1 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

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

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

4 What is the domain of the function shown below?

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

5 Perform the indicated operations and simplify completely:

\[
\frac{x^3 - 3x^2 + 6x - 18}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} \div \frac{x^2 + 2x - 8}{16 - x^2}
\]
6. What is the common difference of the arithmetic sequence below?
\[-7x, -4x, -x, 2x, 5x, \ldots\]
1) \(-3\)
2) \(-3x\)
3) 3
4) \(3x\)

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

8. Find the number of possible different 10-letter arrangements using the letters of the word “STATISTICS.”

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

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

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

12. 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
13 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?

14 What is the equation of the graph shown below?

![Graph](image)

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

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

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

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

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

18 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.

19 The points (2,3), \( \left( 4, \frac{3}{4} \right) \), and (6,\( d \)) lie on the graph of a function. If \( y \) is inversely proportional to the square of \( x \), what is the value of \( d \)?

1) 1
2) \( \frac{1}{3} \)
3) 3
4) 27
20. 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

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

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

23. 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

24. 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

25. The expression \((x + i)^2 - (x - i)^2\) is equivalent to
1) 0
2) \(-2\)
3) \(-2 + 4xi\)
4) \(4xi\)

26. Which expression is equivalent to \( \left(9x^2y^6\right)^{\frac{1}{3}} \)?
1) \(\frac{1}{3xy^3}\)
2) \(3xy^3\)
3) \(\frac{3}{xy^5}\)
4) \(\frac{xy^5}{3}\)

27. In \(\triangle DEF\), \(d = 5\), \(e = 8\), and \(m\angle D = 32^\circ\). How many distinct triangles can be drawn given these measurements?
1) 1
2) 2
3) 3
4) 0
28 Which graph represents the function $\log_2 x = y$?

1) 
![Graph 1](image1)

2) 
![Graph 2](image2)

3) 
![Graph 3](image3)

4) 
![Graph 4](image4)

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

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

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

1) $\frac{-6y^2 + 36y - 54}{(2y-6)(6-2y)}$
2) $\frac{3y - 9}{2y - 6}$
3) $\frac{3}{2}$
4) $-\frac{3}{2}$

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

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

32 If $g(x) = \left( ax \sqrt{1-x} \right)^2$, express $g(10)$ in simplest form.
33. Determine the sum and the product of the roots of the equation \(12x^2 + x - 6 = 0\).

34. 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.

35. In parallelogram \(BFLO\), \(OL = 3.8\), \(LF = 7.4\), and \(m\angle O = 126\). If diagonal \(BL\) is drawn, what is the area of \(\triangle BLO\)?

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

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

41. If order does not matter, which selection of students would produce the most possible committees?

42. 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?

36. Which value of \(k\) satisfies the equation \(8^{3k+4} = 4^{2k-1}\)?

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

38. Find the third term in the recursive sequence \(a_{k+1} = 2a_k - 1\), where \(a_1 = 3\).
43 The expression $(2a)^{-4}$ is equivalent to
1) $-8a^4$
2) $\frac{16}{a^4}$
3) $\frac{2}{a^4}$
4) $\frac{1}{16a^4}$

44 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%.

45 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) \{\}

46 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) $4x^2 - 9x - 3 = 0$

47 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) $2x^4y^2$

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

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

49 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) $(x - 3)^2 + (y + 4)^2 = 90$

50 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.
51 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

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

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

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

56 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

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

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

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

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

\[
\begin{array}{ccccccc}
25 & 55 & 40 & 65 & 29 \\
45 & 59 & 35 & 25 & 37 \\
52 & 30 & 8 & 40 & 55
\end{array}
\]

Determine the number of employees whose travel time is within one standard deviation of the mean.
60 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) $4a^2 - 20a + 30$

61 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.

62 The simplest form of $\frac{1 - \frac{4}{x}}{1 - \frac{2}{x} - \frac{8}{x^2}}$ is

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

63 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) $2b + 2a$

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

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

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

66 Solve algebraically for all values of $x$:

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

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

68 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) $6\pi$
69. 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

70. 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.

71. What is the solution set of the equation
\[3x^5 - 48x = 0?\]
1) \(\{0, \pm 2\}\)
2) \(\{0, \pm 2, 3\}\)
3) \(\{0, \pm 2, \pm 2i\}\)
4) \(\{\pm 2, \pm 2i\}\)

72. 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) \(\{60^\circ, 300^\circ\}\)

73. Which expression is equivalent to \((3x^2)^{-1}\)?
1) \(\frac{1}{3x^2}\)
2) \(-3x^2\)
3) \(\frac{1}{9x^2}\)
4) \(-9x^2\)

74. 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) \(3\sin^2 x\)

75. 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) \(-2a + 5\)
76 The function $f(x)$ is graphed on the set of axes below. On the same set of axes, graph $f(x+1)+2$.

![Graph of $f(x)$ and $f(x+1)+2$](image)

77 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

78 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) $5808.08$

79 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

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

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

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

82 The expression $\log 4m^2$ is equivalent to

1) $2(\log 4 + \log m)$  
2) $2 \log 4 + \log m$  
3) $\log 4 + 2 \log m$  
4) $\log 16 + 2 \log m$

83 The expression $\sqrt[3]{64a^{16}}$ is equivalent to

1) $8a^4$  
2) $8a^8$  
3) $4a^{\frac{16}{3}} \sqrt[3]{a}$  
4) $4a \sqrt[3]{a^5}$
84 Which equation is graphed in the diagram below?

![Diagram with a point (15,8) and a curve]

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

85 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.

![Diagram with a triangle representing the height of the tower and the guy wire]

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

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

88 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) \((8,3)\)

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

90 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) \( 30C_3 + 20C_2 \)

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

\[
\text{Lin Reg} \\
y = a + bx \\
a = 59.026 \\
b = 6.767 \\
1) \ r = .8643 \\
\text{Lin Reg} \\
y = a + bx \\
a = .7 \\
b = 24.2 \\
2) \ r = .8361 \\
\text{Lin Reg} \\
y = a + bx \\
a = 2.45 \\
b = .95 \\
3) \ r = .6022 \\
\text{Lin Reg} \\
y = a + bx \\
a = -2.9 \\
b = 24.1 \\
4) \ r = -.8924
\]

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

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

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

96. What is the range of the function shown below?

\[
1) \ x \leq 0 \\
2) \ x \geq 0 \\
3) \ y \leq 0 \\
4) \ y \geq 0
\]

94. Solve algebraically for \( x \):

\[
\sqrt{x^2 + x - 1 + 11x} = 7x + 3
\]
97 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) $1.27 \leq y \leq 2.38$

98 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

99 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) $\frac{q \sin R}{\sin Q}$

100 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) $-3 \pm 2i$

101 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.]

102 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.

103 Express in simplest terms:

$$1 + \frac{3}{x}$$

$$1 - \frac{5}{x} - \frac{24}{x^2}$$
104 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.

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

106 What is the graph of the solution set of \( |2x - 1| > 5 \)?
1)
2)
3)
4)

107 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

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

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

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

111 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) \( 3\pi \)

112 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) \( 4n^{-1} > (6n)^{-1} \)
113 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) $\csc(-118^\circ)$

114 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) $\frac{7}{9}$

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

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

116 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) $\frac{24}{25}$

117 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) $\{225^\circ, 315^\circ\}$

118 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) $\frac{15}{4}x^4y^2$

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

16
120 The value of \( \sin(180 + x) \) is equivalent to
1) \( -\sin x \)
2) \( -\sin(90 - x) \)
3) \( \sin x \)
4) \( \sin(90 - x) \)

121 Which function is one-to-one?
1) \( f(x) = |x| \)
2) \( f(x) = 2^x \)
3) \( f(x) = x^2 \)
4) \( f(x) = \sin x \)

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

123 A jogger ran \( \frac{1}{3} \) mile on day 1, and \( \frac{2}{3} \) mile on day 2, and \( 1 \frac{1}{3} \) miles on day 3, and \( 2 \frac{2}{3} \) miles on day 4, and this pattern continued for 3 more days. Which expression represents the total distance the jogger ran?
1) \( \sum_{d=1}^{7} \frac{1}{3} (2)^{d-1} \)
2) \( \sum_{d=1}^{7} \frac{1}{3} (2)^d \)
3) \( \sum_{d=1}^{7} 2 \left( \frac{1}{3} \right)^{d-1} \)
4) \( \sum_{d=1}^{7} 2 \left( \frac{1}{3} \right)^{d} \)

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

125 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.

126 If \( \sec(a + 15)^\circ = \csc(2a)^\circ \), find the smallest positive value of \( a \), in degrees.
127 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) \( \frac{7 - \sqrt{11}}{60} \)

128 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

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

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

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

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

1) \( \{x \mid x \geq 3 \} \)
2) \( \{y \mid y \geq 2 \} \)
3) \( \{x \mid x \in \text{real numbers} \} \)
4) \( \{y \mid y \in \text{real numbers} \} \)

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

133 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) \( \cos x + \sin x \)

134 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.

135 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) \( 8^3 \)
2) \( 8^3 \)
3) \( 8^5 \)
4) \( 8^5 \)
136 Express the exact value of \( \csc 60^\circ \), with a rational denominator.

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

138 Solve algebraically for all values of \( x \):
\[
\log_{(x+3)}(2x + 3) + \log_{(x+3)}(x + 5) = 2
\]

139 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

140 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.

141 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°.

142 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.

143 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 \( \sec P > 0 \)

144 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

145 Determine the value of \( n \) in simplest form:
\[
i^{13} + i^{18} + i^{31} + n = 0
\]

146 Determine the sum and the product of the roots of
\[
3x^2 = 11x - 6.
\]

147 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
148 Which equation is represented by the graph below?

\[ y = 2 \cos 3x \]

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

149 The expression \( \sin(\theta + 90)\)° is equivalent to

1) \( -\sin \theta \)
2) \( -\cos \theta \)
3) \( \sin \theta \)
4) \( \cos \theta \)

150 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 = - \( \frac{2}{3} \)

151 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 \((e, 1)\).

152 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) \( \overline{OS} \)

153 A population of rabbits doubles every 60 days according to the formula \( P = 10(2)^{\frac{t}{50}} \), 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
154 Write an equation for the graph of the trigonometric function shown below.

\[ y = \sin(x) \]

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

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

156 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%

157 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) \( \frac{12! P_{12}}{8} \)
4) \( \frac{12! P_{12}}{6!} \)

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

159 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) \( x^2 - 6x - 36 = 25 - 36 \)
160 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

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

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

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

1)  
2)  
3)  
4)

164 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) \(\frac{1}{11 - x}\)
165 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) \( -\frac{63}{65} \)

166 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?

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

168 Solve the equation below algebraically, and express the result in simplest radical form:

\( \frac{13}{x} = 10 - x \)

169 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

170 Which graph represents a function?
171 The expression \( \frac{a + b}{c} \) is equivalent to

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

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

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

173 Which function is one-to-one?

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

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

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

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

1) 
2) 
3) 
4)
177 The expression $4 + \sum_{k=2}^{5} 3(k - x)$ is equal to

1) $58 - 4x$
2) $46 - 4x$
3) $58 - 12x$
4) $46 - 12x$

178 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) $(-4, 9)$

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

180 Which graph represents the solution set of $\frac{x + 16}{x - 2} \leq 7$?

1) 2) 3) 4)

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

1) 2) 3) 4)

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

183 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

184 Solve $|2x - 3| > 5$ algebraically.
185 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

186 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

187 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) \(-65,535\)

188 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.

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

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

191 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) \(y = -2\cos \frac{1}{2}x\)
192 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

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

194 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.

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

196 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) \( \frac{6b}{a^2} \)  
3) \( \frac{3a^2}{b} \)  
4) \( \frac{6a^2}{b} \)

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

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

199 Circle \( O \) shown below has a radius of 12 centimeters. To the nearest tenth of a centimeter, determine the length of the arc, \( x \), subtended by an angle of 83°50'.
200 For $y = \frac{3}{\sqrt{x - 4}}$, what are the domain and range?

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

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

202 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)

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

204 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

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

206 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.

207 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 $[0, \pi]$.

208 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

209 Express $4xi + 5yi^8 + 6xi^3 + 2yi^4$ in simplest $a + bi$ form.
210 If \( \tan \left( \arccos \frac{\sqrt{3}}{k} \right) = \frac{\sqrt{3}}{3} \), then \( k \) is

1) 1 \\
2) 2 \\
3) \sqrt{2} \\
4) 3\sqrt{2}

211 The expression \( \cot x \csc x \) is equivalent to

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

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

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

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

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

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

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

![Diagram](image)

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

216 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

217 Express in simplest form: \( \sqrt[3]{\frac{a^6 b^9}{-64}} \)
218 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) \( \log 6 + 2\log a \)

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

220 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.

221 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.

222 Solve \(|-4x + 5| < 13\) algebraically for \( x \).
227 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

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

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

230 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: $\{y \mid y \geq 0\}$

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

232 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) $\frac{2b}{a + 1}$

233 What is the product of the roots of the quadratic equation $2x^2 - 7x = 5$?
1) $\frac{5}{2}$
2) $\frac{5}{2}$
3) $-5$
4) $\frac{-5}{2}$
234 If \( \log x = 2 \log a + \log b \), then \( x \) equals
1) \( a^2 b \)
2) \( 2ab \)
3) \( a^2 + b \)
4) \( 2a + b \)

235 If \( m = \{(-1,1),(1,1),(-2,4),(2,4),(-3,9),(3,9)\} \), which statement is true?
1) \( m \) and its inverse are both functions.
2) \( m \) is a function and its inverse is not a function.
3) \( m \) is not a function and its inverse is a function.
4) Neither \( m \) nor its inverse is a function.

