin \theta \cdot \frac{\cos \theta}{\sin \theta} = 1
\]

PTS: 2  
REF: 011428a2  
STA: A2.A.58  
TOP: Reciprocal Trigonometric Relationships

\[
\frac{1}{2} (7.4)(3.8) \sin 126 \approx 11.4
\]

PTS: 2  
REF: 011218a2  
STA: A2.A.74  
TOP: Using Trigonometry to Find Area

\[
2x - 3 > 5 \text{ or } 2x - 3 < -5
\]

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

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

PTS: 2  
REF: 061430a2  
STA: A2.A.1  
TOP: Absolute Value Inequalities
149 ANS: 
\((x + yi)(x - yi) = x^2 - y^2i^2 = x^2 + y^2\)

PTS: 2  REF: 061432a2  STA: A2.N.8  TOP: Conjugates of Complex Numbers

150 ANS: 
\[\begin{align*}
a + 15 + 2a &= 90 \\
3a + 15 &= 90 \\
3a &= 75 \\
a &= 25
\end{align*}\]

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

151 ANS: 3
If \(\csc P > 0, \sin P > 0\). If \(\cot P < 0\) and \(\sin P > 0\), \(\cos P < 0\)

PTS: 2  REF: 061320a2  STA: A2.A.60  TOP: Finding the Terminal Side of an Angle

152 ANS: 1
TOP: Negative Exponents

153 ANS: 
\[\begin{align*}
x(x + 3) &= 10 \\
x^2 + 3x - 10 &= 0 \\
(x + 5)(x - 2) &= 0 \\
x &= -5, 2
\end{align*}\]

PTS: 2  REF: 011431a2  STA: A2.A.3  TOP: Quadratic-Linear Systems
KEY: equations

154 ANS: 4
PTS: 1  REF: 011312a2  STA: A2.A.56
TOP: Determining Trigonometric Functions
KEY: degrees, common angles

155 ANS: 4
\[
\sin(\theta + 90) = \sin \theta \cdot \cos 90 + \cos \theta \cdot \sin 90 = \sin \theta \cdot (0) + \cos \theta \cdot (1) = \cos \theta
\]

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

156 ANS: 4

PTS: 2  REF: 061222a2  STA: A2.A.50  TOP: Solving Polynomial Equations
\[(x + 2)^2 = -9\]
\[x + 2 = \pm \sqrt{-9}\]
\[x = -2 \pm 3i\]

PTS: 2 REF: 011408a2 STA: A2.A.24 TOP: Completing the Square

\[3 \times \frac{180}{\pi} \approx 171.89^\circ \approx 171^\circ 53'.\]

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

\[8^{3k + 4} = 4^{2k - 1} \cdot \]
\[(2^3)^{3k + 4} = (2^2)^{2k - 1} \cdot \]
\[2^{9k + 12} = 2^{4k - 2} \cdot \]
\[9k + 12 = 4k - 2 \cdot \]
\[5k = -14 \cdot \]
\[k = -\frac{14}{5} \cdot \]

PTS: 2 REF: 011309a2 STA: A2.A.27 TOP: Exponential Equations

\[2x^2 - 7x - 5 = 0\]
\[
\frac{c}{a} = \frac{-5}{2} \cdot \]

PTS: 2 REF: 061414a2 STA: A2.A.20 TOP: Roots of Quadratics

\[c_{2} = \frac{5}{2} \cdot \]

PTS: 2 REF: 011301a2 STA: A2.A.53 TOP: Graphing Exponential Functions

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
\[
\frac{1}{2} (22)(13) \sin 55 \approx 117
\]

PTS: 2  REF: 061403a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area

KEY: basic

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

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

\[i^{18} + i^{18} + i^{31} + n = 0\]
\[i + (-1) - i + n = 0\]
\[-1 + n = 0\]
\[n = 1\]

PTS: 2  REF: 061228a2  STA: A2.N.7  TOP: Imaginary Numbers

TOP: Analysis of Data

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

PTS: 2  REF: 011304a2  STA: A2.A.31  TOP: Sequences

TOP: Domain and Range

KEY: real domain

\[x = 2y. \quad y^2 - (3y)^2 + 32 = 0. \quad x = 3(-2) = -6\]

\[y^2 - 9y^2 = -32\]
\[-8y^2 = -32\]
\[y^2 = 4\]
\[y = \pm 2\]

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

KEY: equations

\[g \left( \frac{1}{2} \right) = \frac{1}{1} = 2. \quad f(2) = 4(2) - 2^2 = 4\]

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

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

PTS: 6  REF: 011339a2  STA: A2.A.22  TOP: Solving Radicals
KEY: extraneous solutions

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

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

173 ANS: 1  PTS: 2  REF: 061420a2  STA: A2.A.34
TOP: Sigma Notation

174 ANS:

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

175 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
176 ANS:
\[ 2x - 1 = 27 \]
\[ 2x = 28 \]
\[ x = 14 \]

PTS: 2 REF: 061329a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: advanced

177 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

178 ANS:
\[ 3x^3 - 5x^2 - 48x + 80 \]
\[ x^2(3x - 5) - 16(3x - 5) \]
\[ (x^2 - 16)(3x - 5) \]
\[ (x + 4)(x - 4)(3x - 5) \]

PTS: 2 REF: 011317a2 STA: A2.A.7 TOP: Factoring by Grouping

179 ANS:
\[ \text{Sum } \frac{b}{a} = -\frac{1}{12} \]
\[ \text{Product } \frac{c}{a} = -\frac{1}{2} \]

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

180 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

181 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

KEY: determine nature of roots given equation
183 ANS:  
\[ y = 0.488(1.116)^x \]

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

184 ANS: 3   PTS: 2   REF: 061308ge   STA: A2.A.51   TOP: Domain and Range

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

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

PTS: 2   REF: 061315a2   STA: A2.N.10   TOP: Sigma Notation   KEY: advanced

187 ANS:  
\[-104. \]

PTS: 2   REF: 011230a2   STA: A2.N.10   TOP: Sigma Notation   KEY: basic

188 ANS:  
\[ \frac{15}{\sin 103} = \frac{a}{\sin 42} \cdot \frac{1}{2} \cdot (15)(10.3) \sin 35 \approx 44 \]
\[ a \approx 10.3 \]

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

189 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
190 ANS:

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

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

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

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


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

192 ANS:

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

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

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

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


193 ANS: 2

\[ \frac{2\pi}{6} = \frac{\pi}{3} \]


194 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
\[ r = \sqrt{2^2 + 3^2} = \sqrt{13} \cdot (x + 5)^2 + (y - 2)^2 = 13 \]

196 ANS: 4

\[
\begin{align*}
&(a - 1)^2 + (a - 2)^2 + (a - 3)^2 + (a - 4)^2 \\
&= (a^2 - 2a + 1) + (a^2 - 4a + 4) + (a^2 - 6a + 9) + (a^2 - 8a + 16) \\
&= 4a^2 - 20a + 30
\end{align*}
\]

PTS: 2  REF: 011414a2  STA: A2.N.10  TOP: Sigma Notation  KEY: advanced

197 ANS: 1  PTS: 2  REF: 011416a2  STA: A2.A.39  TOP: Domain and Range  KEY: real domain

198 ANS: 2  PTS: 2  REF: 011213a2  STA: A2.N.8  TOP: Conjugates of Complex Numbers

199 ANS: 2

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

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

200 ANS:

\[
\begin{align*}
\sec x &= \sqrt{2} \\
\cos x &= \frac{1}{\sqrt{2}} \\
\cos x &= \frac{\sqrt{2}}{2} \\
\end{align*}
\]