236 By law, a wheelchair service ramp may be inclined no more than 4.76°. If the base of a ramp begins 15 feet from the base of a public building, which equation could be used to determine the maximum height, \( h \), of the ramp where it reaches the building’s entrance?
1) \( \sin 4.76^\circ = \frac{h}{15} \)
2) \( \sin 4.76^\circ = \frac{15}{h} \)
3) \( \tan 4.76^\circ = \frac{h}{15} \)
4) \( \tan 4.76^\circ = \frac{15}{h} \)

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

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

239 Given the sequence: \( x, (x + y), (x + 2y), \ldots \) Which expression can be used to determine the common difference of this sequence?
1) \( x - (x + y) \)
2) \( (x + 2y) - (x + y) \)
3) \( \frac{x}{(x+y)} \)
4) \( \frac{(x+2y)}{(x+y)} \)

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

<table>
<thead>
<tr>
<th>Years After 1990 (x)</th>
<th>0</th>
<th>2</th>
<th>5</th>
<th>9</th>
<th>14</th>
<th>17</th>
<th>19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount (y)</td>
<td>750</td>
<td>461</td>
<td>210</td>
<td>84</td>
<td>25</td>
<td>12</td>
<td>8</td>
</tr>
</tbody>
</table>

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

241 Solve \( e^{4x} = 12 \) algebraically for \( x \), rounded to the nearest hundredth.
242 The roots of \(3x^2 + x = 14\) are
1) imaginary
2) real, rational, and equal
3) real, rational, and unequal
4) real, irrational, and unequal

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

244 What is the equation of a circle with its center at \((0, -2)\) and passing through the point \((3, -5)\)?
1) \(x^2 + (y + 2)^2 = 9\)
2) \((x + 2)^2 + y^2 = 9\)
3) \(x^2 + (y + 2)^2 = 18\)
4) \((x + 2)^2 + y^2 = 18\)

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

246 Solve algebraically for the exact value of \(x\):
\[\log_8 16 = x + 1\]

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

248 What is the solution of the inequality \(9 - x^2 < 0\)?
1) \(\{x | -3 < x < 3\}\)
2) \(\{x | x > 3 \text{ or } x < -3\}\)
3) \(\{x | x > 3\}\)
4) \(\{x | x < -3\}\)
249 The legs of a right triangle are represented by \( x + \sqrt{2} \) and \( x - \sqrt{2} \). The length of the hypotenuse of the right triangle is represented by

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

250 The amount of money in an account can be determined by the formula \( A = Pe^{rt} \), where \( P \) is the initial investment, \( r \) is the annual interest rate, and \( t \) is the number of years the money was invested. What is the value of a $5000 investment after 18 years, if it was invested at 4% interest compounded continuously?

1) $9367.30
2) $9869.39
3) $10,129.08
4) $10,272.17

252 Solve for \( x \): \( \frac{1}{16} = 2^{3x-1} \)

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

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

![Graph](image)

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

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

1) \( \frac{3}{4} \)
2) \( \frac{5}{4} \)
3) \( -\frac{3}{4} \)
4) \( -\frac{5}{4} \)
256 What is the third term of the recursive sequence below?
\[ a_1 = -6 \]
\[ a_n = \frac{1}{2} a_{n-1} - n \]
1) \(-\frac{11}{2}\)
2) \(-\frac{5}{2}\)
3) \(-\frac{1}{2}\)
4) \(-4\)

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

258 In a circle with a diameter of 24 cm, a central angle of \(\frac{4\pi}{3}\) radians intercepts an arc. The length of the arc, in centimeters, is
1) \(8\pi\)
2) \(9\pi\)
3) \(16\pi\)
4) \(32\pi\)

259 Determine how many eleven-letter arrangements can be formed from the word "CATTARAGUS."

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

261 If \(T = \frac{10x^2}{y}\), then \(\log T\) is equivalent to
1) \((1 + 2\log x) - \log y\)
2) \(\log(1 + 2x) - \log y\)
3) \((1 - 2\log x) + \log y\)
4) \(2(1 - \log x) + \log y\)

262 The ninth term of the expansion of \((3x + 2y)^{15}\) is
1) \(\binom{15}{9}(3x)^6(2y)^9\)
2) \(\binom{15}{9}(3x)^9(2y)^6\)
3) \(\binom{15}{8}(3x)^7(2y)^8\)
4) \(\binom{15}{8}(3x)^8(2y)^7\)

263 A video-streaming service can choose from six half-hour shows and four one-hour shows. Which expression could be used to calculate the number of different ways the service can choose four half-hour shows and two one-hour shows?
1) \(C_4^6 P_4^6\)
2) \(P_4^6 + C_4^4 P_2\)
3) \(C_4^6 + C_2\)
4) \(C_4^4 + C_2\)
264 The scores of 1000 students on a standardized test were normally distributed with a mean of 50 and a standard deviation of 5. What is the expected number of students who had scores greater than 60?

1) 1.7  
2) 23  
3) 46  
4) 304

265 Express \( xt^8 - yt^6 \) in simplest form.

266 Solve algebraically for \( x \): \( \sqrt{2x+1} + 4 = 8 \)

267 A customer will select three different toppings for a supreme pizza. If there are nine different toppings to choose from, how many different supreme pizzas can be made?

1) 12  
2) 27  
3) 84  
4) 504

268 The expression \( \frac{3 - \sqrt{8}}{\sqrt{3}} \) is equivalent to

1) \( \frac{\sqrt{3} - 2\sqrt{6}}{\sqrt{3}} \)

2) \( -\sqrt{3} + \frac{2}{3}\sqrt{6} \)

3) \( \frac{3 - \sqrt{24}}{3} \)

4) \( \sqrt{3} - \frac{2}{3}\sqrt{6} \)

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

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

270 Solve the equation \( \cos 2x = \cos x \) algebraically for all values of \( x \) in the interval \( 0^\circ \leq x < 360^\circ \).

271 In a triangle, two sides that measure 8 centimeters and 11 centimeters form an angle that measures \( 82^\circ \). To the nearest tenth of a degree, determine the measure of the smallest angle in the triangle.

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

<table>
<thead>
<tr>
<th>Set A</th>
<th>( x )</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td>24</td>
<td>30</td>
<td>36</td>
<td>51</td>
<td>70</td>
<td>86</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set B</th>
<th>( x )</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td>81</td>
<td>64</td>
<td>49</td>
<td>36</td>
<td>25</td>
<td>16</td>
</tr>
</tbody>
</table>

273 The probability of Ashley being the catcher in a softball game is \( \frac{2}{5} \). Calculate the exact probability that she will be the catcher in exactly five of the next six games.
274 Which statement is true about the graphs of \( f \) and \( g \) shown below?

1) \( f \) is a relation and \( g \) is a function.
2) \( f \) is a function and \( g \) is a relation.
3) Both \( f \) and \( g \) are functions.
4) Neither \( f \) nor \( g \) is a function.

275 If \( f(x) = 2x^2 - 3x + 4 \), then \( f(x + 3) \) is equal to

1) \( 2x^2 - 3x + 7 \)
2) \( 2x^2 - 3x + 13 \)
3) \( 2x^2 + 9x + 13 \)
4) \( 2x^2 + 9x + 25 \)

276 How many different 11-letter arrangements are possible using the letters in the word “ARRANGEMENT”?

1) 2,494,800
2) 4,989,600
3) 19,958,400
4) 39,916,800

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

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

278 What is the sum of the roots of the equation \(-3x^2 + 6x - 2 = 0\)?

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

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

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

What is the population standard deviation, to the nearest hundredth, for this group?

1) 1.11
2) 1.12
3) 1.14
4) 1.15
280 In the diagram below, the spinner is divided into eight equal regions.

Which expression represents the probability of the spinner landing on B exactly three times in five spins?

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

281 Expressed as a function of a positive acute angle, \( \sin 230^\circ \) is equal to

1) \( -\sin 40^\circ \)
2) \( -\sin 50^\circ \)
3) \( \sin 40^\circ \)
4) \( \sin 50^\circ \)

283 If \( \cos \theta = \frac{3}{4} \), then what is \( \cos 2\theta \)?

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

284 Find the exact roots of \( x^2 + 10x - 8 = 0 \) by completing the square.

\[ \frac{1}{x} + \frac{3}{y} \]

285 The expression \( \frac{2}{xy} \) is equivalent to

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

286 Which list of ordered pairs does not represent a one-to-one function?

1) \( (1,-1),(2,0),(3,1),(4,2) \)
2) \( (1,2),(2,3),(3,4),(4,6) \)
3) \( (1,3),(2,4),(3,3),(4,1) \)
4) \( (1,5),(2,4),(3,1),(4,0) \)
287 A study compared the number of years of education a person received and that person's average yearly salary. It was determined that the relationship between these two quantities was linear and the correlation coefficient was 0.91. Which conclusion can be made based on the findings of this study?
1) There was a weak relationship.
2) There was a strong relationship.
3) There was no relationship.
4) There was an unpredictable relationship.

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

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

290 When the inverse of \( \tan \theta \) is sketched, its domain is
1) \(-1 \leq \theta \leq 1\)
2) \(-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}\)
3) \(0 \leq \theta \leq \pi\)
4) \(-\infty < \theta < \infty\)

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

292 Determine the area, to the nearest integer, of \( \triangle SRO \) shown below.

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

39
The table below gives the relationship between \( x \) and \( y \).

<table>
<thead>
<tr>
<th>( x )</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>4.2</td>
<td>33.5</td>
<td>113.1</td>
<td>268.1</td>
<td>523.6</td>
</tr>
</tbody>
</table>

Use exponential regression to find an equation for \( y \) as a function of \( x \), rounding all values to the nearest hundredth. Using this equation, predict the value of \( x \) if \( y \) is 426.21, rounding to the nearest tenth. [Only an algebraic solution can receive full credit.]

Which values of \( x \) in the interval \( 0^\circ \leq x < 360^\circ \) satisfy the equation \( 2 \sin^2 x + \sin x - 1 = 0 \)?

1) \( \{30^\circ, 270^\circ\} \)
2) \( \{30^\circ, 150^\circ, 270^\circ\} \)
3) \( \{90^\circ, 210^\circ, 330^\circ\} \)
4) \( \{90^\circ, 210^\circ, 270^\circ, 330^\circ\} \)

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

1) \( \frac{10b^4}{a^3} \)
2) \( \frac{25b^4}{a^3} \)
3) \( \frac{a^3}{25b^4} \)
4) \( \frac{a^7}{125b^5} \)

Solve algebraically for the exact values of \( x \):

\[
\frac{5x}{2} = \frac{1}{x} + \frac{x}{4}
\]

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

1) \(-4\)
2) \(-1\)
3) \(0\)
4) undefined

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

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

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

1) \( 4ab^2 \sqrt[3]{a} \)
2) \( 4a^2 b^3 \sqrt[3]{a} \)
3) \( 8ab^2 \sqrt[3]{a^2} \)
4) \( 8a^2 b^3 \sqrt[3]{a} \)

If \( x^2 = 12x - 7 \) is solved by completing the square, one of the steps in the process is

1) \( (x - 6)^2 = -43 \)
2) \( (x + 6)^2 = -43 \)
3) \( (x - 6)^2 = 29 \)
4) \( (x + 6)^2 = 29 \)
302 Which expression is equivalent to \( \frac{x^{-1}y^2}{x^2y^{-4}} \)?

1) \( \frac{x}{y^2} \)
2) \( \frac{x^3}{y^6} \)
3) \( \frac{y^2}{x} \)
4) \( \frac{y^6}{x^3} \)

303 Given the equation \( 3x^2 + 2x + k = 0 \), state the sum and product of the roots.

304 What is the value of \( \tan \left( \arccos \frac{15}{17} \right) \)?

1) \( \frac{8}{15} \)
2) \( \frac{8}{17} \)
3) \( \frac{15}{8} \)
4) \( \frac{17}{8} \)

305 Which statement about the equation \( 3x^2 + 9x - 12 = 0 \) is true?

1) The product of the roots is \(-12\).
2) The product of the roots is \(-4\).
3) The sum of the roots is \(3\).
4) The sum of the roots is \(-9\).

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

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

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

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

1) \( f^{-1}(x) = x^4 \)
2) \( f^{-1}(x) = 4^x \)
3) \( f^{-1}(x) = \log_4 4 \)
4) \( f^{-1}(x) = -\log_4 4 \)

308 Which graph is the solution to the inequality \( 4|2x + 6| - 5 < 27 \)?

1) 
2) 
3) 
4) 

309 If \( \log_{(x+1)} 64 = 3 \), find the value of \( x \).
310 The scores on a standardized exam have a mean of 82 and a standard deviation of 3.6. Assuming a normal distribution, a student's score of 91 would rank
1) below the 75th percentile
2) between the 75th and 85th percentiles
3) between the 85th and 95th percentiles
4) above the 95th percentile

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

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

313 The equation \( \log_a x = y \) where \( x > 0 \) and \( a > 1 \) is equivalent to
1) \( x^y = a \)
2) \( y^a = x \)
3) \( a^y = x \)
4) \( a^x = y \)

314 What is the value of \( \sum_{n=1}^{3} \cos \frac{n\pi}{2} \)?
1) 1
2) -1
3) 0
4) \( -\frac{1}{2} \)

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

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

317 Which value of \( k \) will make \( x^2 - \frac{1}{4}x + k \) a perfect square trinomial?
1) \( \frac{1}{64} \)
2) \( \frac{1}{16} \)
3) \( \frac{1}{8} \)
4) \( \frac{1}{4} \)
318 The expression \( \frac{3}{2}x + 1 \left( \frac{3}{2}x - 1 \right) - \left( \frac{3}{2}x - 1 \right)^2 \) is equivalent to
1) 0
2) \(-3x\)
3) \(\frac{3}{4}x - 2\)
4) \(3x - 2\)

319 Which statement regarding correlation is not true?
1) The closer the absolute value of the correlation coefficient is to one, the closer the data conform to a line.
2) A correlation coefficient measures the strength of the linear relationship between two variables.
3) A negative correlation coefficient indicates that there is a weak relationship between two variables.
4) A relation for which most of the data fall close to a line is considered strong.

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

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

322 What is the total number of points of intersection of the graphs of the equations \(2x^2 - y^2 = 8\) and \(y = x + 2\)?
1) 1
2) 2
3) 3
4) 0

323 A circle with center \(O\) and passing through the origin is graphed below.

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

324 What is the solution set of \(|x - 2| = 3x + 10\)?
1) \(\{\}\)
2) \(\{-2\}\)
3) \(\{-6\}\)
4) \(\{-2, -6\}\)
325 What are the zeros of the polynomial function graphed below?

1) \{-3, -1, 2\} 
2) \{3, 1, -2\} 
3) \{4, -8\} 
4) \{-6\}

326 Solve algebraically, to the nearest hundredth, for all values of \(x\):

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

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

1) 46 
2) 49 
3) 51 
4) 68

328 If \(p\) and \(q\) vary inversely and \(p\) is 25 when \(q\) is 6, determine \(q\) when \(p\) is equal to 30.

329 A survey is to be conducted in a small upstate village to determine whether or not local residents should fund construction of a skateboard park by raising taxes. Which segment of the population would provide the most unbiased responses?