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

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

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

202 ANS:

\[
\begin{align*}
-4x + 5 &< 13 \\
-4x + 5 &> -13 \\
-2 &< x < 4.5 \\
-4x &< 8 \\
-4x &> -18 \\
x &> -2 \\
x &< 4.5
\end{align*}
\]

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

203 ANS: 2  PTS: 2  REF: 061218a2  STA: A2.A.43  TOP: Defining Functions
204 ANS:
\[ 2.5 \cdot \frac{180}{\pi} \approx 143^\circ 14' \]

PTS: 2       REF: 061431a2   STA: A2.M.2   TOP: Radian Measure
KEY: degrees

205 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

206 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

207 ANS: 3
\[ S_8 = \frac{3(1 - (-4)^8)}{1 - (-4)} = \frac{196,605}{5} = -39,321 \]

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

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

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

209 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
210 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

211 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

212 ANS:  
\[ x^4 + 4x^3 + 4x^2 + 16x = 0 \]  
\[ x(x^3 + 4x^2 + 4x + 16) = 0 \]  
\[ x(x^2(x + 4) + 4(x + 4)) = 0 \]  
\[ x(x^2 + 4)(x + 4) = 0 \]  
\[ x = 0, \pm 2i, -4 \]


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

214 ANS:  
\[ \left( \frac{5x - 1}{3} \right)^3 = 4 \]  
\[ 5x - 1 = 64 \]  
\[ 5x = 65 \]  
\[ x = 13 \]

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

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

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

216 ANS: 4  
\[ x^2(x + 2) - (x + 2) \]  
\[ (x^2 - 1)(x + 2) \]  
\[ (x + 1)(x - 1)(x + 2) \]

PTS: 2  REF: 011426a2  STA: A2.A.7  TOP: Factoring by Grouping
\[ \sqrt{27^2 + 32^2 - 2(27)(32)\cos 132} \approx 54 \]

**ANS:**

\[ \sqrt{27^2 + 32^2 - 2(27)(32)\cos 132} \approx 54 \]

**PTS:** 4  
**REF:** 011438a2  
**STA:** A2.A.73  
**TOP:** Law of Cosines

**KEY:** applied

**218 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

**KEY:** applied

**219 ANS:** 2

\[ \log x^2 = \log 3 a + \log 2 a \]

\[ 2 \log x = \log 6 a^2 \]

\[ \log x = \frac{\log 6}{2} + \frac{\log a^2}{2} \]

\[ \log x = \frac{1}{2} \log 6 + \frac{2 \log a}{2} \]

\[ \log x = \frac{1}{2} \log 6 + \log a \]

**PTS:** 2  
**REF:** 011224a2  
**STA:** A2.A.19  
**TOP:** Properties of Logarithms

**KEY:** splitting logs

**220 ANS:** 1

\[ 2 \cdot \frac{180}{\pi} = \frac{360}{\pi} \]

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

**KEY:** degrees

**221 ANS:** 4

\[ \left( \frac{3}{\sqrt{27x^2}} \right) \left( \frac{3}{\sqrt{16x^4}} \right) = \frac{3\sqrt{3} \cdot 2^4 \cdot x^6}{3 \cdot 2 \cdot x^2 \sqrt{2}} = 6 \cdot x^3 \sqrt{2} \]

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

**222 ANS:** 3

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

**PTS:** 2  
**REF:** 011325a2  
**STA:** A2.A.16  
**TOP:** Addition and Subtraction of Rationals

**223 ANS:** 4

**PTS:** 2  
**REF:** 061318a2  
**STA:** A2.A.49  
**TOP:** Equations of Circles
ANS: \[
\frac{-2(x^2 + 6)}{x^4} \cdot \frac{x^2(x - 3) + 6(x - 3)}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} + \frac{x^2 + 2x - 8}{16 - x^2} \\
\left(\frac{x^2 + 6)(x - 3)}{x(x - 4)}\right) \cdot \frac{2(x - 2)}{x^3(x - 3)} \cdot \frac{(4 + x)(4 - x)}{(x + 4)(x - 2)} \\
\frac{-2(x^2 + 6)}{x^4}
\]

PTS: 6  REF: 011239a2  STA: A2.A.16  TOP: Multiplication and Division of Rationals

KEY: division

ANS: 4  PTS: 2  REF: 011219a2  STA: A2.A.52

TOP: Properties of Graphs of Functions and Relations

ANS: \[a_1 = 3, \ a_2 = 2(3) - 1 = 5, \ a_3 = 2(5) - 1 = 9.\]

PTS: 2  REF: 061233a2  STA: A2.A.33  TOP: Recursive Sequences

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


ANS: 4  PTS: 2  REF: 061402a2  STA: A2.A.8

TOP: Negative and Fractional Exponents

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

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

ANS: 2

\[
\sin^{-1}\left(\frac{8}{17}\right) \cdot \text{DMS} \approx 28^\circ 4' 20.953''
\]

\[
\sin S = \frac{8}{17}
\]

\[S = \sin^{-1} \frac{8}{17}\]

\[S \approx 28^\circ 4'\]

PTS: 2  REF: 061311a2  STA: A2.A.55  TOP: Trigonometric Ratios
\[ 8C_3 \cdot x^{8-3} \cdot (-2)^3 = 56x^5 \cdot (-8) = -448x^5 \]

PTS: 2  
REF: 011308a2  
STA: A2.A.36  
TOP: Binomial Expansions

\[ (-5)^2 - 4(2)(0) = 25 \]

PTS: 2  
REF: 061423a2  
STA: A2.A.2  
TOP: Using the Discriminant  
KEY: determine equation given nature of roots

\[ \sqrt{2x - 4} = x - 2 \]

\[ 2x - 4 = x^2 - 4x + 4 \]

\[ 0 = x^2 - 6x + 8 \]

\[ 0 = (x - 4)(x - 2) \]

\[ x = 4, 2 \]

PTS: 2  
REF: 061406a2  
STA: A2.A.22  
TOP: Solving Radicals  
KEY: extraneous solutions

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

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

\[ 3.45 \times \frac{180}{\pi} \approx 197^\circ 40' \]

PTS: 2  
REF: fall0931a2  
STA: A2.M.2  
TOP: Radian Measure  
KEY: degrees
Controlled experiment because Howard is comparing the results obtained from an experimental sample against a control sample.

\[
\frac{4}{5 - \sqrt{13}} \cdot \frac{5 + \sqrt{13}}{5 + \sqrt{13}} = \frac{4(5 + \sqrt{13})}{25 - 13} = \frac{5 + \sqrt{13}}{3}
\]

\(-3, -5, -8, -12\)

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

\(-3) = (-3)^2 - 6 = 3, \quad g(x) = 2^3 - 1 = 7.\]

\[
\text{Sum } \frac{-b}{a} = -\frac{11}{5}, \quad \text{Product } \frac{c}{a} = -\frac{3}{5}
\]

\[
\text{Sum } \frac{-b}{a} = -\frac{11}{5}, \quad \text{Product } \frac{c}{a} = -\frac{3}{5}
\]
244 ANS:  
45, 225 \[ 2 \tan C - 3 = 3 \tan C - 4 \]

\[ 1 = \tan C \]

\[ \tan^{-1} 1 = C \]

\[ C = 45, 225 \]