1) a club of local skateboard enthusiasts 
2) senior citizens living on fixed incomes 
3) a group opposed to any increase in taxes 
4) every tenth person 18 years of age or older walking down Main St.

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

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

331 Solve the equation \(2x^3 - x^2 - 8x + 4 = 0\) algebraically for all values of \(x\).

332 Express \(-130^\circ\) in radian measure, to the nearest hundredth.

333 The domain of \(f(x) = \frac{3}{\sqrt{2-x}}\) is the set of all real numbers

1) greater than 2 
2) less than 2 
3) except 2 
4) between \(-2\) and 2
334 Factor completely: \(x^3 + 3x^2 + 2x + 6\)

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

336 What are the amplitude and the period of the graph represented by the equation \(y = -3 \cos \frac{\theta}{3}\)?

1) amplitude: \(-3\); period: \(\frac{\pi}{3}\)
2) amplitude: \(-3\); period: \(6\pi\)
3) amplitude: \(3\); period: \(\frac{\pi}{3}\)
4) amplitude: \(3\); period: \(6\pi\)

337 What is the total number of different nine-letter arrangements that can be formed using the letters in the word “TENNESSEE”?

1) 3,780
2) 15,120
3) 45,360
4) 362,880

338 Which angle does not terminate in Quadrant IV when drawn on a unit circle in standard position?

1) \(-300^\circ\)
2) \(-50^\circ\)
3) \(280^\circ\)
4) \(1030^\circ\)

339 The expression \(4\sqrt{81x^2y^5}\) is equivalent to

1) \(3x^2y^4\)
2) \(3x^2y^4\)
3) \(9xy^\frac{5}{2}\)
4) \(9xy^\frac{2}{5}\)

340 If angles \(A\) and \(B\) are complementary, then \(\sec B\) equals

1) \(\csc(90^\circ - B)\)
2) \(\csc(B - 90^\circ)\)
3) \(\cos(B - 90^\circ)\)
4) \(\cos(90^\circ - B)\)

341 Which equation represents a circle with its center at \((2, -3)\) and that passes through the point \((6, 2)\)?

1) \((x - 2)^2 + (y + 3)^2 = 41\)
2) \((x + 2)^2 + (y - 3)^2 = 41\)
3) \((x - 2)^2 + (y + 3)^2 = 41\)
4) \((x + 2)^2 + (y - 3)^2 = 41\)

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

1) \(-13\)
2) \(-5\)
3) \(5\)
4) \(13\)
343 The area of a parallelogram is 594, and the lengths of its sides are 32 and 46. Determine, to the nearest tenth of a degree, the measure of the acute angle of the parallelogram.

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

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

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

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

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

349 What is \( \frac{x}{x - 1} - \frac{1}{2 - 2x} \) expressed as a single fraction?
1) \( \frac{x + 1}{x - 1} \)
2) \( \frac{2x - 1}{2 - 2x} \)
3) \( \frac{2x + 1}{2(x - 1)} \)
4) \( \frac{2x - 1}{2(x - 1)} \)

350 A theater has 35 seats in the first row. Each row has four more seats than the row before it. Which expression represents the number of seats in the \( n \)th row?
1) \( 35 + (n + 4) \)
2) \( 35 + (4n) \)
3) \( 35 + (n + 1)(4) \)
4) \( 35 + (n - 1)(4) \)

351 The roots of the equation \( 4(x^2 - 1) = -3x \) are
1) imaginary
2) real, rational, equal
3) real, rational, unequal
4) real, irrational, unequal
352 The expression $\sqrt[4]{-180x^{16}}$ is equivalent to
1) $-6x^4 \sqrt[5]{5}$
2) $-6x^8 \sqrt[5]{5}$
3) $6x^4 i \sqrt{5}$
4) $6x^8 i \sqrt{5}$

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

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

355 Express in simplest form: \[
\frac{36 - x^2}{(x + 6)^2} \div \frac{x - 3}{x^2 + 3x - 18}
\]

357 The expression $\frac{3\sqrt{27a^{-6}b^3c^2}}{a^2}$ is equivalent to
1) $\frac{2bc^3}{a^2}$
2) $\frac{3b^9c^6}{a^{18}}$
3) $\frac{3b^6c^5}{a^3}$
4) $\frac{3\sqrt[3]{3c^2}}{a^2}$

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

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

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

359 Which equation has real, rational, and unequal roots?
1) $x^2 + 10x + 25 = 0$
2) $x^2 - 5x + 4 = 0$
3) $x^2 - 3x + 1 = 0$
4) $x^2 - 2x + 5 = 0$
360 The first four terms of the sequence defined by
\[ a_1 = \frac{1}{2} \text{ and } a_{n+1} = 1 - a_n \] are
1) \( \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2} \)
2) \( \frac{1}{2}, 1, 1, \frac{1}{2}, 2 \)
3) \( \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16} \)
4) \( \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{3}{2} \)

361 When \( \frac{7}{8} x^2 - \frac{3}{4} x \) is subtracted from \( \frac{5}{8} x^2 - \frac{1}{4} x + 2 \),
the difference is
1) \( -\frac{1}{4} x^2 - x + 2 \)
2) \( \frac{1}{4} x^2 - x + 2 \)
3) \( -\frac{1}{4} x^2 + \frac{1}{2} x + 2 \)
4) \( \frac{1}{4} x^2 - \frac{1}{2} x - 2 \)

362 Show that \( \frac{\sec^2 x - 1}{\sec^2 x} \) is equivalent to \( \sin^2 x \).

363 Find the difference when \( \frac{4}{3} x^3 - \frac{5}{8} x^2 + \frac{7}{9} x \) is
subtracted from \( 2x^3 + \frac{3}{4} x^2 - \frac{2}{9} \).

364 Circle \( O \) has a radius of 2 units. An angle with a
measure of \( \frac{\pi}{6} \) radians is in standard position. If
the terminal side of the angle intersects the circle at
point \( B \), what are the coordinates of \( B \)?
1) \( \left( \frac{\sqrt{3}}{2}, \frac{1}{2} \right) \)
2) \( \left( \sqrt{3}, 1 \right) \)
3) \( \left( \frac{1}{2}, \frac{\sqrt{3}}{2} \right) \)
4) \( \left( 1, \sqrt{3} \right) \)

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

366 Solve algebraically for \( x \): \( 5^{4x} = 125^{x-1} \)

367 Six people met at a dinner party, and each person
shook hands once with everyone there. Which
expression represents the total number of
handshakes?
1) \( 6! \)
2) \( 6! - 2! \)
3) \( \frac{6!}{2!} \)
4) \( \frac{6!}{4! \cdot 2!} \)
368 The table below shows the final examination scores for Mr. Spear’s class last year.

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

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

369 The expression \( x(3i^2)^3 + 2xi^{12} \) is equivalent to
1) \( 2x + 27xi \)
2) \(-7x\)
3) \(-25x\)
4) \(-29x\)

370 Given \( y \) varies inversely as \( x \), when \( y \) is multiplied by \( \frac{1}{2} \), then \( x \) is multiplied by
1) \( \frac{1}{2} \)
2) \( 2 \)
3) \(-\frac{1}{2} \)
4) \(-2 \)

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

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

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

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

375 Prove that the equation shown below is an identity for all values for which the functions are defined:
\( \csc \theta \cdot \sin^2 \theta \cdot \cot \theta = \cos \theta \)

376 In \( \triangle FGH \), \( f = 6 \), \( g = 9 \), and \( m\angle H = 57^\circ \). Which statement can be used to determine the numerical value of \( h \)?
1) \( h^2 = 6^2 + 9^2 - 2(9)(h) \cos 57^\circ \)
2) \( h^2 = 6^2 + 9^2 - 2(6)(9) \cos 57^\circ \)
3) \( 6^2 = 9^2 + h^2 - 2(9)(h) \cos 57^\circ \)
4) \( 9^2 = 6^2 + h^2 - 2(6)(h) \cos 57^\circ \)
377 How many different ways can teams of four members be formed from a class of 20 students?
1) 5
2) 80
3) 4,845
4) 116,280

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

379 Given: \( DC = 10, \ AG = 15, \ BE = 6, \ FE = 10 \), \( m\angle ABG = 40, \ m\angle GBD = 90, \ m\angle C < 90 \), \( BE \cong ED \), and \( GF \cong FB \)

Find \( m\angle A \) to the nearest tenth. Find \( BC \) to the nearest tenth.

380 Which relation does \textit{not} represent a function?

1)  
2)  
3)  
4)  

381 If the terminal side of angle \( \theta \) passes through point \((-3, -4)\), what is the value of \( \sec \theta \)?
1) \( \frac{5}{3} \)
2) \( -\frac{5}{3} \)
3) \( \frac{5}{4} \)
4) \( -\frac{5}{4} \)
382 The terminal side of an angle measuring $\frac{4\pi}{5}$ radians lies in Quadrant
1) I
2) II
3) III
4) IV

383 The probability of winning a game is $\frac{2}{3}$.
Determine the probability, expressed as a fraction, of winning exactly four games if seven games are played.

384 Solve algebraically for $x$: $\frac{3}{x} + \frac{x}{x+2} = \frac{2}{x+2}$

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

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

387 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

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

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

390 The probability that Kay and Joseph Dowling will have a redheaded child is 1 out of 4. If the Dowlings plan to have three children, what is the exact probability that only one child will have red hair?
Algebra 2/Trigonometry Regents at Random

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

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

392 Which equation is represented by the graph below?

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

393 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.

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

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

395 Solve algebraically for \( x \):

\[
\frac{1}{x+3} - \frac{2}{3-x} = \frac{4}{x^2 - 9}
\]
396 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) $\sum_{k=1}^{39} (2k - 1)$

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

398 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.

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

400 Which graph does not represent a function?

1) 

2) 

3) 

4) 

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

$a_1 = -3$

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

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

1) 6.4

2) 2.56

3) $\frac{9}{5}$

4) $\frac{8}{5}$
403 The graph below shows the function \( f(x) \).

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

1)  

2)  

3)  

4)  

404 Which arithmetic sequence has a common difference of 4?

1) \( \{0, 4n, 8n, 12n, \ldots \} \)

2) \( \{n, 4n, 16n, 64n, \ldots \} \)

3) \( \{n + 1, n + 5, n + 9, n + 13, \ldots \} \)

4) \( \{n + 4, n + 16, n + 64, n + 256, \ldots \} \)

405 The product of \( 3 + \sqrt{5} \) and \( 3 - \sqrt{5} \) is

1) \( 4 - 6\sqrt{5} \)

2) \( 14 - 6\sqrt{5} \)

3) \( 14 \)

4) \( 4 \)

406 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 \( \tan(A + B) \).

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

1) \( -720x^2 \)

2) \( -240x \)

3) \( 720x^2 \)

4) \( 1,080x^3 \)

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

1) \( 150 \)

2) \( 165 \)

3) \( 330 \)

4) \( 518 \)
409 The expression \( \log_{5} \left( \frac{1}{25} \right) \) is equivalent to

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

410 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

411 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) \( -5ab \sqrt{2b} + 7ab \sqrt{6b} \)

412 Express \( \frac{\sqrt{108x^5y^8}}{\sqrt{6xy^5}} \) in simplest radical form.

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

414 In \( \triangle ABC \), \( m\angle A = 74 \), \( a = 59.2 \), and \( c = 60.3 \). What are the two possible values for \( m\angle C \), to the nearest tenth?

1) 73.7 and 106.3
2) 73.7 and 163.7
3) 78.3 and 101.7
4) 78.3 and 168.3

415 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) \( f(x) = \log_2 x \)

416 The expression \( \sqrt[4]{16x^2y^7} \) is equivalent to

1) \( \frac{1}{2} \) \( \frac{7}{4} \)
2) \( 2x^2y^{28} \)
3) \( 4x^2y^{4} \)
4) \( 4x^8y^{28} \)
417 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.

418 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.

419 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.

420 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) \( \{-2,0,3\} \)

421 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) \( \frac{8}{9} \)
422 The table below shows the first-quarter averages for Mr. Harper’s statistics class.

<table>
<thead>
<tr>
<th>Statistics Class Averages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter Averages</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>99</td>
</tr>
<tr>
<td>97</td>
</tr>
<tr>
<td>95</td>
</tr>
<tr>
<td>92</td>
</tr>
<tr>
<td>90</td>
</tr>
<tr>
<td>87</td>
</tr>
<tr>
<td>84</td>
</tr>
<tr>
<td>81</td>
</tr>
<tr>
<td>75</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>65</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

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

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

425 Write a quadratic equation such that the sum of its roots is 6 and the product of its roots is \(-27\).

426 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) \( 6\pi \)

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

<table>
<thead>
<tr>
<th>Unit 2 Mathematics Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Score</td>
</tr>
<tr>
<td>------------</td>
</tr>
<tr>
<td>96</td>
</tr>
<tr>
<td>92</td>
</tr>
<tr>
<td>84</td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td>76</td>
</tr>
<tr>
<td>72</td>
</tr>
<tr>
<td>68</td>
</tr>
</tbody>
</table>

Find the population standard deviation of these scores, to the nearest tenth.
428 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

429 In the diagram below of right triangle $JTM$, $JT = 12$, $JM = 6$, and $m\angle JMT = 90$.

What is the value of cot$J$?
1) $\frac{\sqrt{3}}{3}$
2) 2
3) $\sqrt{3}$
4) $\frac{2\sqrt{3}}{3}$

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

431 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

432 The expression $x^{-\frac{2}{5}}$ is equivalent to
1) $\frac{-2}{\sqrt[5]{x}}$
2) $-\frac{5}{\sqrt[5]{x^2}}$
3) $\frac{1}{\sqrt[5]{x^5}}$
4) $\frac{1}{\sqrt[2]{x^5}}$

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

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

435 The solution set of $\sqrt{3x + 16} = x + 2$ is
1) {-3, 4}
2) {-4, 3}
3) {3}
4) {-4}
436 Use the discriminant to determine all values of $k$ that would result in the equation $x^2 - kx + 4 = 0$ having equal roots.

437 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.]

438 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

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

440 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.