PTS: 2 REF: 081032a2 STA: A2.A.68 TOP: Trigonometric Equations

KEY: basic

245 ANS: 1 
\[ a_n = -\sqrt[5]{(-\sqrt{2})^{n-1}} \]

\[ a_{15} = -\sqrt[5]{(-\sqrt{2})^{15-1}} = -\sqrt[5]{(-\sqrt{2})^{14}} = -\sqrt[5]{2^7} = -128\sqrt[5]{2} \]

PTS: 2 REF: 061109a2 STA: A2.A.32 TOP: Sequences

246 ANS: 
\[ 5\sqrt{3x^3} - 2\sqrt{27x^3} = 5\sqrt{x^2 \cdot 3x} - 2\sqrt{9x^2 \cdot 3x} = 5x\sqrt{3x} - 6x\sqrt{3x} = -x\sqrt{3x} \]

PTS: 2 REF: 061032a2 STA: A2.N.2 TOP: Operations with Radicals

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

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

\[ 2^{4x+10} = 2^{9x} \]

\[ 4x + 10 = 9x \]

\[ 10 = 5x \]

\[ 2 = x \]

PTS: 2 REF: 061105a2 STA: A2.A.27 TOP: Exponential Equations

KEY: common base not shown

248 ANS: 4 
\[ (3 + \sqrt{5})(3 - \sqrt{5}) = 9 - \sqrt{25} = 4 \]

PTS: 2 REF: 081001a2 STA: A2.N.4 TOP: Operations with Irrational Expressions

KEY: without variables | index = 2

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

PTS: 2 REF: fall0920a2 STA: A2.A.17 TOP: Complex Fractions

250 ANS: 3 PTS: 2 REF: 061007a2 STA: A2.S.9 TOP: Differentiating Permutations and Combinations
251 ANS:
\[
\frac{\frac{1}{d} - \frac{4}{2d}}{\frac{1}{d} + \frac{3}{2d}} = \frac{d - 8}{2d} \times \frac{2d}{5d} = \frac{d - 8}{5}
\]

PTS: 2 REF: 061035a2 STA: A2.A.17 TOP: Complex Fractions

252 ANS: 7.4

PTS: 2 REF: 061029a2 STA: A2.S.4 TOP: Dispersion
KEY: basic, group frequency distributions

253 ANS: 4
\[
7^2 = 3^2 + 5^2 - 2(3)(5)\cos A \\
49 = 34 - 30\cos A \\
15 = -30\cos A \\
\frac{1}{2} = \cos A \\
120 = A
\]

PTS: 2 REF: 081017a2 STA: A2.A.73 TOP: Law of Cosines
KEY: angle, without calculator

254 ANS: 4
\[
y - 2\sin \theta = 3 \\
y = 2\sin \theta + 3 \\
f(\theta) = 2\sin \theta + 3
\]

PTS: 2 REF: fall0927a2 STA: A2.A.40 TOP: Functional Notation

255 ANS: 1
\[
8 \times 8 \times 7 \times 1 = 448. \text{ The first digit cannot be 0 or 5. The second digit cannot be 5 or the same as the first digit. The third digit cannot be 5 or the same as the first or second digit.}
\]

PTS: 2 REF: 011125a2 STA: A2.S.10 TOP: Permutations

256 ANS:
\[
K = ab\sin C = 24 \cdot 30\sin 57 \approx 604
\]

PTS: 2 REF: 061034a2 STA: A2.A.74 TOP: Using Trigonometry to Find Area
KEY: parallelograms
257 ANS: 1

\[ \tan \theta - \sqrt{3} = 0 \]

\[ \tan \theta = \sqrt{3} \]

\[ \theta = \tan^{-1} \sqrt{3} \]

\[ \theta = 60, 240 \]

PTS: 2 REF: fall0903a2 STA: A2.A.68 TOP: Trigonometric Equations

KEY: basic

258 ANS: 3

\[ 75000 = 25000e^{0.0475t} \]

\[ 3 = e^{0.0475t} \]

\[ \ln 3 = \ln e^{0.0475t} \]

\[ \frac{\ln 3}{0.0475} = \frac{0.0475t \cdot \ln e}{0.0475} \]

\[ 23.1 \approx t \]

PTS: 2 REF: 061117a2 STA: A2.A.6 TOP: Exponential Growth

259 ANS:

\[ \ln(T - T_0) = -kt + 4.718 \quad \ln(T - 68) = -0.104(10) + 4.718. \]

\[ \ln(150 - 68) = -k(3) + 4.718 \quad \ln(T - 68) = 3.678 \]

\[ 4.407 \approx -3k + 4.718 \quad T - 68 \approx 39.6 \]

\[ k \approx 0.104 \quad T \approx 108 \]


KEY: advanced

260 ANS: 4

PTS: 2 REF: 061026a2 STA: A2.A.29

TOP: Sequences

261 ANS: 2

\[ \frac{10}{\sin 35} = \frac{13}{\sin B} \quad 35 + 48 < 180 \]

\[ B \approx 48, 132 \quad 35 + 132 < 180 \]

PTS: 2 REF: 011113a2 STA: A2.A.75 TOP: Law of Sines - The Ambiguous Case
262 ANS: 
\[
\left( -\frac{9}{2}, \frac{1}{2} \right) \text{ and } \left( \frac{1}{2}, \frac{11}{2} \right).
\]
\[
y = x + 5 \quad \text{and} \quad 4x^2 + 17x - 4 = x + 5
\]
\[
y = 4x^2 + 17x - 4 \quad 4x^2 + 16x - 9 = 0
\]
\[
(2x + 9)(2x - 1) = 0
\]
\[
x = -\frac{9}{2} \text{ and } x = \frac{1}{2}
\]
\[
y = -\frac{9}{2} + 5 = \frac{1}{2} \text{ and } y = \frac{1}{2} + 5 = \frac{11}{2}
\]

PTS: 6 REF: 061139a2 STA: A2.A.3 TOP: Quadratic-Linear Systems
KEY: equations

263 ANS: 4
\[
x^{-\frac{2}{5}} = \frac{1}{2} = \frac{1}{\sqrt[5]{x^2}}
\]

PTS: 2 REF: 011118a2 STA: A2.A.10 TOP: Fractional Exponents as Radicals

264 ANS:
33. \( a = \sqrt[2]{10^2 + 6^2 - 2(10)(6)\cos 80} \approx 10.7 \). \( \angle C \) is opposite the shortest side. \( \frac{6}{\sin C} = \frac{10.7}{\sin 80} \)
\[
C \approx 33
\]

KEY: advanced

265 ANS: 3
Cofunctions tangent and cotangent are complementary

PTS: 2 REF: 061014a2 STA: A2.A.58 TOP: Cofunction Trigonometric Relationships

266 ANS: 4
(4) fails the horizontal line test. Not every element of the range corresponds to only one element of the domain.