441 In which graph is $\theta$ coterminal with an angle of $-70^\circ$?
442 The expression \((3 - 7i)^2\) is equivalent to
1) \(-40 + 0i\)
2) \(-40 - 42i\)
3) \(58 + 0i\)
4) \(58 - 42i\)

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

444 Which graph does not represent a function?

1) ![Graph 1]
2) ![Graph 2]
3) ![Graph 3]
4) ![Graph 4]

445 Express the sum \(7 + 14 + 21 + 28 + \ldots + 105\) using sigma notation.

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

447 What is the solution set of the equation \(|4a + 6| - 4a = -10\)?
1) \(\emptyset\)
2) \(\{0\}\)
3) \(\left\{\frac{1}{2}\right\}\)
4) \(\left\{0, \frac{1}{2}\right\}\)

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

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

450 What is the value of \(x\) in the equation \(\log_5 x = 4\)?
1) 1.16
2) 20
3) 625
4) 1,024
451 If a function is defined by the equation $f(x) = 4^x$, which graph represents the inverse of this function?

1)  

2)  

3)  

4)  

452 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)  $(-6, -3)$  

453 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)  $17 = \frac{446 + 16x}{26 + x}$  

454 Which formula can be used to determine the total number of different eight-letter arrangements that can be formed using the letters in the word DEADLINE?

1)  $8!$  

2)  $\frac{8!}{4!}$  

3)  $\frac{8!}{2! + 2!}$  

4)  $\frac{8!}{2! \cdot 2!}$
455 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.

![Graph of \( y = \left( \frac{1}{2} \right)^x \)](image)

456 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) \( -x(x + 3)(x - 2) \)

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

458 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) \( \frac{7\pi}{3} \)

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

460 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

461 Factor the expression \( 12t^8 - 75t^4 \) completely.

462 If \( \angle A \) is acute and \( \tan A = \frac{2}{3} \), then
1) \( \cot A = \frac{2}{3} \)
2) \( \cot A = \frac{1}{3} \)
3) \( \cot(90^\circ - A) = \frac{2}{3} \)
4) \( \cot(90^\circ - A) = \frac{1}{3} \)
463 Which graph represents a relation that is not a function?

1) 

2) 

3) 

4) 

464 Express as a single fraction the exact value of \( \sin 75^\circ \).

465 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.

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

1) \(-5,376\)
2) \(-336\)
3) \(336\)
4) \(5,376\)

467 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

468 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

469 Find, to the nearest tenth of a degree, the angle whose measure is 2.5 radians.
470 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

471 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

472 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) \(4x^2 + 3x - 2 = 0\)

473 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) \(2\sqrt{x + 2}\)

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

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

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

1) \(\frac{8}{5}\)
2) \(-3\)
3) 3
4) 9
477 If \( r = \sqrt[3]{\frac{A^2 + B}{C}} \), then \( \log r \) can be represented by

1) \( \frac{1}{6} \log A + \frac{1}{3} \log B - \log C \)
2) \( 3(\log A^2 + \log B - \log C) \)
3) \( \frac{1}{3} \log (A^2 + B) - C \)
4) \( \frac{2}{3} \log A + \frac{1}{3} \log B - \frac{1}{3} \log C \)

478 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) \( \left\{ x \mid \frac{\pi}{2} < x < \frac{3\pi}{2} \right\} \)

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

1) \(-163,840\)
2) \(-81,920\)
3) \(81,920\)
4) \(327,680\)

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

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

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

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

![Diagram of right triangle KTW]

What is the measure of \( \angle K \), to the nearest minute?

1) \( 33^\circ33'\)
2) \( 33^\circ34'\)
3) \( 33^\circ55'\)
4) \( 33^\circ56'\)

483 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) \( 8 \)

484 What is the domain of the function \( f(x) = \sqrt{x - 2} + 3 \)?

1) \( (-\infty, \infty) \)
2) \( (2, \infty) \)
3) \( [2, \infty) \)
4) \( [3, \infty) \)
485 Which graph represents one complete cycle of the equation \( y = \sin 3\pi x \)?

1)  
2)  
3)  
4)  

486 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.

487 Which graph represents a one-to-one function?

1)  
2)  
3)  
4)  

488 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?
489 Write an equation of the circle shown in the graph below.

490 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) \( w^{14} \)

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

492 Which graph best represents the inequality \( y + 6 \geq x^{2} - x \)?

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

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

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

496 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

497 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) $-\cos^2 \theta - 1$

498 Which graph represents the solution set of $|6x - 7| \leq 5$?
1)
2)
3)
4)

499 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.

500 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.

501 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) $\frac{17 + 5\sqrt{3}}{14}$
502 What is the principal value of \( \cos^{-1}\left(\frac{\sqrt{3}}{2}\right) \)?

1) \(-30^\circ\)
2) \(60^\circ\)
3) \(150^\circ\)
4) \(240^\circ\)

503 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.

504 In \( \triangle ABC \), \( a = 15 \), \( b = 14 \), and \( c = 13 \), as shown in the diagram below. What is the \( m \angle C \), to the nearest degree?

1) 53
2) 59
3) 67
4) 127

505 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?

506 Solve the equation \( 8x^3 + 4x^2 - 18x - 9 = 0 \) algebraically for all values of \( x \).
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) $\frac{4(5 + \sqrt{13})}{38}$

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

In $\triangle ABC$, $a = 3$, $b = 5$, and $c = 7$. What is $m\angle C$?

1) 22
2) 38
3) 60
4) 120

The expression $\log_8 64$ is equivalent to

1) 8
2) 2
3) $\frac{1}{2}$
4) $\frac{1}{8}$

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) $(x + 1)^2 + (y + 3)^2 = 10$
514 The value of \( \tan 126^\circ43' \) to the nearest ten-thousandth is
1) \(-1.3407\)
2) \(-1.3408\)
3) \(-1.3548\)
4) \(-1.3549\)

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

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

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

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

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

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

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

State the domain and range of this function.
520 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) \( \frac{20!}{3!} \)
2) \( \frac{20!}{3!} \)
3) \( \binom{20}{3} \)
4) \( \binom{20}{3} \)

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

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

522 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

523 Solve algebraically for \( x \): \( \log_{x+3} \left( \frac{x^3 + x - 2}{x} \right) = 2 \)
525 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) $16384\sqrt{10}$

526 If $x^2 + 2 = 6x$ is solved by completing the square, an intermediate step would be

1) $(x + 3)^2 = 7$
2) $(x - 3)^2 = 7$
3) $(x - 3)^2 = 11$
4) $(x - 6)^2 = 34$

527 The graph of $y = x^3 - 4x^2 + x + 6$ is shown below.

What is $m \angle \theta$?

1) 45
2) 135
3) 225
4) 240

528 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) $\csc^2 \theta$

529 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 the product of the roots of the equation $x^3 - 4x^2 + x + 6 = 0$?

1) $-36$
2) $-6$
3) 6
4) 4

530 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.
531 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) \( \frac{\sqrt{3}}{a} \)

532 Solve the following systems of equations algebraically:  
\[ 5 = y - x \]
\[ 4x^2 = -17x + y + 4 \]

533 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) \( f(\theta) = 2\sin \theta + 3 \)

534 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

535 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) \( \frac{4}{3} \)

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

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

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

540 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) \( 2\pi \)

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

542 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.

543 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) \( -6, 2 \)

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

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

546 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) \( \sin 55^\circ \)
547 If \( f(x) = x^2 - 6 \) and \( g(x) = 2^x - 1 \), determine the value of \( (g \circ f)(-3) \).

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

548 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

552 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

549 Express \( 5\sqrt[3]{3x^3} - 2\sqrt[3]{27x^3} \) in simplest radical form.

553 Factor completely: \( 10ax^2 - 23ax - 5a \)

550 Which equation is represented by the graph below?

![Graph](image)

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

554 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

555 When \( x^{-1} - 1 \) is divided by \( x - 1 \), the quotient is
1) \( -1 \)
2) \( \frac{1}{x} \)
3) \( \frac{1}{x^2} \)
4) \( \frac{1}{(x - 1)^2} \)
556 Which graph represents the equation \( y = \cos^{-1}x \)?

1) 

2) 

3) 

4) 

557 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.

558 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.

559 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) \( \frac{7\pi}{6} \)

560 Express \( \frac{5}{3 - \sqrt{2}} \) with a rational denominator, in simplest radical form.
561 The value of $x$ in the equation $4^{2x+5} = 8^{3x}$ is
   1) 1
   2) 2
   3) 5
   4) −10

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

563 Which equation is sketched in the diagram below?

564 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.

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

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

567 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) $\log \frac{2xz}{3y}$

568 Express $\left( \frac{2}{3} x - 1 \right)^2$ as a trinomial.
569 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 \( \sin 240^\circ \).

570 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) \( \frac{4\sqrt{5}}{9} \)

572 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

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

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

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

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

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

574 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

575 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.
576 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.

577 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) $2x^2(2x + 3)(3x - 2)$

578 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) $\frac{7 + \sqrt{73}}{4}$

579 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) $a_n = 54 \left( \frac{1}{3} \right)^{n-1}$

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

581 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) $\frac{5}{18}$

582 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
583 The expression $2i^2 + 3i^3$ is equivalent to

1) $-2 - 3i$

2) $2 - 3i$

3) $-2 + 3i$

4) $2 + 3i$

584 Which function is not one-to-one?

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

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

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

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

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

1) $-38$

2) $-12$

3) $26$

4) $62$
Algebra 2/Trigonometry Regents at Random
Answer Section

1 ANS: 1
10 \cdot \frac{3}{2} = \frac{3}{5}p

\frac{15}{2} = \frac{3}{5}p

25 = p

PTS: 2 REF: 011226a2 STA: A2.A.5 TOP: Inverse Variation

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

3 ANS: 1
\frac{2\pi}{b} = 4\pi

b = \frac{1}{2}

PTS: 2 REF: 011425a2 STA: A2.A.69
TOP: Properties of Graphs of Trigonometric Functions KEY: period

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

5 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} \cdot \frac{x^2 + 2x - 8}{16 - x^2}

\frac{(x^2 + 6)(x - 3)}{x(x - 4)} \cdot \frac{2(x - 2)}{x^3(x - 3)} \cdot \frac{(4 + x)(4 - x)}{(x + 4)(x - 2)}

\frac{-2(x^2 + 6)}{x^4}

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

6 ANS: 4 PTS: 2 REF: 061411a2 STA: A2.A.30
TOP: Sequences
7 \text{ ANS: } 2 \\
\sqrt{2x - 4} = x - 2 \\
2x - 4 = x^2 - 4x + 4 \\
0 = x^2 - 6x + 8 \\
0 = (x - 4)(x - 2) \\
x = 4, 2 \\
PTS: 2 \quad \text{REF: A2.A.22} \quad \text{TOP: Solving Radicals} \\
\text{KEY: extraneous solutions}

8 \text{ ANS: } \\
\frac{10!\cdot P_{10}}{3!\cdot 3!\cdot 2!} = \frac{3,628,800}{72} = 50,400 \\
PTS: 2 \quad \text{REF: A2.S.10} \quad \text{TOP: Permutations}

9 \text{ ANS: } \\
2.5 \cdot \frac{180}{\pi} \approx 143^\circ 14' \\
PTS: 2 \quad \text{REF: A2.M.2} \quad \text{TOP: Radian Measure} \\
\text{KEY: degrees}

10 \text{ ANS: } \\
r = \sqrt{2^2 + 3^2} = \sqrt{13} \quad (x + 5)^2 + (y - 2)^2 = 13 \\
PTS: 2 \quad \text{REF: A2.A.49} \quad \text{TOP: Writing Equations of Circles}

11 \text{ ANS: } 4 \\
\frac{10}{4} = 2.5 \\
PTS: 2 \quad \text{REF: A2.A.29} \quad \text{TOP: Sequences}

12 \text{ ANS: } 1 \\
\text{LinReg} \\
w = ax + b \\
a = -664.2857143 \\
b = 146.5297143 \\
r = -0.9982686981 \\
PTS: 2 \quad \text{REF: A2.S.8} \quad \text{TOP: Correlation Coefficient}

13 \text{ ANS: } \\
\sigma \approx 6.2 \quad 6 \text{ scores are within a population standard deviation of the mean. } \quad Q_3 - Q_1 = 41 - 37 = 4 \\
\bar{x} \approx 38.2 \\
PTS: 4 \quad \text{REF: A2.S.4} \quad \text{TOP: Dispersion} \\
\text{KEY: advanced}
14 ANS: 2  PTS: 2  REF: 011301a2  STA: A2.A.52  TOP: Families of Functions
17 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
18 ANS:
\(y = 180.377(0.954)^x\)

PTS: 2  REF: 061231a2  STA: A2.S.7  TOP: Regression  KEY: exponential
19 ANS: 2
2. \(2^3 \cdot 3 = 12\cdot 6^2d = 12\)
4. \(\frac{3}{4} = 12\cdot 36d = 12\)
   \(d = \frac{1}{3}\)

PTS: 2  REF: 061310a2  STA: A2.A.5  TOP: Inverse Variation
20 ANS: 4
\(\frac{4 \cdot 0 + 6 \cdot 1 + 10 \cdot 2 + 0 \cdot 3 + 4k + 2 \cdot 5}{4 + 6 + 10 + 0 + k + 2} = 2\)
   \(\frac{4k + 36}{k + 22} = 2\)
   \(4k + 36 = 2k + 44\)
   \(2k = 8\)
   \(k = 4\)

PTS: 2  REF: 061221a2  STA: A2.S.3  TOP: Average Known with Missing Data
21 ANS: 4

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

22 ANS:
\[ \sec x = \sqrt{2} \]
\[ \cos x = \frac{1}{\sqrt{2}} \]
\[ \cos x = \frac{\sqrt{2}}{2} \]
\[ x = 45^\circ, 315^\circ \]

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

23 ANS: 1

If \( \sin x = 0.8 \), then \( \cos x = 0.6 \). \( \tan \frac{x}{2} = \frac{1 - 0.6}{1 + 0.6} = \frac{0.4}{1.6} = 0.5 \).