PTS: 2 REF: fall0906a2 STA: A2.A.43 TOP: Defining Functions

267 ANS: 3
\[68\% \times 50 = 34\]

PTS: 2 REF: 081013a2 STA: A2.S.5 TOP: Normal Distributions
KEY: predict

268 ANS: 4 PTS: 2 REF: 061124a2 STA: A2.S.3 TOP: Average Known with Missing Data

269 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
270 ANS:

\[ \frac{\sqrt{3}}{2} \]

PTS: 2  REF: 061033a2  STA: A2.A.60  TOP: Unit Circle


272 ANS:

\[ y = 0 \]

PTS: 2  REF: 061031a2  STA: A2.A.53  TOP: Graphing Exponential Functions

273 ANS: 1

\[ \frac{4}{\sqrt{16x^2y^7}} = 16^\frac{1}{4} \times x^\frac{2}{4} y^\frac{7}{4} = 2x^\frac{1}{2} y^\frac{7}{4} \]

PTS: 2  REF: 061107a2  STA: A2.A.11  TOP: Radicals as Fractional Exponents
274 ANS:
\[ \pm \frac{3}{2}, -\frac{1}{2}. \quad 8x^3 + 4x^2 - 18x - 9 = 0 \]
\[ 4x^2(2x + 1) - 9(2x + 1) = 0 \]
\[ (4x^2 - 9)(2x + 1) = 0 \]
\[ 4x^2 - 9 = 0 \text{ or } 2x + 1 = 0 \]
\[ (2x + 3)(2x - 3) = 0 \quad x = -\frac{1}{2} \]
\[ \quad x = \pm \frac{3}{2} \]
PTS: 4 REF: fall0937a2 STA: A2.A.26 TOP: Solving Polynomial Equations

275 ANS: 1 PTS: 2 REF: 061018a2 STA: A2.A.22
TOP: Solving Radicals KEY: extraneous solutions

276 ANS: 1

PTS: 2 REF: 011123a2 STA: A2.A.71 TOP: Graphing Trigonometric Functions

277 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

278 ANS:
\[ 10 + (1^3 - 1) + (2^3 - 1) + (3^3 - 1) + (4^3 - 1) + (5^3 - 1) = 10 + 0 + 7 + 26 + 63 + 124 = 230 \]

PTS: 2 REF: 011131a2 STA: A2.N.10 TOP: Sigma Notation
KEY: basic

279 ANS: 2
\[ 8^2 = 64 \]

PTS: 2 REF: fall0909a2 STA: A2.A.18 TOP: Evaluating Logarithmic Expressions

280 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
The document contains a series of math problems and solutions, along with their corresponding answers and references. Here is a structured representation of the content:

**Problem 281**

\[ 9^{3x+1} = 27^{x+2} \]

\[ (3^2)^{3x+1} = (3^3)^{x+2} \]

\[ 3^{6x+2} = 3^{3x+6} \]

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

\[ 3x = 4 \]

\[ x = \frac{4}{3} \]

**Answer:** 4

**Reference:** 081008a2

**Standard:** A2.A.27

**Topic:** Exponential Equations

**Key:** common base not shown

**Problem 282**

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

\[ 3x = 4 \]

\[ x = \frac{4}{3} \]

**Answer:** 4

**Reference:** 081022a2

**Standard:** A2.A.46

**Topic:** Transformations with Functions and Relations

**Problem 283**

\[ 6x - 7 \leq 5 \]

\[ 6x - 7 \geq -5 \]

\[ 6x \leq 12 \]

\[ 6x \geq 2 \]

\[ x \leq 2 \]

\[ x \geq \frac{1}{3} \]

**Answer:** 1

**Reference:** 061013a2

**Standard:** A2.A.38

**Topic:** Defining Functions

**Problem 284**

\[ (x + 3)^2 + (y - 4)^2 = 25 \]

**Answer:** 4

**Reference:** 011127a2

**Standard:** A2.S.9

**Topic:** Differentiating Permutations and Combinations

**Problem 285**

\[ (w^{-5})^\frac{1}{2} = (w^{4})^\frac{1}{2} = w^2 \]

**Answer:** 2

**Reference:** 081011a2

**Standard:** A2.A.8

**Topic:** Negative and Fractional Exponents

**Problem 286**

\[ \left( \frac{w^{-5}}{w^{-9}} \right)^\frac{1}{2} = (w^4)^\frac{1}{2} = w^2 \]

**Answer:** 2

**Reference:** 081029a2

**Standard:** A2.A.49

**Topic:** Writing Equations of Circles

**Problem 287**

\[ w - 5 \]

\[ w - 9 \]

\[ 1 \]

\[ 2 \]

\[ \left( \frac{w^{-5}}{w^{-9}} \right)^\frac{1}{2} = (w^4)^\frac{1}{2} = w^2 \]

**Answer:** 2

**Reference:** 061112a2

**Standard:** A2.A.39

**Topic:** Domain and Range

**Key:** real domain

**Problem 288**

\[ w - 5 \]

\[ w - 9 \]

\[ 1 \]

\[ 2 \]

\[ \left( \frac{w^{-5}}{w^{-9}} \right)^\frac{1}{2} = (w^4)^\frac{1}{2} = w^2 \]

**Answer:** 4

**Reference:** 011127a2

**Standard:** A2.S.1

**Topic:** Analysis of Data

**Problem 289**

\[ w - 5 \]

\[ w - 9 \]

\[ 1 \]

\[ 2 \]

\[ \left( \frac{w^{-5}}{w^{-9}} \right)^\frac{1}{2} = (w^4)^\frac{1}{2} = w^2 \]

**Answer:** 1

**Reference:** 011117a2

**Standard:** A2.S.9

**Topic:** Differentiating Permutations and Combinations

**Problem 290**

\[ \left( \frac{w^{-5}}{w^{-9}} \right)^\frac{1}{2} = (w^4)^\frac{1}{2} = w^2 \]

**Answer:** 2

**Reference:** 081011a2

**Standard:** A2.A.8

**Topic:** Negative and Fractional Exponents
\[ \frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta} = \frac{1}{\cos^2 \theta} = \sec^2 \theta \]


\[ \sqrt{12^2 - 6^2} = \sqrt{108} = \sqrt{36 \cdot 3} = 6\sqrt{3} \quad \text{cot } J = \frac{A}{O} = \frac{6}{6\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3} \]


\[ 3x + 16 = (x + 2)^2 \quad -4 \text{ is an extraneous solution.} \]
\[ 3x + 16 = x^2 + 4x + 4 \]
\[ 0 = x^2 + x - 12 \]
\[ 0 = (x + 4)(x - 3) \]
\[ x = -4 \quad x = 3 \]


KEY: extraneous solutions

\[ \frac{3}{\sqrt{3a^2b}} = \frac{3}{a\sqrt{3b}} \cdot \frac{\sqrt{3b}}{\sqrt{3b}} = \frac{3\sqrt{3b}}{3ab} = \frac{\sqrt{3b}}{ab} \]


KEY: index = 2

\[ \binom{10}{4} = 210 \]


TOP: Inverse of Functions

KEY: equations

\[ 12 \cdot 6 = 9w \]
\[ 8 = w \]

PTS: 2  REF: A2.A.5  STA: A2.A.5  TOP: Inverse Variation
\[
\frac{\pi}{3} + \frac{\pi}{3} = \frac{2\pi}{3} = \frac{1}{3}
\]

PTS: 2  REF: 011108a2  STA: A2.S.13  TOP: Geometric Probability

299 ANS: 3

\[
x = 5^4 = 625
\]

PTS: 2  REF: 061106a2  STA: A2.A.28  TOP: Logarithmic Equations

KEY: basic

300 ANS: 3

PTS: 2  REF: 061020a2  STA: A2.A.71  TOP: Graphing Trigonometric Functions

301 ANS: 2

\[6(x^2 - 5) = 6x^2 - 30\]