PTS: 2 REF: 061220a2 STA: A2.A.77 TOP: Half Angle Identities

24 ANS: 1

TOP: Analysis of Data

25 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

26 ANS: 1

TOP: Negative and Fractional Exponents

27 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

28 ANS: 1

TOP: Graphing Logarithmic Functions
29 ANS: 4
\[ \left( \frac{3}{\sqrt{27x^2}} \right) \left( \frac{1}{\sqrt{16x^4}} \right) = \frac{3}{2} \sqrt{2} \cdot 2^4 \cdot x^6 = 3 \cdot 2 \cdot x^2 \sqrt{2} = 6x^2 \sqrt{2} \]

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

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


31 ANS: 3
\[ \sqrt{9} \sqrt{-1} \sqrt{2} - \sqrt{16} \sqrt{-1} \sqrt{2} = 3i \sqrt{2} - 4i \sqrt{2} = -i \sqrt{2} \]

PTS: 2 REF: 061404a2 STA: A2.N.6 TOP: Square Roots of Negative Numbers

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

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

33 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

34 ANS:
\[ \binom{7}{3} \left( \frac{1}{4} \right)^3 \left( \frac{3}{4} \right)^4 = 35 \left( \frac{1}{64} \right) \left( \frac{81}{256} \right) = \frac{2835}{16384} \approx 0.173 \]

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

KEY: exactly

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

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

KEY: basic
36 ANS: 4
\[ 8^{3k+4} = 4^{2k-1} \]
\[ (2^3)^{3k+4} = (2^2)^{2k-1} \]
\[ 2^{9k+12} = 2^{4k-2} \]
\[ 9k + 12 = 4k - 2 \]
\[ 5k = -14 \]
\[ k = -\frac{14}{5} \]

PTS: 2 REF: 011309a2 STA: A2.A.27 TOP: Exponential Equations
KEY: common base not shown

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

PTS: 4 REF: 011336a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: basic

38 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: Sequences

39 ANS:
\[ 800. \ x = 4^{\frac{3}{5}} = 32. \ \frac{x}{y} = 125 \]
\[ \frac{32}{y} = 800 \]
\[ y = 125 \]
\[ \frac{2}{3} = \frac{1}{25} \]

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

40 ANS: 2 PTS: 2 REF: 061205a2 STA: A2.A.34 TOP: Sigma Notation

41 ANS: 4
\[ \begin{align*}
_{15}C_5 &= 3,003. \\
_{25}C_5 &= _{25}C_20 = 53,130. \\
_{25}C_{15} &= 3,268,760.
\end{align*} \]

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

42 ANS: 4 PTS: 2 REF: 011406a2 STA: A2.S.1 TOP: Analysis of Data
43 ANS: 4 PTS: 2 REF: 061402a2 STA: A2.A.8
TOP: Negative and Fractional Exponents

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

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

45 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

46 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

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

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

48 ANS:
y = 0.488(1.116)^x

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

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

50 ANS:

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

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

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

51 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

52 ANS:

\[ \frac{31 - 19}{7 - 4} = \frac{12}{3} = 4 \]

\[ x + (4 - 1)4 = 19 \]  \[ a_n = 7 + (n - 1)4 \]

\[ x + 12 = 19 \]

\[ x = 7 \]

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

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

54 ANS:

\[ \bar{x} = 14.9, \quad x = 40. \] There are 8 scores between 25.1 and 54.9.

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

55 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

56 ANS: 2 PTS: 2 REF: 061301a2 STA: A2.S.1 TOP: Analysis of Data

57 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
58 ANS: 1
\[
\frac{9}{\sin A} = \frac{10}{\sin 70^\circ} \quad 58^\circ + 70^\circ \text{ is possible.} \quad 122^\circ + 70^\circ \text{ is not possible.}
\]
\[
A \approx 58^\circ
\]

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

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

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

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

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

61 ANS:
\[
\binom{5}{5} \cdot 0.57^0 \cdot 0.43^5 + \binom{5}{4} \cdot 0.57^1 \cdot 0.43^4 + \binom{5}{3} \cdot 0.57^2 \cdot 0.43^3 \approx 0.37
\]

PTS: 4 REF: 061438a2 STA: A2.S.15 TOP: Binomial Probability KEY: at least or at most

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

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

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

PTS: 2 REF: 061421a2 STA: A2.A.76 TOP: Angle Sum and Difference Identities KEY: simplifying
64 ANS: 3
\[ -3 \cdot C_3 \cdot x^{-3} \cdot (-2)^3 = 56x^5 \cdot (-8) = -448x^5 \]

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

65 ANS:

\[ K = absinC = 18 \cdot 22 \sin 60 = 396 \cdot \frac{\sqrt{3}}{2} = 198\sqrt{3} \]

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

KEY: parallelograms

66 ANS:

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

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

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

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

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

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

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

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

KEY: common base not shown

67 ANS:

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

PTS: 2  REF: 011332a2  STA: A2.A.25  TOP: Solving Quadratics

KEY: quadratic formula

68 ANS: 2

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

PTS: 2  REF: 061413a2  STA: A2.A.69  TOP: Properties of Graphs of Trigonometric Functions

KEY: period

69 ANS: 4  PTS: 2  REF: 011201a2  STA: A2.S.2  TOP: Analysis of Data
70 \text{ ANS:} \\
y = 215.983(1.652)^x. \ 215.983(1.652)^7 \approx 7250 \\

PTS: 4 \quad \text{REF: 011337a2} \quad \text{STA: A2.S.7} \quad \text{TOP: Regression} \\
KEY: \text{exponential} \\

71 \text{ 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 \quad \text{REF: 011216a2} \quad \text{STA: A2.A.26} \quad \text{TOP: Solving Polynomial Equations} \\

72 \text{ ANS: 4} \\
2 \cos \theta = 1 \\
\cos \theta = \frac{1}{2} \\
\theta = \cos^{-1} \left( \frac{1}{2} \right) = 60, 300 \\

PTS: 2 \quad \text{REF: 061203a2} \quad \text{STA: A2.A.68} \quad \text{TOP: Trigonometric Equations} \\
KEY: \text{basic} \\

73 \text{ ANS: 1} \quad \text{PTS: 2} \quad \text{REF: 011402a2} \quad \text{STA: A2.A.8} \\
TOP: \text{Negative and Fractional Exponents} \\

74 \text{ ANS: 2} \quad \text{PTS: 2} \quad \text{REF: 061216a2} \quad \text{STA: A2.A.42} \\
TOP: \text{Compositions of Functions} \quad \text{KEY: variables} \\

75 \text{ ANS: 1} \\
(4a + 4) - (2a + 1) = 2a + 3 \\

PTS: 2 \quad \text{REF: 011401a2} \quad \text{STA: A2.A.30} \quad \text{TOP: Sequences}
76 ANS:

![Graphing Quadratic Functions](image)

(−5)² − 4(2)(0) = 25

77 ANS: 3

PTS: 2 REF: 061435a2 STA: A2.A.46 TOP: Graphing Quadratic Functions

77 ANS: 3

KEY: determine equation given nature of roots

78 ANS: 3

5000\left(1 + \frac{.03}{4}\right)^{4.5} = 5000(1.0075)^{20} \approx 5805.92

78 ANS: 3

PTS: 2 REF: 061423a2 STA: A2.A.2 TOP: Using the Discriminant

78 ANS: 3

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

79 ANS: 3

TOP: Finding the Terminal Side of an Angle

80 ANS: 4

![Finding the Terminal Side of an Angle](image)

80 ANS: 4

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

81 ANS:

\begin{align*}
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, ±2i, −4
\end{align*}

81 ANS:

82 ANS: 3
\[
\log 4m^2 = \log 4 + \log m^2 = \log 4 + 2 \log m
\]

KEY: splitting logs

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

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

84 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

85 ANS:
\[
88. \quad \frac{100}{\sin 35^\circ} = \frac{x}{\sin 32^\circ} \quad \sin 66^\circ \approx \frac{T}{97.3}
\]

\[
x \approx 97.3 \quad t \approx 88
\]

KEY: advanced

86 ANS:
\[
x^3 + 5x^2 - 4x - 20 = 0
\]
\[
x^2(x + 5) - 4(x + 5) = 0
\]
\[
(x^2 - 4)(x + 5) = 0
\]
\[
(x + 2)(x - 2)(x + 5) = 0
\]

\[
x = \pm 2, -5
\]

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

87 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
88 ANS: 3
\[ x^2 + y^2 - 16x + 6y + 53 = 0 \]
\[ x^2 - 16x + 64 + y^2 + 6y + 9 = -53 + 64 + 9 \]
\[ (x - 8)^2 + (y + 3)^2 = 20 \]

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

89 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.17 TOP: Complex Fractions

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

91 ANS: 2
\[ \frac{x^{-1} + 1}{x + 1} = \frac{1}{x} + \frac{1}{x + 1} = \frac{1+x}{x} = \frac{1}{x} \]

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

92 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

93 ANS: 1 PTS: 2 REF: 061210a2 STA: A2.A.9 TOP: Negative Exponents

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

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

KEY: extraneous solutions
ANS: 

![Graph of an exponential function]

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

96 ANS: 3  
**PTS:** 2  
**REF:** 061308a2  
**TOP:** Domain and Range  
**KEY:** graph

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

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

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

99 ANS: 2  
**PTS:** 2  
**REF:** 061322a2  
**STA:** A2.A.73  
**TOP:** Law of Sines  
**KEY:** modeling

100 ANS: 2  
\[(x + 2)^2 = -9\]
\[x + 2 = \pm \sqrt{-9}\]
\[x = -2 \pm 3i\]

**PTS:** 2  
**REF:** 011408a2  
**STA:** A2.A.24  
**TOP:** Solving Quadratics  
**KEY:** completing the square

101 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

102 ANS: 
Ordered, the heights are 71, 71, 72, 74, 74, 75, 78, 79, 79, 83. \(Q_1 = 72\) and \(Q_3 = 79\). \(79 - 72 = 7\).

**PTS:** 2  
**REF:** 011331a2  
**STA:** A2.S.4  
**TOP:** Central Tendency and Dispersion  
**KEY:** compute
103 ANS:

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

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

104 ANS:

\[\binom{25}{20} = 53,130\]

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

105 ANS: 1

\[5 \cdot \frac{180}{\pi} \approx 286\]

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

KEY: degrees

106 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

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

108 ANS: 3

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

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

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

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

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

\[-12mi + 12\]

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


110 ANS: 3 PTS: 2 REF: 061219a2 STA: A2.N.8 TOP: Conjugates of Complex Numbers
111 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

112 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

113 ANS: 1

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

114 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

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

116 ANS: 2
\[ \text{If } \sin A = -\frac{7}{25}, \cos A = \frac{24}{25}, \text{ and } \tan A = \frac{\sin A}{\cos A} = \frac{-7}{24} \]

PTS: 2 REF: 011413a2 STA: A2.A.64 TOP: Using Inverse Trigonometric Functions
KEY: advanced
117 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

118 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

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

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

120 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

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

122 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

123 ANS: 1 PTS: 2 REF: 061420a2 STA: A2.A.34
TOP: Sigma Notation
124 ANS: 3
\[
\frac{4x - 5}{3} > 1 \quad \text{or} \quad \frac{4x - 5}{3} < -1
\]
\[
4x - 5 > 3 \quad 4x - 5 < -3
\]
\[
4x > 8 \quad 4x < 2
\]
\[
x > 2 \quad x < \frac{1}{2}
\]

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

125 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: Regression
KEY: exponential

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

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

127 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

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

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

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

130 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

KEY: real domain, absolute value
132 ANS: 2
\[ x^3 + 3x^2 - 4x - 12 \]
\[ x^2(x + 3) - 4(x + 3) \]
\[ (x^2 - 4)(x + 3) \]
\[ (x + 2)(x - 2)(x + 3) \]

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

133 ANS: 2

TOP: Simplifying Trigonometric Expressions

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


KEY: applied

135 ANS: 2

TOP: Differentiating Permutations and Combinations

136 ANS:
\[ \frac{2\sqrt{3}}{3}. \] If \( \sin 60 = \frac{\sqrt{3}}{2} \), then \( \csc 60 = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3} \]

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

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

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

KEY: basic

138 ANS:
\[ \log_{(x + 3)}(2x + 3)(x + 5) = 2 \]
\[ x = -6 \] is extraneous

\[ (x + 3)^2 = (2x + 3)(x + 5) \]
\[ x^2 + 6x + 9 = 2x^2 + 13x + 15 \]
\[ x^2 + 7x + 6 = 0 \]
\[ (x + 6)(x + 1) = 0 \]
\[ x = -1 \]


KEY: applying properties of logarithms

139 ANS: 4

TOP: Using the Discriminant

KEY: determine nature of roots given equation
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

ANS: 

\[ K = ab\sin C = 6 \cdot 6\sin 50^\circ \approx 27.6 \]

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

KEY: parallelograms

ANS: 

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

PTS: 2  REF: 061343a2  STA: A2.A.58  TOP: Reciprocal Trigonometric Relationships

ANS: 

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

PTS: 2  REF: 061324a2  STA: A2.A.60  TOP: Finding the Terminal Side of an Angle

ANS: 

\[ 4 \div 2 = -2 \]

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

ANS: 

\[ i^{13} + i^{18} + i^{31} + n = 0 \]
\[ i + (-1) - i + n = 0 \]
\[ -1 + n = 0 \]
\[ n = 1 \]

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

ANS: 

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

PTS: 2  REF: 011329a2  STA: A2.A.20  TOP: Roots of Quadratics
147 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

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

149 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

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

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

151 ANS: 4 PTS: 2 REF: 011219a2 STA: A2.A.52
TOP: Properties of Graphs of Functions and Relations

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

153 ANS: 2
\[ \frac{r}{60} = 320 = 10(2) \]
\[ \frac{r}{60} = 32 = (2) \]
\[ \log 32 = \log(2) \]
\[ \log 32 = \frac{t \log 2}{60} \]
\[ \frac{60 \log 32}{\log 2} = t \]
\[ 300 = t \]

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

154 ANS:
\[ y = -3 \sin 2x. \text{ The period of the function is } \pi, \text{ the amplitude is 3 and it is reflected over the } x\text{-axis.} \]

PTS: 2 REF: 061235a2 STA: A2.A.72 TOP: Identifying the Equation of a Trigonometric Graph

155 ANS: 4 PTS: 2 REF: 061207a2 STA: A2.A.19
TOP: Properties of Logarithms KEY: antilogarithms
156 ANS: 3
34.1\% + 19.1\% = 53.2\%

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

157 ANS: 3
2! \cdot 2! \cdot 2! = 8

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


159 ANS: 1 PTS: 2 REF: 061408a2 STA: A2.A.24 TOP: Solving Quadratics KEY: completing the square

160 ANS: 3
1000 = 500e^{0.05t}
2 = e^{0.05t}
\ln 2 = \ln e^{0.05t}
\frac{\ln 2}{0.05} = \frac{0.05 \cdot \ln e}{0.05}
13.9 \approx t