PTS: 2  REF: 011109a2  STA: A2.A.42  TOP: Compositions of Functions

KEY: variables

302 ANS: 3  PTS: 2  REF: 011119a2  STA: A2.A.52

TOP: Families of Functions

303 ANS: 2

\[
\frac{2\pi}{b} = \frac{2\pi}{3}
\]

4a + 6 = 4a - 10. 4a + 6 = -4a + 10. \(4 \left( \frac{1}{2} \right) + 6 \left| -4 \left( \frac{1}{2} \right) \right| = -10\)

\(6 \neq -10\) \(8a = 4\)

\(a = \frac{4}{8} = \frac{1}{2}\) \(8 - 2 \neq -10\)

305 ANS: 2

\(x^2 - x - 6 = 3x - 6\)

\(x^2 - 4x = 0\)

\(x(x - 4) = 0\)

\(x = 0, 4\)

306 ANS: 4

\[
\frac{3 \pm \sqrt{(-3)^2 - 4(1)(-9)}}{2(1)} = \frac{3 \pm \sqrt{45}}{2} = \frac{3 \pm 3\sqrt{5}}{2}
\]

307 ANS: 2

308 ANS: 2

309 ANS: 1

\(2i^2 + 3i^3 = 2(-1) + 3(-i) = -2 - 3i\)

310 ANS:

\[
\frac{51}{243} \cdot sC_3 \left( \frac{1}{3} \right)^3 \left( \frac{2}{3} \right)^2 = \frac{40}{243}
\]

\[
sC_4 \left( \frac{1}{3} \right)^4 \left( \frac{2}{3} \right) = \frac{10}{243}
\]

\[
sC_5 \left( \frac{1}{3} \right)^5 \left( \frac{2}{3} \right)^0 = \frac{1}{243}
\]
311 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

312 ANS: 
\[ \frac{\sqrt{13}}{2} \cdot \sin \theta = \frac{\sqrt{2}}{\sqrt{(-3)^2 + 2^2}} \cdot \csc \theta = \frac{\sqrt{13}}{2}. \]

PTS: 2 REF: fall0933a2 STA: A2.A.62 TOP: Determining Trigonometric Functions

313 ANS: 
\[ 16^{2x+3} = 64^{x+2} \]
\[ (4^2)^{2x+3} = (4^3)^{x+2} \]
\[ 4x + 6 = 3x + 6 \]
\[ x = 0 \]

PTS: 2 REF: 011128a2 STA: A2.A.27 TOP: Exponential Equations

KEY: common base not shown

314 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

315 ANS: 
\[ r^2 = 25^2 + 85^2 - 2(25)(85)\cos 125. \]
\[ r^2 \approx 10287.7 \]
\[ r \approx 101.43 \]

\[ \frac{2.5}{\sin x} = \frac{101.43}{\sin 125} \]
\[ x \approx 12 \]

PTS: 6 REF: fall0939a2 STA: A2.A.73 TOP: Vectors

316 ANS: 68% of the students are within one standard deviation of the mean. 16% of the students are more than one standard deviation above the mean.

PTS: 2 REF: 011134a2 STA: A2.S.5 TOP: Normal Distributions

KEY: percent
317 ANS: 
\[
\frac{5(3 + \sqrt{2})}{7} \times \frac{3 + \sqrt{2}}{3 - \sqrt{2}} = \frac{5(3 + \sqrt{2})}{9 - 2} = \frac{5(3 + \sqrt{2})}{7}
\]

PTS: 2 REF: fall0928a2 STA: A2.N.5 TOP: Rationalizing Denominators

318 ANS: 3 PTS: 2 REF: 081007a2 STA: A2.A.64 TOP: Using Inverse Trigonometric Functions KEY: basic

319 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

320 ANS: 4

\[b^2 - 4ac = 3^2 - 4(9)(-4) = 9 + 144 = 153\]

PTS: 2 REF: 081016a2 STA: A2.A.2 TOP: Using the Discriminant KEY: determine nature of roots given equation

321 ANS: 1

\[13^2 = 15^2 + 14^2 - 2(15)(14)\cos C\]
\[169 = 421 - 420 \cos C\]
\[-252 = -420 \cos C\]
\[252 = 420 \cos C\]
\[\frac{252}{420} = \cos C\]
\[53 \approx C\]


322 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

323 ANS:

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

\[\tan^2 A + 1 = \sec^2 A\]

PTS: 2 REF: 011135a2 STA: A2.A.67 TOP: Proving Trigonometric Identities

324 ANS:

\[0.468. \ \text{s}_6 \left(\frac{2}{3}\right)^6 \left(\frac{1}{3}\right)^2 \approx 0.27313. \ \text{s}_7 \left(\frac{2}{3}\right)^7 \left(\frac{1}{3}\right)^1 \approx 0.15607. \ \text{s}_8 \left(\frac{2}{3}\right)^8 \left(\frac{1}{3}\right)^0 \approx 0.03902.\]

PTS: 4 REF: 011138a2 STA: A2.S.15 TOP: Binomial Probability KEY: at least or at most
325 ANS: 1
\[-420 \left( \frac{\pi}{180} \right) = -\frac{7\pi}{3}\]

PTS: 2 REF: 081002a2 STA: A2.M.2 TOP: Radian Measure
KEY: radians

326 ANS: 
y = 10.596(1.586)^x

PTS: 2 REF: 081031a2 STA: A2.S.7 TOP: Exponential Regression

327 ANS: 1

\[
\begin{align*}
\cos^{-1} \left( \frac{5}{6} \right) & = 53.55730976 \\
\text{Ans: DMS} & = 33^\circ 33'26.315''
\end{align*}
\]

\[\cos K = \frac{5}{6}\]

\[K = \cos^{-1} \frac{5}{6}\]

\[K \approx 33^\circ 33'\]

PTS: 2 REF: 061023a2 STA: A2.A.55 TOP: Trigonometric Ratios

328 ANS: 3

\[
-7 \pm \sqrt{7^2 - 4(2)(-3)} = \frac{-7 \pm \sqrt{73}}{4}
\]

PTS: 2 REF: 081009a2 STA: A2.A.25 TOP: Quadratics with Irrational Solutions

329 ANS: 2 PTS: 2 REF: 061021a2 STA: A2.S.8 TOP: Correlation Coefficient

330 ANS:

\[39,916,800 \cdot \frac{12!}{3!2!} = \frac{479,001,600}{12} = 39,916,800\]

PTS: 2 REF: 081035a2 STA: A2.S.10 TOP: Permutations

331 ANS:

\[0.167 \cdot \binom{10}{0} \cdot 0.6^8 \cdot 0.4^2 + \binom{10}{1} \cdot 0.6^9 \cdot 0.4^1 + \binom{10}{2} \cdot 0.6^{10} \cdot 0.4^0 \approx 0.167\]

KEY: at least or at most
\[ y \geq x^2 - x - 6 \]
\[ y \geq (x - 3)(x + 2) \]

**PTS:** 2  **REF:** 061017a2  **STA:** A2.A.4  **TOP:** Quadratic Inequalities

**KEY:** two variables

**333**  **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

**334**  **ANS:** 1

\[ 2 \log x - (3 \log y + \log z) = \log x^2 - \log y^3 - \log z = \log \frac{x^2}{y^3z} \]

**PTS:** 2  **REF:** 061010a2  **STA:** A2.A.19  **TOP:** Properties of Logarithms

**335**  **ANS:**

\[ \frac{4}{9} x^3 - \frac{4}{3} x + 1 \cdot \left( \frac{2}{3} x - 1 \right)^2 = \left( \frac{2}{3} x - 1 \right) \left( \frac{2}{3} x - 1 \right) = \frac{4}{9} x^2 - \frac{2}{3} x - \frac{2}{3} x + 1 = \frac{4}{9} x^2 - \frac{4}{3} x + 1 \]

**PTS:** 2  **REF:** 081034a2  **STA:** A2.N.3  **TOP:** Operations with Polynomials

**336**  **ANS:** 2  **PTS:** 2  

**REF:** 011126a2  **STA:** A2.A.49  **TOP:** Equations of Circles

**337**  **ANS:**

\[ \frac{\sqrt{108x^5y^8}}{\sqrt{6xy^5}} = \sqrt{18x^4y^3} = 3x^2y\sqrt{2}y \]

**PTS:** 2  **REF:** 011133a2  **STA:** A2.A.14  **TOP:** Operations with Radicals

**KEY:** with variables | index = 2

**338**  **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
\[ s \binom{3}{x}^{2}(-2)^{3} = 10 \cdot 9x^2 \cdot -8 = -720x^2 \]

PTS: 2  REF: fall0919a2  STA: A2.A.36  TOP: Binomial Expansions

TOP:  Sigma Notation

### Table 1

<table>
<thead>
<tr>
<th>n</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>Σ</th>
</tr>
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<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>2 \times 12 = 24</td>
</tr>
</tbody>
</table>

PTS: 2  REF: fall0911a2  STA: A2.N.10  TOP: Sigma Notation

KEY: basic

TOP:  Domain and Range

### Equations

\[ \frac{1}{x + 3} - \frac{2}{3 - x} = \frac{4}{x^2 - 9} \]
\[ \frac{1}{x + 3} + \frac{2}{x - 3} = \frac{4}{x^2 - 9} \]
\[ \frac{x - 3 + 2(x + 3)}{(x + 3)(x - 3)} = \frac{4}{(x + 3)(x - 3)} \]
\[ x - 3 + 2x + 6 = 4 \]
\[ 3x = 1 \]
\[ x = \frac{1}{3} \]

PTS: 4  REF: 081036a2  STA: A2.A.23  TOP: Solving Rationals

KEY: rational solutions

### Equation

\[ \cos(-305^\circ + 360^\circ) = \cos(55^\circ) \]

PTS: 2  REF: 061104a2  STA: A2.A.57  TOP: Reference Angles

TOP:  Sequences

\[ 27r^{4-1} = 64 \]
\[ r^3 = \frac{64}{27} \]
\[ r = \frac{4}{3} \]
\[ \sqrt{-300} = \sqrt{100} \sqrt{-1} \sqrt{3} \]

PTS: 2  REF: 061006a2  STA: A2.N.6  TOP: Square Roots of Negative Numbers

347  ANS: 3  PTS: 2  REF: 011104a2  STA: A2.A.64  TOP: Using Inverse Trigonometric Functions  KEY: unit circle

\[ K = \frac{1}{2} (10)(18)\sin 120 = 45 \sqrt{3} \approx 78 \]

PTS: 2  REF: fall0907a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area  KEY: basic

349  ANS: 2

\[ _{15}C_8 = 6,435 \]

PTS: 2  REF: 081012a2  STA: A2.S.11  TOP: Combinations

\[ b^2 - 4ac = 0 \]
\[ k^2 - 4(1)(4) = 0 \]
\[ k^2 - 16 = 0 \]
\[ (k + 4)(k - 4) = 0 \]
\[ k = \pm 4 \]

PTS: 2  REF: 061028a2  STA: A2.A.2  TOP: Using the Discriminant  KEY: determine equation given nature of roots

351  ANS: 3

\[ \frac{59.2}{\sin 74} = \frac{60.3}{\sin C} \quad 180 - 78.3 = 101.7 \]

\[ C \approx 78.3 \]

PTS: 2  REF: 081006a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

352  ANS: 1

<table>
<thead>
<tr>
<th>( n )</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>( \Sigma )</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-r^2 + r)</td>
<td>(-3^2 + 3 = -6)</td>
<td>(-4^2 + 4 = -12)</td>
<td>(-5^2 + 5 = -20)</td>
<td>(-38)</td>
</tr>
</tbody>
</table>

PTS: 2  REF: 061118a2  STA: A2.N.10  TOP: Sigma Notation  KEY: basic

353  ANS:

No. TENNESSEE: \( \frac{9P_9}{4! \cdot 2! \cdot 2!} = \frac{362,880}{96} = 3,780 \)

VERMONT: \( \cdot P_7 = 5,040 \)

PTS: 4  REF: 061038a2  STA: A2.S.10  TOP: Permutations

18

355 ANS: 4
12x^4 + 10x^3 - 12x^2 = 2x^2(6x^2 + 5x - 6) = 2x^2(2x + 3)(3x - 2)

PTS: 2 REF: 061008a2 STA: A2.A.7 TOP: Factoring Polynomials

KEY: single variable

356 ANS: 4

PTS: 2 REF: 081005a2 STA: A2.A.60

TOP: Unit Circle

357 ANS: 2

x^2 - 2x + y^2 + 6y = -3
x^2 - 2x + 1 + y^2 + 6y + 9 = -3 + 1 + 9
(x - 1)^2 + (y + 3)^2 = 7

PTS: 2 REF: 061016a2 STA: A2.A.47 TOP: Equations of Circles

358 ANS: 3

PTS: 2 REF: 061119a2 STA: A2.A.65

TOP: Graphing Trigonometric Functions

359 ANS:

\[ x = -\frac{1}{3}, -1 \log_{x+3} \frac{x^3 + x - 2}{x} = 2 \]

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

\[ \frac{x^3 + x - 2}{x} = x^2 + 6x + 9 \]

\[ x^3 + x - 2 = x^3 + 6x^2 + 9x \]
\[ 0 = 6x^2 + 8x + 2 \]
\[ 0 = 3x^2 + 4x + 1 \]
\[ 0 = (3x + 1)(x + 1) \]
\[ x = -\frac{1}{3}, -1 \]


KEY: basic

360 ANS:

\[ 32x^5 - 80x^4 + 80x^3 - 40x^2 + 10x - 1. \]
\[ 5C_0(2x)^5(-1)^0 = 32x^5. \]
\[ 5C_1(2x)^4(-1)^1 = -80x^4. \]
\[ 5C_2(2x)^3(-1)^2 = 80x^3. \]
\[ 5C_3(2x)^2(-1)^3 = -40x^2. \]
\[ 5C_4(2x)^1(-1)^4 = 10x. \]
\[ 5C_5(2x)^0(-1)^5 = -1 \]

PTS: 4 REF: 011136a2 STA: A2.A.36 TOP: Binomial Expansions
361 ANS: 41,040.