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


162 ANS: \[
\sum_{i=1}^{3} \left( -\frac{1}{i!} \right)
\] = -\frac{1}{2}

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

163 ANS: 3

PTS: 2 REF: 011207a2 STA: A2.A.71 TOP: Graphing Trigonometric Functions
\[
\frac{x^2 + 9x - 22}{x^2 - 121} \div (2 - x) = \left(\frac{x + 11}{x + 11}\right) \div \left(\frac{x^2 - 2}{x - 11}\right) = -\frac{1}{x - 11}
\]

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

KEY: division

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

PTS: 2  REF: 011214a2  STA: A2.A.76  TOP: Angle Sum and Difference Identities

KEY: evaluating

\[
a_n = 9n - 4 \quad \text{.} \quad S_n = \frac{20(5 + 176)}{2} = 1810
\]

\[
a_1 = 9(1) - 4 = 5
\]

\[
a_{20} = 9(20) - 4 = 176
\]

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

KEY: arithmetic

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

\[13 = 10x - x^2 \]

\[x^2 - 10x + 13 = 0\]

PTS: 4  REF: 061336a2  STA: A2.A.23  TOP: Solving Rationals

KEY: irrational and complex solutions

\[
\sum C_1 \cdot \sum C_2 = 3 \cdot 10 = 30
\]

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

TOP: Defining Functions  KEY: graphs

\[
\frac{a + b}{c} = \frac{ac + b}{c} = \frac{ac + b}{cd - b}
\]

\[
\frac{d - b}{c} = \frac{ac + b}{c} = \frac{ac + b}{cd - b}
\]

PTS: 2  REF: 011405a2  STA: A2.A.17  TOP: Complex Fractions
172 ANS: 4 PTS: 1 REF: 011312a2 STA: A2.A.56 TOP: Determining Trigonometric Functions KEY: degrees, common angles
173 ANS: 2 PTS: 2 REF: 061218a2 STA: A2.A.43 TOP: Defining Functions
174 ANS: 4
\[ \log_2 x^3 = \log_2 (\log x^3) = \log_2 + 3 \log x \]
175 ANS:
\[ x(x + 3) = 10 \]
\[ x^2 + 3x - 10 = 0 \]
\[ (x + 5)(x - 2) = 0 \]
\[ x = -5, 2 \]
176 ANS: 4 PTS: 2 REF: 061206a2 STA: A2.A.60 TOP: Unit Circle
177 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
178 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: circle
179 ANS: 2 PTS: 2 REF: 011213a2 STA: A2.N.8 TOP: Conjugates of Complex Numbers
\[
\frac{x + 16}{x - 2} - \frac{7(x - 2)}{x - 2} \leq 0 \quad -6x + 30 = 0 \quad x - 2 = 0. \quad \text{Check points such that } x < 2, 2 < x < 5, \text{ and } x > 5. \quad \text{If } x = 1,
\]

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

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

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

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

181  ANS: 2  PTS: 2  REF: 011407a2  STA: A2.A.43  TOP: Defining Functions

182  ANS: 2 \sin^2 x + 5 \sin x - 3 = 0

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

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

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


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

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

184  ANS: 4  
\[2x - 3 > 5 \quad \text{or} \quad 2x - 3 < -5\]

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

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

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

185  ANS: 3  PTS: 2  REF: 011305a2  STA: A2.A.37  TOP: Defining Functions  KEY: ordered pairs

186  ANS: 4  
\[\frac{13}{\sin 40} = \frac{20}{\sin M}. \quad 81 + 40 < 180. \quad (180 - 81) + 40 < 180\]

\[M \approx 81\]

PTS: 2  REF: 061327a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case
\[ S_8 = \frac{3(1 - (-4)^8)}{1 - (-4)} = \frac{196,605}{5} = -39,321 \]

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

188 ANS: 3  
As originally written, alternatives (2) and (3) had no domain restriction, so that both were correct.

PTS: 2  REF: 061405a2  STA: A2.A.52  
TOP: Properties of Graphs of Functions and Relations

\[ a^3\sqrt{6ab^2} + 3a\sqrt{6ab^2} \]

\[ 4a^3\sqrt{6ab^2} \]

189 ANS: 3

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

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

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

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

192 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: Solving Quadratics  
KEY: quadratic formula

193 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
194 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

195 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

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

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

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

PTS: 2  REF: 011428a2  STA: A2.A.67  TOP: Proving Trigonometric Identities

198 ANS:
\[(x + yi)(x - yi) = x^2 - y^2 i^2 = x^2 + y^2
\]

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

199 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
200 ANS: 1  PTS: 2  REF: 011416a2  STA: A2.A.39
TOP: Domain and Range  KEY: real domain, rational

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

PTS: 2  REF: 011228a2  STA: A2.A.4  TOP: Quadratic Inequalities
KEY: one variable

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

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

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

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

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

PTS: 2  REF: 061302a2  STA: A2.M.2  TOP: Radian Measure
KEY: degrees
205 ANS:
\[ 2x - 1 = 27^{\frac{4}{3}} \]
\[ 2x = 27^{\frac{4}{3}} + 1 \]
\[ x = 41 \]

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

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

PTS: 2 REF: 061428a2 STA: A2.S.5 TOP: Normal Distributions
KEY: predict

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

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

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

209 ANS:
\[ 4xi + 5yi^2 + 6xi^3 + 2yi^4 = 4xi + 5y - 6xi + 2y = 7y - 2xi \]

PTS: 2 REF: 011433a2 STA: A2.N.7 TOP: Imaginary Numbers

210 ANS: 2
\[ \tan 30 = \frac{\sqrt{3}}{3} \cdot \frac{\sqrt{3}}{k} = 30 \]
\[ \frac{\sqrt{3}}{k} = \cos 30 \]
\[ k = 2 \]

PTS: 2 REF: 061323a2 STA: A2.A.64 TOP: Using Inverse Trigonometric Functions
KEY: advanced

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

PTS: 2 REF: 061410a2 STA: A2.A.58 TOP: Reciprocal Trigonometric Relationships
\[ \frac{x}{x - \sqrt{x}} \times \frac{x + \sqrt{x}}{x + \sqrt{x}} = \frac{x^2 + x\sqrt{x}}{x^2 - x} = \frac{x(x + \sqrt{x})}{x(x - 1)} = \frac{x + \sqrt{x}}{x - 1} \]

PTS: 2  REF: 061325a2  STA: A2.A.15  TOP: Rationalizing Denominators

ANS: 4

\[ 212 \]

\[ 213 \]

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

ANS: 2

The binomials are conjugates, so use FL.

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

KEY: multiplication

ANS: 2

\[ \sin^{-1}(\frac{8}{17}) \times \text{DMS} \]

\[ 28^\circ 4^\prime 20.953^\prime \]

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

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

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

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

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
\[
\frac{a^2b^3}{4}
\]

PTS: 2  REF: 011231a2  STA: A2.A.13  TOP: Simplifying Radicals
KEY: index > 2

218 ANS: 2

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

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

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

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

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

KEY: splitting logs

219 ANS: 3  PTS: 2  REF: 061224a2  STA: A2.A.63

TOP: Domain and Range

220 ANS:

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

PTS: 2  REF: 011430a2  STA: A2.S.4  TOP: Central Tendency and Dispersion
KEY: compute

221 ANS:

\[\begin{align*}
\binom{5}{4}0.28^4 \cdot 0.72^1 + \binom{5}{5}0.28^5 \cdot 0.72^0 &= 0.024
\end{align*}\]

PTS: 4  REF: 011437a2  STA: A2.S.15  TOP: Binomial Probability
KEY: at least or at most

222 ANS:

\[-4x + 5 < 13 \quad -4x + 5 > -13 \quad -2 < x < 4.5
\]

\[-4x < 8 \quad -4x > -18
\]

\[x > -2 \quad x < 4.5
\]

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

223 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
224 ANS: 3
\[ h(-8) = \frac{1}{2}(-8) - 2 = -4 - 2 = -6. \quad g(-6) = \frac{1}{2}(-6) + 8 = -3 + 8 = 5 \]

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

225 ANS:
\[
\begin{align*}
(3 \times \frac{180}{\pi}) \cdot DMS \\
171^\circ 53' 14.419''
\end{align*}
\]

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

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

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

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

227 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

228 ANS: 1
\[ \frac{6!}{3!2!} = \frac{720}{12} = 60 \]

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

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

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

230 ANS: 1

TOP: Domain and Range
KEY: real domain, radical
231  ANS: 3
\[3x^3 - 5x^2 - 48x + 80\]
\[x^2(3x - 5) - 16(3x - 5)\]
\[(x^2 - 16)(3x - 5)\]
\[(x + 4)(x - 4)(3x - 5)\]

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

232  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

233  ANS: 4
\[2x^2 - 7x - 5 = 0\]
\[
\frac{c}{a} = \frac{-5}{2}
\]

PTS: 2  REF: 061414a2  STA: A2.A.20  TOP: Roots of Quadratics
Algebra 2/Trigonometry Regents at Random
Answer Section

234 ANS: 1
\[ \log x = \log a^2 + \log b \]
\[ \log x = \log a^2 b \]
\[ x = a^2 b \]

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

235 ANS: 2 PTS: 2 REF: 081523a2 STA: A2.A.44
TOP: Inverse of Functions KEY: ordered pairs

236 ANS: 3 PTS: 2 REF: 061514a2 STA: A2.A.55
TOP: Trigonometric Ratios

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

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

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

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

239 ANS: 2 PTS: 2 REF: 011610a2 STA: A2.A.30
TOP: Sequences

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

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

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

PTS: 2 REF: 011530a2 STA: A2.A.27 TOP: Exponential Equations
KEY: without common base
242  ANS: 3
3x^2 + x - 14 = 0  1^2 - 4(3)(-14) = 1 + 168 = 169 = 13^2

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

243  ANS: 4
\[
\frac{\sqrt{34}}{\sin 30} = \frac{12}{\sin B}
\]

\[
B = \sin^{-1} \frac{12 \sin 30}{\sqrt{34}}
\]

\[
\approx \sin^{-1} \frac{6}{5.8}
\]

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

244  ANS: 3
\[
r = \sqrt{(3 - 0)^2 + (-5 - (-2))^2} = \sqrt{9 + 9} = \sqrt{18}
\]

PTS: 2    REF: 011624a2    STA: A2.A.48    TOP: Equations of Circles

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

\[
5x - 2x + 6 = x^2 - 3x
\]

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

PTS: 2    REF: 011522a2    STA: A2.A.23    TOP: Solving Rationals
KEY: irrational and complex solutions

246  ANS:
\[
8^{x+1} = 16
\]
\[
2^{3(x+1)} = 2^4
\]
\[
3x + 3 = 4
\]
\[
3x = 1
\]
\[
x = \frac{1}{3}
\]

PTS: 2    REF: 011630a2    STA: A2.A.28    TOP: Logarithmic Equations
KEY: basic

247  ANS: 1    PTS: 2    REF: 011505a2    STA: A2.A.53
TOP: Graphing Exponential Functions
248  ANS: 2

\[9 - x^2 < 0 \quad \text{or} \quad x + 3 < 0 \text{ and } x - 3 < 0\]

\[x^2 - 9 > 0 \quad \text{or} \quad x < -3 \text{ and } x < 3\]

\[(x + 3)(x - 3) > 0 \quad \text{or} \quad x < -3\]

\[x + 3 > 0 \text{ and } x - 3 > 0\]

\[x > -3 \text{ and } x > 3\]

\[x > 3\]

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

KEY: one variable

249  ANS: 1

\[c = \sqrt{(x + \sqrt{2})^2 + (x - \sqrt{2})^2} = \sqrt{x^2 + 2\sqrt{2}x + 2 + x^2 - 2\sqrt{2}x + 2} = \sqrt{2x^2 + 4}\]


KEY: with variables | index = 2

250  ANS: 4

\[A = 5000e^{(0.04)(18)} \approx 10272.17\]

PTS: 2  REF: 011607a2  STA: A2.A.12  TOP: Evaluating Exponential Expressions

251  ANS: 2

\[A = 50\left(1 + \frac{0.0325}{4}\right)^{4 \cdot 12} = 50(1.008125)^{48} \approx 73.73\]

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

252  ANS:

\[-4 = 2^x - 1\]

\[-3 = 3x\]

\[-1 = x\]

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

KEY: common base shown

253  ANS:

\[(x + 1)^2 - (x + 1) = x^2 + 2x + 1 - x - 1 = x^2 + x\]

PTS: 2  REF: 081530a2  STA: A2.A.42  TOP: Compositions of Functions

KEY: variables

254  ANS: 4  PTS: 2  REF: 061518a2  STA: A2.A.51  TOP: Domain and Range

KEY: graph
\[
\begin{align*}
\frac{c}{a} &= \frac{-3}{4} \\
\text{PTS: } 2 & \quad \text{REF: } 011517a2 \quad \text{STA: } A2.A.20 \quad \text{TOP: } \text{Roots of Quadratics}
\end{align*}
\]

256 ANS: 1
\[
\begin{align*}
a_2 &= \frac{1}{2}(-6) - 2 = -5 \\
a_3 &= \frac{1}{2}(-5) - 3 = \frac{-11}{2}
\end{align*}
\]

PTS: 2 \quad \text{REF: } 011623a2 \quad \text{STA: } A2.A.33 \quad \text{TOP: } \text{Sequences}

\begin{align*}
K &= 8 \cdot 12 \sin 120 = 96 \cdot \frac{\sqrt{3}}{2} = 48\sqrt{3} \\
\text{PTS: } 2 & \quad \text{REF: } 061508a2 \quad \text{STA: } A2.A.74 \quad \text{TOP: } \text{Using Trigonometry to Find Area} \\
\text{KEY: } & \text{parallelograms}
\end{align*}

258 ANS: 3
\[
\begin{align*}
s &= \theta r = \frac{4\pi}{3} \cdot \frac{24}{2} = 16\pi
\end{align*}
\]

PTS: 2 \quad \text{REF: } 011611a2 \quad \text{STA: } A2.A.61 \quad \text{TOP: } \text{Arc Length} \\
\text{KEY: } \text{arc length}

\begin{align*}
\frac{11!}{3!2!2!} &= 1,663,200 \\
\text{PTS: } 2 & \quad \text{REF: } 011631a2 \quad \text{STA: } A2.S.10 \quad \text{TOP: } \text{Permutations}
\end{align*}

260 ANS: 3 \quad \text{PTS: } 2 \quad \text{REF: } 081517a2 \quad \text{STA: } A2.A.39 \quad \text{TOP: } \text{Domain and Range} \quad \text{KEY: } \text{real domain, exponential}