PTS: 2 REF: fall0935a2 STA: A2.S.12 TOP: Sample Space

362 ANS: 2,298.65.

PTS: 2 REF: fall0932a2 STA: A2.A.12 TOP: Evaluating Exponential Expressions


364 ANS: 2.5 \cdot \frac{180}{\pi} \approx 143.2^\circ

PTS: 2 KEY: degrees REF: 011129a2 STA: A2.M.2 TOP: Radian Measure

365 ANS: 2 PTS: 2 REF: 061011a2 STA: A2.A.10 TOP: Fractional Exponents as Radicals

366 ANS: 3 PTS: 2 REF: fall0923a2 STA: A2.A.39 TOP: Domain and Range KEY: real domain

367 ANS: 3

\begin{align*}
4x^2 + 4x &= 2^{-6} & 2x^2 + 8x &= -6 \\
(2x)^2 + x &= 2^{-6} & 2x^2 + 8x + 6 &= 0 \\
2x^2 + 8x &= 2^{-6} & x^2 + 4x + 3 &= 0 \\
& & (x + 3)(x + 1) &= 0 \\
& & x &= -3 \text{ or } x = -1
\end{align*}

PTS: 2 KEY: common base shown REF: 061015a2 STA: A2.A.27 TOP: Exponential Equations
\[
\left(\frac{2}{3}\right)^2 + \cos^2 A = 1 \quad \sin 2A = 2 \sin A \cos A
\]
\[
\cos^2 A = \frac{5}{9} \quad = 2 \left(\frac{2}{3}\right) \left(\frac{\sqrt{5}}{3}\right)
\]
\[
\cos A = \frac{4\sqrt{5}}{9}, \text{ sin } A \text{ is acute.}
\]

PTS: 2 \quad REF: 011107a2 \quad STA: A2.A.77 \quad TOP: Double Angle Identities

KEY: evaluating

369 \quad \text{ANS: 1}

\cos^2 \theta - \cos 2\theta = \cos^2 \theta - (\cos^2 \theta - \sin^2 \theta) = \sin^2 \theta

PTS: 2 \quad REF: 061024a2 \quad STA: A2.A.77 \quad TOP: Double Angle Identities

KEY: simplifying

370 \quad \text{ANS: 3} \quad \text{PTS: 2} \quad \text{REF: fall0910a2} \quad \text{STA: A2.A.76}

TOP: Angle Sum and Difference Identities

KEY: simplifying

371 \quad \text{ANS: 2} \quad \text{PTS: 2} \quad \text{REF: 011114a2} \quad \text{STA: A2.N.3}

TOP: Operations with Polynomials

372 \quad \text{ANS: 2}

\[(3 - 7i)(3 - 7i) = 9 - 21i - 21i + 49i^2 = 9 - 42i - 49 = -40 - 42i\]

PTS: 2 \quad REF: fall0901a2 \quad STA: A2.N.9

TOP: Multiplication and Division of Complex Numbers

373 \quad \text{ANS: 2} \quad \text{PTS: 2} \quad \text{REF: 081003a2} \quad \text{STA: A2.A.51}

TOP: Domain and Range

374 \quad \text{ANS:}

\[-3|6 - x| < -15 \quad |6 - x| > 5\]

\[6 - x > 5 \text{ or } 6 - x < -5\]

\[1 > x \text{ or } 11 < x\]

PTS: 2 \quad REF: 061137a2 \quad STA: A2.A.1 \quad TOP: Absolute Value Inequalities

KEY: graph

375 \quad \text{ANS:}

D: \[-5 \leq x \leq 8. \quad R: -3 \leq y \leq 2\]

PTS: 2 \quad REF: 011132a2 \quad STA: A2.A.51 \quad TOP: Domain and Range

376 \quad \text{ANS: 4} \quad \text{PTS: 2} \quad \text{REF: 011124a2} \quad \text{STA: A2.A.18}

TOP: Evaluating Logarithmic Expressions
\[3^{-2} = \frac{1}{9} \quad (-2)^{-3} = \frac{1}{-8} = -\frac{8}{9}\]

PTS: 2  REF: 061003a2  STA: A2.N.1  TOP: Negative and Fractional Exponents

\[\frac{2\pi}{b} = \frac{2\pi}{\frac{1}{3}} = 6\pi\]


\[x^2 - 3x - 10 > 0\]
\[(x - 5)(x + 2) > 0\]
\[x - 5 > 0\] and \[x + 2 > 0\]
\[x > 5\] and \[x > -2\]
\[x > 5\]

or

\[x - 5 < 0\] and \[x + 2 < 0\]
\[x < 5\] and \[x < -2\]
\[x < -2\]

PTS: 2  REF: 011115a2  STA: A2.A.4  TOP: Quadratic Inequalities  KEY: one variable

\[b_n = x + 2n\]
\[10 = x + 2(1)\]
\[8 = x\]

PTS: 2  REF: 081014a2  STA: A2.A.29  TOP: Sequences

PTS: 2  REF: fall0915a2  STA: A2.S.5  TOP: Normal Distributions  KEY: interval

PTS: 2  REF: 061101a2  STA: A2.S.1  TOP: Analysis of Data
384 ANS: 1 PTS: 2 REF: fall0914a2 STA: A2.A.9
TOP: Negative and Fractional Exponents

385 ANS: 1 PTS: 2 REF: 061019a2 STA: A2.N.7
TOP: Imaginary Numbers

386 ANS: 4 PTS: 2 REF: 061005a2 STA: A2.A.50
TOP: Solving Polynomial Equations

387 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

388 ANS:
\[ x^2 - 6x - 27 = 0, \quad \frac{-b}{a} = 6, \quad \frac{c}{a} = -27. \quad \text{If } a = 1 \text{ then } b = -6 \text{ and } c = -27 \]

PTS: 4 REF: 061130a2 STA: A2.A.21 TOP: Roots of Quadratics
KEY: basic

389 ANS: 3

\[ \sum_{n=1}^{15} 7n \]

PTS: 2 REF: fall0924a2 STA: A2.S.4 TOP: Dispersion
KEY: range, quartiles, interquartile range, variance

390 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

391 ANS:

\[ \sum_{n=1}^{15} 7n \]

PTS: 2 REF: 081029a2 STA: A2.A.34 TOP: Sigma Notation
392 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

393 ANS: 3 PTS: 2 REF: 011110a2 STA: A2.A.30
TOP: Sequences

394 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

395 ANS:
\[10ax^2 - 23ax - 5a = a(10x^2 - 23x - 5) = a(5x + 1)(2x - 5)\]

PTS: 2 REF: 081028a2 STA: A2.A.7 TOP: Factoring Polynomials
KEY: multiple variables

396 ANS: 3
\[S = \frac{-b}{a} = \frac{-(-3)}{4} = \frac{3}{4}, \quad P = \frac{c}{a} = \frac{-8}{4} = -2\]

PTS: 2 REF: fall0912a2 STA: A2.A.21 TOP: Roots of Quadratics
KEY: basic

397 ANS: 3 PTS: 2 REF: 061127a2 STA: A2.S.6
TOP: Regression

398 ANS:
\[\frac{12x^2}{y^9} \cdot \frac{3x^4y^5}{(2x^3y^{-7})^2} = \frac{3y^5(2x^3y^{-7})^2}{x^4} = \frac{3y^5(4x^6y^{-14})}{x^4} = \frac{12x^6y^{-9}}{x^4} = \frac{12x^2}{y^9}\]

PTS: 2 REF: 061134a2 STA: A2.A.9 TOP: Negative Exponents

399 ANS:
\[\frac{12}{\sin 32} = \frac{10}{\sin B} \quad . \quad C \approx 180 - (32 + 26.2) \approx 121.8. \quad \frac{12}{\sin 32} = \frac{c}{\sin 121.8}\]
\[B = \sin^{-1} \left( \frac{10\sin 32}{12} \right) \approx 26.2 \quad \quad c = \frac{12 \sin 121.8}{\sin 32} \approx 19.2\]

PTS: 4 REF: 011137a2 STA: A2.A.73 TOP: Law of Sines
KEY: basic

400 ANS:
\[(x + 5)^2 + (y - 3)^2 = 32\]

PTS: 2 REF: 081033a2 STA: A2.A.49 TOP: Writing Equations of Circles
401 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

402 ANS:
\[ \sin(45 + 30) = \sin 45 \cos 30 + \cos 45 \sin 30 \]
\[ = \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} + \frac{\sqrt{2}}{2} \cdot \frac{1}{2} = \frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4} = \frac{\sqrt{6} + \sqrt{2}}{4} \]

PTS: 4 REF: 061136a2 STA: A2.A.76 TOP: Angle Sum and Difference Identities

403 ANS:
\[ 26.2\%. \quad _{10}C_8 \cdot 0.65^8 \cdot 0.35^2 + _{10}C_9 \cdot 0.65^9 \cdot 0.35^1 + _{10}C_{10} \cdot 0.65^{10} \cdot 0.35^0 \approx 0.262 \]


404 ANS: 4
\[ 6x - x^3 - x^2 = -x(x^2 + x - 6) = -x(x + 3)(x - 2) \]

PTS: 2 REF: fall0917a2 STA: A2.A.7 TOP: Factoring Polynomials

405 ANS: 2
\[ \tan(126^\circ 43') \]
\[ \approx -1.3407883784 \]

PTS: 2 REF: 061115a2 STA: A2.A.66 TOP: Determining Trigonometric Functions

406 ANS: 2 PTS: 2 REF: fall0926a2 STA: A2.A.46 TOP: Transformations with Functions and Relations

407 ANS: 2
\[ \frac{11\pi}{12} \cdot \frac{180}{\pi} = 165 \]

PTS: 2 REF: 061002a2 STA: A2.M.2 TOP: Radian Measure

KEY: degrees
408 ANS: 3  
\( f(4) = \frac{1}{2} (4) - 3 = -1 \). \( g(-1) = 2(-1) + 5 = 3 \)  

PTS: 2 
REF: fall0902a2 
STA: A2.A.42 
TOP: Compositions of Functions 
KEY: numbers

409 ANS: 2  
TOP: Identifying the Equation of a Graph

410 ANS: 2  
\( x^2 + 2 = 6x \)  
\( x^2 - 6x = -2 \)  
\( x^2 - 6x + 9 = -2 + 9 \)  
\( (x - 3)^2 = 7 \)  

PTS: 2 
REF: 061108a2 
STA: A2.A.52 
TOP: Compositions of Functions

411 ANS: 2  
\( e^{\ln 2} = e^{\ln 2^3} = e^{\ln 8} = 8 \)  

PTS: 2 
REF: 011116a2 
STA: A2.A.24 
TOP: Completing the Square

412 ANS: 4  
\( 4ab \sqrt{2b} - 3a \sqrt{9b^2} - 7ab \sqrt{6b} = 4ab \sqrt{2b} - 9ab \sqrt{2b} + 7ab \sqrt{6b} = -5ab \sqrt{2b} + 7ab \sqrt{6b} \)  

PTS: 2 
REF: fall0918a2 
STA: A2.A.12 
TOP: Operations with Radicals

413 ANS: 2.001 \( x^{2.298} \), 1,009. \( y = 2.001(15)^{2.298} \approx 1009 \)  

PTS: 4 
REF: fall0938a2 
STA: A2.S.7 
TOP: Power Regression

414 ANS: 4  
\( s = 9r = 2 \cdot 4 = 8 \)  

PTS: 2 
REF: fall0922a2 
STA: A2.A.61 
TOP: Arc Length

415 ANS: 4  
\( 6y^3 - \frac{37}{10} y^2 - \frac{1}{5} y \cdot \left( \frac{1}{2} y^2 - \frac{1}{3} y \right) \left( 12y + \frac{3}{5} \right) = 6y^3 + \frac{3}{10} y^2 - 4y^2 - \frac{1}{5} y = 6y^3 - \frac{37}{10} y^2 - \frac{1}{5} y \)  

PTS: 2 
REF: 061128a2 
STA: A2.N.3 
TOP: Operations with Polynomials

416 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
\[9c_3a^6(-4b)^3 = -5376a^6b^3\]

PTS: 2     REF: 061126a2     STA: A2.A.36     TOP: Binomial Expansions

\[\frac{x^{-1} - 1}{x - 1} = \frac{1 - x}{x - 1} = \frac{-1}{x} = \frac{-x}{x - 1} = -\frac{1}{x}\]

PTS: 2     REF: 081018a2     STA: A2.A.9     TOP: Negative Exponents

TOP: Conjugates of Complex Numbers

TOP: Defining Functions     KEY: graphs

\[\begin{align*}
\frac{23}{2} \cos^2 B + \sin^2 B &= 1 \\
\tan B &= \frac{\sin B}{\cos B} = \frac{\frac{5}{\sqrt{41}}}{\frac{4}{\sqrt{41}}} = \frac{5}{4}
\end{align*}\]

\[\begin{align*}
\cos^2 B + \left( \frac{5}{\sqrt{41}} \right)^2 &= 1 \\
\cos^2 B + \frac{25}{41} &= \frac{41}{41} \\
\cos^2 B &= \frac{16}{41} \\
\cos B &= \frac{4}{\sqrt{41}}
\end{align*}\]

\[\begin{align*}
\tan(A + B) &= \frac{\frac{2}{3} + \frac{5}{4}}{1 - \left( \frac{2}{3} \right) \left( \frac{5}{4} \right)} = \frac{\frac{8 + 15}{12}}{\frac{12}{12} - \frac{10}{12}} = \frac{\frac{23}{12}}{\frac{2}{12}} = \frac{23}{2}
\end{align*}\]

PTS: 4     REF: 081037a2     STA: A2.A.76     TOP: Angle Sum and Difference Identities

KEY: evaluating

TOP: Graphing Logarithmic Functions
423 ANS: 
\[ y = x^2 - 6. \text{ } f^{-1}(x) \text{ is not a function.} \]
\[ x = y^2 - 6 \]
\[ x + 6 = y^2 \]
\[ \pm \sqrt{x+6} = y \]

PTS: 2  REF: 061132a2  STA: A2.A.44  TOP: Inverse of Functions
KEY: equations

424 ANS: 2
The roots are \(-1, 2, 3\).

PTS: 2  REF: 081023a2  STA: A2.A.50  TOP: Solving Polynomial Equations

425 ANS: 1

PTS: 2  REF: 061004a2  STA: A2.A.52
TOP: Identifying the Equation of a Graph

426 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

427 ANS: 4
\[ S_n = \frac{n}{2} [2a + (n - 1)d] = \frac{21}{2} [2(18) + (21 - 1)2] = 798 \]

PTS: 2  REF: 061103a2  STA: A2.A.35  TOP: Series
KEY: arithmetic

428 ANS: 4
\[ 2 \log_4(5x) = 3 \]
\[ \log_4(5x) = \frac{3}{2} \]
\[ 5x = 4^{\frac{3}{2}} \]
\[ 5x = 8 \]
\[ x = \frac{8}{5} \]

PTS: 2  REF: fall0921a2  STA: A2.A.28  TOP: Logarithmic Equations
KEY: advanced

429 ANS: 3

PTS: 2  REF: 061001a2  STA: A2.A.30
TOP: Sequences