261 ANS: 1
\[
\begin{align*}
\log T &= \log \frac{10x^2}{y} = \log 10 + \log x^2 - \log y = 1 + 2 \log x - \log y \\
\text{PTS: } 2 & \quad \text{REF: } 011615a2 \quad \text{STA: } A2.A.19 \quad \text{TOP: } \text{Properties of Logarithms} \\
\text{KEY: } & \text{splitting logs}
\end{align*}
\]

262 ANS: 3 \quad \text{PTS: } 2 \quad \text{REF: } 081525a2 \quad \text{STA: } A2.A.36 \quad \text{TOP: } \text{Binomial Expansions}

263 ANS: 3 \quad \text{PTS: } 2 \quad \text{REF: } 061523a2 \quad \text{STA: } A2.S.9 \quad \text{TOP: } \text{Differentiating Permutations and Combinations}
\[
\frac{60-50}{5} = 2 \text{ standards above the mean or } 2.3\% \quad 2.3\% \cdot 1000 = 23
\]

PTS: 2  
REF: 011614a2  
STA: A2.S.5  
TOP: Normal Distributions  
KEY: predict

265  
ANS:
\[
x^8 - y^6 = x(1) - y(-1) = x + y
\]

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

266  
ANS:
\[
\sqrt{2x + 1} = 4
\]
\[
2x + 1 = 16
\]
\[
x = \frac{15}{2}
\]

PTS: 2  
REF: 011628a2  
STA: A2.A.22  
TOP: Solving Radicals  
KEY: basic

267  
ANS: 3
\[
\binom{9}{3} = 84
\]

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

268  
ANS: 4
\[
\frac{3 - \sqrt{8}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3} - \sqrt{24}}{3} = \frac{\sqrt{3} - 2\sqrt{6}}{3} = \sqrt{3} - \frac{2}{3}\sqrt{6}
\]

PTS: 2  
REF: 081518a2  
STA: A2.N.5  
TOP: Rationalizing Denominators

269  
ANS:
\[
(x + 14)(x + 22) = 800 \quad x = \frac{-36 \pm \sqrt{(-36)^2 - 4(1)(-492)}}{2(1)} = \frac{-36 \pm \sqrt{3264}}{2} \approx 10.6 \quad 10 \text{ feet increase.}
\]
\[
x^2 + 36x + 308 = 800
\]
\[
x^2 + 36x - 492 = 0
\]

PTS: 6  
REF: 011539a2  
STA: A2.A.25  
TOP: Solving Quadratics  
KEY: quadratic formula
270 ANS:

\[ 2 \cos^2 x - 1 = \cos x \]

\[ 2 \cos^2 x - \cos x - 1 = 0 \]

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

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

\[ x = 0, 120, 240 \]

PTS: 4 REF: 011638a2 STA: A2.A.68 TOP: Trigonometric Equations KEY: double angle identities

271 ANS:

\[ a = \sqrt{8^2 + 11^2 - 2(8)(11) \cos 82^\circ} \approx 12.67 \]

The angle opposite the shortest side:

\[ \frac{8}{\sin x} = \frac{12.67}{\sin 82^\circ} \]

\[ x \approx 38.7 \]


272 ANS:

\[ r_A \approx 0.976 \quad r_B \approx 0.994 \]

Set B has the stronger linear relationship since \( r \) is higher.

PTS: 2 REF: 061535a2 STA: A2.S.8 TOP: Correlation Coefficient

273 ANS:

\[ _6C_5 \left( \frac{2}{5} \right)^5 \left( \frac{3}{5} \right)^5 = 6 \left( \frac{32}{3125} \right) \left( \frac{3}{5} \right) = \frac{576}{15,625} \]


274 ANS: 2 PTS: 2 REF: 011507a2 STA: A2.A.38 TOP: Defining Functions KEY: graphs

275 ANS: 3

\[ f(x + 3) = 2(x + 3)^3 - 3(x + 3) + 4 = 2x^3 + 12x + 18 - 3x - 9 + 4 = 2x^3 + 9x + 13 \]

PTS: 2 REF: 011619a2 STA: A2.A.41 TOP: Functional Notation

276 ANS: 1

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

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

277 ANS: 4 PTS: 2 REF: 011504a2 STA: A2.A.34 TOP: Sigma Notation
\[
\frac{-b}{a} = \frac{-6}{-3} = 2
\]

PTS: 2  REF: 011613a2  STA: A2.A.20  TOP: Roots of Quadratics

279  ANS: 2

PTS: 2  REF: 081509a2  STA: A2.S.4

TOP: Dispersion  KEY: basic, group frequency distributions

280  ANS: 4

PTS: 2  REF: 011605a2  STA: A2.S.15

TOP: Binomial Probability  KEY: modeling

281  ANS: 2

PTS: 2  REF: 081515a2  STA: A2.A.57

TOP: Reference Angles

282  ANS: 1

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

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

KEY: simplifying

283  ANS: 1

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

PTS: 2  REF: 081522a2  STA: A2.A.77  TOP: Double Angle Identities

KEY: evaluating

284  ANS:

\[x^2 + 10x + 25 = 8 + 25\]

\[(x + 5)^2 = 33\]

\[x + 5 = \pm \sqrt{33}\]

\[x = -5 \pm \sqrt{33}\]

PTS: 4  REF: 011636a2  STA: A2.A.24  TOP: Completing the Square

285  ANS: 4

\[
\frac{\sqrt[xy]{3x+y}}{2} = \frac{3x+y}{xy} \cdot \frac{xy}{2} = \frac{3x+y}{2}
\]

PTS: 2  REF: 011603a2  STA: A2.A.17  TOP: Complex Fractions

286  ANS: 3

PTS: 2  REF: 061501a2  STA: A2.A.43

TOP: Defining Functions

287  ANS: 2

PTS: 2  REF: 081502a2  STA: A2.S.8

TOP: Correlation Coefficient
288 ANS: 4
3 \cdot 400 = 8x
150 = x

PTS: 2 REF: 081507a2 STA: A2.A.5 TOP: Inverse Variation

289 ANS:
a = 3, b = 2, c = 1 \quad y = 3 \cos 2x + 1.

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

290 ANS: 4 PTS: 2 REF: 011622a2 STA: A2.A.63 TOP: Domain and Range

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

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

292 ANS:
\[ \frac{1}{2} \cdot 15 \cdot 31.6 \sin 125 \approx 194 \]

PTS: 2 REF: 011633a2 STA: A2.A.74 TOP: Using Trigonometry to Find Area

293 ANS: 1
\[ \frac{3}{4} = \frac{3}{2} \]

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

294 ANS:
y = 2.19(3.23)^x 
426.21 = 2.19(3.23)^x
\[ \frac{426.21}{2.19} = (3.23)^x \]
\[ \log \frac{426.21}{2.19} = x \log(3.23) \]
\[ \frac{\log 426.21}{\log 2.19} = x \]
\[ x \approx 4.5 \]

PTS: 4 REF: 011637a2 STA: A2.S.7 TOP: Exponential Regression
\[(2 \sin x - 1)(\sin x + 1) = 0\]

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

\[x = 30, 150, 270\]

PTS: 2  
KEY: quadratics  
STA: A2.A.68  
TOP: Trigonometric Equations

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

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

\[
\frac{10x}{4} = \frac{1}{x} + \frac{x}{4}
\]

\[
\frac{9x}{4} = \frac{1}{x}
\]

\[9x^2 = 4\]

\[x^2 = \frac{4}{9}\]

\[x = \pm \frac{2}{3}\]

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

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

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

\[\cos 2A = 1 - 2\sin^2 A = 1 - 2\left(\frac{3}{8}\right)^2 = \frac{32}{32} - \frac{9}{32} = \frac{23}{32}\]

PTS: 2  
REF: 011510a2  
STA: A2.A.77  
TOP: Double Angle Identities  
KEY: evaluating

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

PTS: 2  
REF: 011516a2  
STA: A2.N.2  
TOP: Operations with Radicals
301 ANS: 3

\[ x^2 = 12x - 7 \]
\[ x^2 - 12x = -7 \]
\[ x^2 - 12x + 36 = -7 + 36 \]
\[ (x - 6)^2 = 29 \]

PTS: 2  REF: 061505a2  STA: A2.A.24  TOP: Solving Quadratics
KEY: completing the square

302 ANS: 4  PTS: 2  REF: 061506a2  STA: A2.A.9
TOP: Negative Exponents

303 ANS:

\[ \frac{-b}{a} = \frac{-2}{3} \]\nProduct \[ \frac{c}{a} = \frac{k}{3} \]

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

304 ANS: 1

If \[ \sin \theta = \frac{15}{17} \], then \[ \cos \theta = \frac{8}{17} \]. \[ \tan \theta = \frac{17}{15} = \frac{8}{15} \]

PTS: 2  REF: 081508a2  STA: A2.A.64  TOP: Using Inverse Trigonometric Functions
KEY: advanced

305 ANS: 2

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

PTS: 2  REF: 081506a2  STA: A2.A.20  TOP: Roots of Quadratics

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

307 ANS: 2  PTS: 2  REF: 061521a2  STA: A2.A.44
TOP: Inverse of Functions  KEY: equations

308 ANS: 2

\[ 4|2x + 6| < 32 \]  \[ 2x + 6 < 8 \]  \[ 2x + 6 > -8 \]
\[ |2x + 6| < 8 \]  \[ 2x < 2 \]  \[ 2x > -14 \]
\[ x < 1 \]  \[ x > -7 \]

PTS: 2  REF: 011612a2  STA: A2.A.1  TOP: Absolute Value Inequalities
KEY: graph
309 ANS: 
\[(x + 1)^3 = 64\]
\[x + 1 = 4\]
\[x = 3\]

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

310 ANS: 4
\[\frac{91 - 82}{3.6} = 2.5\text{ sd}\]

PTS: 2 REF: 081521a2 STA: A2.S.5 TOP: Normal Distributions
KEY: interval

311 ANS: 1
\[\frac{5}{4 - \sqrt{11}} \cdot \frac{4 + \sqrt{11}}{4 + \sqrt{11}} = \frac{5(4 + \sqrt{11})}{16 - 11} = \frac{5(4 + \sqrt{11})}{5} = 4 + \sqrt{11}\]

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

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

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

313 ANS: 3

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

314 ANS: 2
\[\cos \frac{\pi}{2} + \cos \pi + \cos \frac{3\pi}{2} = 0 + (-1) + 0 = -1\]

PTS: 2 REF: 011617a2 STA: A2.N.10 TOP: Sigma Notation
KEY: advanced

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

KEY: with variables | index > 2

316 ANS: 4
\[g(-2) = 3(-2) - 2 = -8\]
\[f(-8) = 2(-8)^2 + 1 = 128 + 1 = 129\]

PTS: 2 REF: 061503a2 STA: A2.A.42 TOP: Compositions of Functions
KEY: numbers
317 ANS: 1
\[
\left(\frac{1}{2} \left( \frac{1}{4} \right) \right)^2 = \frac{1}{64}
\]

PTS: 2  REF: 081527a2  STA: A2.A.24  TOP: Solving Quadratics
KEY: completing the square

318 ANS: 4
\[
\frac{3}{2}x - 1 \left( \frac{3}{2}x + 1 \right) - \frac{3}{2}x - 1 \right) = \frac{3}{2}x - 1 \right) \cdot 2 = 3x - 2
\]

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

319 ANS: 3  PTS: 2  REF: 011616a2  STA: A2.S.8  TOP: Correlation Coefficient

320 ANS: 1
\[
\sin 120 = \frac{\sqrt{3}}{2} \quad \csc 120 = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}
\]

PTS: 2  REF: 081505a2  STA: A2.A.59  TOP: Reciprocal Trigonometric Relationships

321 ANS:
\[
28^2 = 47^2 + 34^2 - 2(47)(34) \cos A
\]
\[
784 = 3365 - 3196 \cos A
\]
\[
-2581 = -3196 \cos A
\]
\[
\frac{2581}{3196} = \cos A
\]
\[
36 \approx A
\]

KEY: find angle

322 ANS: 2
\[
2x^2 - (x + 2)^2 = 8
\]
\[
2x^2 - (x^2 + 4x + 4) - 8 = 0
\]
\[
x^2 - 4x - 12 = 0
\]
\[
(x - 6)(x + 2) = 0
\]
\[
x = 6, -2
\]

PTS: 2  REF: 011609a2  STA: A2.A.3  TOP: Quadratic-Linear Systems
KEY: equations

ANS: 2
\[ x - 2 = 3x + 10 \quad -6 \text{ is extraneous. } x - 2 = -3x - 10 \]
\[ -12 = 2x \quad 4x = -8 \]
\[ -6 = x \quad x = -2 \]

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

TOP: Zeros of Polynomials

ANS:
\[ \log_2 \left( \frac{x^2 - 7x + 12}{2x - 10} \right) = 3 \quad x = \frac{23 \pm \sqrt{(-23)^2 - 4(1)(92)}}{2(1)} \approx 17.84, 5.16 \]
\[ \frac{x^2 - 7x + 12}{2x - 10} = 8 \]
\[ x^2 - 7x + 12 = 16x - 80 \]
\[ x^2 - 23x + 92 = 0 \]

PTS: 6 \quad REF: 081539a2 \quad STA: A2.A.28 \quad TOP: Logarithmic Equations

KEY: applying properties of logarithms

ANS: 3
\[ p(5) - p(0) = 17(1.15)^{2(5)} - 17(1.15)^{2(0)} \approx 68.8 - 17 \approx 51 \]

PTS: 2 \quad REF: 011528a2 \quad STA: A2.A.12 \quad TOP: Functional Notation

ANS:
\[ 25 \cdot 6 = 30q \]
\[ 5 = q \]

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

TOP: Analysis of Data

ANS:
\[ a_2 = 3(2)^{-2} = \frac{3}{4} \quad a_3 = 3 \left( \frac{3}{4} \right)^{-2} = \frac{16}{3} \quad a_4 = 3 \left( \frac{16}{3} \right)^{-2} = \frac{27}{256} \]

PTS: 4 \quad REF: 011537a2 \quad STA: A2.A.33 \quad TOP: Sequences
331 ANS:

\[ x^2 (2x - 1) - 4(2x - 1) = 0 \]

\[ (x^2 - 4)(2x - 1) = 0 \]

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

\[ x = \pm 2, \frac{1}{2} \]

PTS: 4  REF: 081537a2  STA: A2.A.26  TOP: Solving Polynomial Equations

332 ANS:

\[ -130 \cdot \frac{\pi}{180} \approx -2.27 \]

PTS: 2  REF: 011632a2  STA: A2.M.2  TOP: Radian Measure

KEY: radians


KEY: real domain, rational

334 ANS:

\[ x^2(x + 3) + 2(x + 3) = (x^2 + 2)(x + 3) \]

PTS: 2  REF: 011629a2  STA: A2.A.7  TOP: Factoring by Grouping

335 ANS:

\[ \frac{8}{\sin 85} = \frac{2}{\sin C} \]

\[ 85 + 14.4 < 180 \quad 1 \text{ triangle} \]

\[ C = \sin^{-1}\left( \frac{2 \sin 85}{8} \right) \]

\[ C \approx 14.4 \]

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


KEY: period

337 ANS: 1

\[ \binom{9}{5} \cdot 2! \cdot 2! = \frac{362,880}{96} = 3,780 \]

PTS: 2  REF: 061511a2  STA: A2.S.10  TOP: Permutations

338 ANS: 1

\[ -300^\circ + 360^\circ = 60^\circ, \text{ which terminates in Quadrant I.} \]

PTS: 2  REF: 011602a2  STA: A2.A.60  TOP: Unit Circle

339 ANS: 1

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

PTS: 2  REF: 081504a2  STA: A2.A.11  TOP: Radicals as Fractional Exponents
340 ANS: 3
Cofunctions secant and cosecant are complementary

PTS: 2 REF: 011625a2 STA: A2.A.58 TOP: Cofunction Trigonometric Relationships

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


342 ANS: 4
\[ (-3 - 2i)(-3 + 2i) = 9 - 4i^2 = 9 + 4 = 13 \]

PTS: 2 REF: 011512a2 STA: A2.N.9 TOP: Multiplication and Division of Complex Numbers

343 ANS:
\[ 594 = 32 \cdot 46 \sin C \]
\[ \frac{594}{1472} = \sin C \]
\[ 23.8 \approx C \]

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

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

PTS: 2 REF: 081519a2 STA: A2.A.69 TOP: Properties of Graphs of Trigonometric Functions
KEY: period

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

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

346 ANS: 1
\[ \frac{2\pi}{2} = \pi \]
\[ \frac{\pi}{\pi} = 1 \]

PTS: 2 REF: 061519a2 STA: A2.A.69 TOP: Properties of Graphs of Trigonometric Functions
KEY: period
\[ \sin^2 x \left( 1 + \frac{\cos^2 x}{\sin^2 x} \right) = \sin^2 x + \cos^2 x = 1 \quad \frac{1}{\cos^2 x} \quad \text{(cos}^2 x) = 1 \quad \cos^2 x \left( \frac{\sin^2 x}{\cos^2 x} - 1 \right) = \sin^2 x - \cos^2 x \neq 1 \]

\[ \frac{\cos^2 x}{\sin^2 x} \left( \frac{1}{\cos^2 x} - 1 \right) = \frac{1}{\sin^2 x} - \frac{\cos^2 x}{\sin^2 x} = \csc^2 x - \cot x = 1 \]

347 ANS: 3

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

348 ANS:

\[ 2xi(i - 4i^2) = 2x \cdot i - 8xi^3 = 2xi^2 - 8xi^3 = -2x + 8xi \]

PTS: 2 REF: 011533a2 STA: A2.N.9 TOP: Multiplication and Division of Complex Numbers

349 ANS: 3

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

PTS: 2 REF: 011608a2 STA: A2.A.16 TOP: Addition and Subtraction of Rationals

350 ANS: 4 PTS: 2 REF: 061520a2 STA: A2.A.29 TOP: Sequences

351 ANS: 4

\[ 4x^2 + 3x - 4 = 0 \quad b^2 - 4ac = 3^2 - 4(4)(-4) = 9 + 64 = 73 \]

PTS: 2 REF: 011608a2 STA: A2.A.2 TOP: Using the Discriminant

352 ANS: 4

\[ \sqrt{-180x^6} = 6x^3 i \sqrt{5} \]

PTS: 2 REF: 081524a2 STA: A2.N.6 TOP: Square Roots of Negative Numbers

353 ANS: 2

\[ x^3 - 2x^2 - 9x + 18 \]
\[ x^2(x - 2) - 9(x - 2) \]
\[ (x^2 - 9)(x - 2) \]
\[ (x + 3)(x - 3)(x - 2) \]

PTS: 2 REF: 011511a2 STA: A2.A.7 TOP: Factoring by Grouping

354 ANS: 1

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

PTS: 2 REF: 081512a2 STA: A2.S.10 TOP: Permutations
ANS:
\[
\frac{(6-x)(6+x)}{(x+6)(x+6)} \cdot \frac{(x+6)(x-3)}{x-3} = 6-x
\]

PTS: 2  REF: 011529a2  STA: A2.A.17  TOP: Complex Fractions

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

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

ANS: 1
\[
\sqrt[3]{27a^{-6}b^3c^2} = 3a^{-2}bc^{\frac{2}{3}} = \frac{3bc^{\frac{2}{3}}}{a^2}
\]

PTS: 2  REF: 011606a2  STA: A2.A.11  TOP: Radicals as Fractional Exponents

ANS: 2
\[
12 - 7 = 5
\]

PTS: 2  REF: 081525a2  STA: A2.S.4  TOP: Central Tendency and Dispersion

KEY: frequency

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

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

TOP: Sequences

ANS: 1  PTS: 2  REF: 081520a2  STA: A2.A.33

TOP: Operations with Polynomials

KEY: subtraction

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

PTS: 2  REF: 081533a2  STA: A2.A.58  TOP: Reciprocal Trigonometric Relationships

ANS:
\[
\frac{2}{3}x^3 + \frac{11}{8}x^2 - \frac{7}{9}x - \frac{2}{9}
\]

PTS: 2  REF: 011635a2  STA: A2.N.3  TOP: Operations with Polynomials

KEY: subtraction
364 ANS: 2
\[ x = 2 \cdot \frac{\sqrt{3}}{2} = \sqrt{3} \quad y = 2 \cdot \frac{1}{2} = 1 \]

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

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

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

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

PTS: 2 REF: 061528a2 STA: A2.A.27 TOP: Exponential Equations
KEY: common base shown

367 ANS: 4 PTS: 2 REF: 081526a2 STA: A2.S.9 TOP: Differentiating Permutations and Combinations

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

PTS: 4 REF: 061538a2 STA: A2.S.4 TOP: Dispersion
KEY: advanced, group frequency distributions

369 ANS: 3
\[ x(27^6) + x(2i^{12}) = -27x + 2x = -25x \]

PTS: 2 REF: 011620a2 STA: A2.N.7 TOP: Imaginary Numbers

370 ANS: 2 PTS: 2 REF: 061510a2 STA: A2.A.5 TOP: Inverse Variation

371 ANS:
\[ x^2(x - 6) - 25(x - 6) \]
\[ (x^2 - 25)(x - 6) \]
\[ (x + 5)(x - 5)(x - 6) \]

PTS: 2 REF: 061532a2 STA: A2.A.7 TOP: Factoring by Grouping
372 ANS:
\[5 \cos \theta - 2 \sec \theta + 3 = 0\]
\[5 \cos \theta - \frac{2}{\cos \theta} + 3 = 0\]
\[5 \cos^2 \theta + 3 \cos \theta - 2 = 0\]
\[(5 \cos \theta - 2)(\cos \theta + 1) = 0\]
\[
\cos \theta = \frac{2}{5}, -1
\]
\[\theta \approx 66.4, 293.6, 180\]

PTS: 6 REF: 061539a2 STA: A2.A.68 TOP: Trigonometric Equations
KEY: reciprocal functions

373 ANS:
\[sd = \frac{81 - 57}{3} = 8\]

\[57 + 8 = 65\]
\[81 - 2(8) = 65\]

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

374 ANS: 1 PTS: 2 REF: 061516a2 STA: A2.A.46
TOP: Transformations with Functions

375 ANS:
\[
\frac{1}{\sin \theta} \cdot \sin^2 \theta \cdot \frac{\cos \theta}{\sin \theta} = \cos \theta
\]

\[
\cos \theta = \cos \theta
\]

PTS: 2 REF: 011634a2 STA: A2.A.67 TOP: Proving Trigonometric Identities

376 ANS: 2 PTS: 2 REF: 011501a2 STA: A2.A.73
TOP: Law of Cosines KEY: side, without calculator

377 ANS: 3
\[\begin{align*}
\binom{n}{4} &= 4,845 \\
\end{align*}\]

PTS: 2 REF: 011509a2 STA: A2.S.11 TOP: Combinations

378 ANS: 3
\[
\frac{40 - 10}{6 - 1} = \frac{30}{5} = 6 \quad a_n = 6n + 4
\]

\[
a_{20} = 6(20) + 4 = 124
\]

PTS: 2 REF: 081510a2 STA: A2.A.32 TOP: Sequences
\[
\frac{16}{\sin A} = \frac{15}{\sin 40} \quad \frac{10}{\sin 50} = \frac{12}{\sin C} \quad \frac{d}{\sin 63.2} = \frac{12}{\sin 66.8}
\]
\[
\sin A = \frac{16 \sin 40}{15} \quad \sin C = \frac{12 \sin 50}{10} \quad d = \frac{12 \sin 63.2}{\sin 66.8}
\]
\[
A \approx 43.3 \quad C \approx 66.8 \quad d \approx 11.7
\]

PTS: 6  
REF: 011639a2  
STA: A2.A.73  
TOP: Law of Sines  
KEY: advanced

380 ANS: 3  
PTS: 2  
REF: 011604a2  
STA: A2.A.38  
TOP: Defining Functions  
KEY: ordered pairs

381 ANS: 4  
\[
\cos \theta = -\frac{3}{5} \quad \sec \theta = -\frac{5}{3}
\]

PTS: 2  
REF: 011621a2  
STA: A2.A.62  
TOP: Determining Trigonometric Functions  
TOP: Radian Measure

383 ANS:  
\[
\left(\frac{2}{3}\right)^4 \left(\frac{1}{3}\right)^3 = 35 \left(\frac{16}{81}\right) \left(\frac{1}{27}\right) = \frac{560}{2187}
\]

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

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

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

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

PTS: 2  
REF: 081532a2  
STA: A2.A.61  
TOP: Arc Length  
KEY: radius
386 ANS: 4

\[ f(16) = 4(16)^{\frac{1}{2}} + 16^0 + 16^{\frac{1}{4}} \]

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

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

PTS: 2 REF: 081503a2 STA: A2.N.1 TOP: Negative and Fractional Exponents

387 ANS: 2

\[ x \pm \sigma \]

153 ± 22

131 – 175

PTS: 2 REF: 011307a2 STA: A2.S.5 TOP: Normal Distributions KEY: interval

388 ANS: 1

\[ s C_2 (2x)^{5-2}(-3)^2 = 720x^3 \]

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

389 ANS: 4

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

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

\[ = 4a^2 + 8a + 4 - a \]

\[ = 4a^2 + 7a + 4 \]

PTS: 2 REF: 011527a2 STA: A2.A.41 TOP: Functional Notation

390 ANS:

\[ 3 C_1 \left( \frac{1}{4} \right)^1 \left( \frac{3}{4} \right)^2 = 3 \cdot \frac{1}{4} \cdot \frac{9}{16} = \frac{27}{64} \]

Algebra 2/Trigonometry Regents at Random

Answer Section

391 ANS: 1

PTS: 2

REF: fall0914a2

STA: A2.A.9

TOP: Negative and Fractional Exponents

392 ANS: 3

PTS: 2

REF: 061020a2

STA: A2.A.71

TOP: Graphing Trigonometric Functions

393 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

394 ANS: 2

PTS: 2

REF: 081003a2

STA: A2.A.51

TOP: Domain and Range

395 ANS:

\[
\frac{1}{3} \left( \frac{1}{x+3} - \frac{2}{3-x} \right) = \frac{4}{x^2-9} \\
\frac{1}{x+3} + \frac{2}{x-3} = \frac{4}{x^2-9} \\
x - 3 + 2(x + 3) = 4 \\
(x + 3)(x - 3) = (x + 3)(x - 3) \\
x - 3 + 2x + 6 = 4 \\
3x = 1 \\
x = \frac{1}{3}
\]

PTS: 4

REF: 081036a2

STA: A2.A.23

TOP: Solving Rationals

396 ANS: 1

PTS: 2

REF: 061025a2

STA: A2.A.34

TOP: Sigma Notation

397 ANS: 2

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

PTS: 2

REF: 011109a2

STA: A2.A.42

TOP: Compositions of Functions

KEY: variables
398 ANS: 2,298.65.

PTS: 2 REF: fall0932a2 STA: A2.A.12 TOP: Evaluating Exponential Expressions

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

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

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

401 ANS: 

\[-3, -5, -8, -12\]

PTS: 2 REF: fall0934a2 STA: A2.A.33 TOP: Sequences

402 ANS: 4

\[2 \log_4 (5x) = 3\]

\[\log_4 (5x) = \frac{3}{2}\]

\[\frac{1}{2} \cdot 5x = 4\]

\[5x = 8\]

\[x = \frac{8}{5}\]

PTS: 2 REF: fall0921a2 STA: A2.A.28 TOP: Logarithmic Equations

KEY: advanced

403 ANS: 2 PTS: 2 REF: fall0926a2 STA: A2.A.46 TOP: Graphing Quadratic Functions

404 ANS: 3 PTS: 2 REF: 011110a2 STA: A2.A.30 TOP: Sequences

405 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
\[ \frac{23}{2} \cos^2 B + \sin^2 B = 1 \quad \tan B = \frac{\sin B}{\cos B} = \frac{\frac{5}{\sqrt{41}}}{\frac{4}{\sqrt{41}}} = \frac{5}{4} \quad \tan(A + B) = \frac{\frac{2 + \frac{5}{4}}{1 - \left(\frac{2}{3}\right)\left(\frac{5}{4}\right)}}{\frac{8 + 15}{12} - \frac{10}{12}} = \frac{\frac{23}{12}}{\frac{2}{12}} = \frac{23}{2} \]

\[ \cos^2 B + \left(\frac{5}{\sqrt{41}}\right)^2 = 1 \]

\[ \cos^2 B + \frac{25}{41} = \frac{41}{41} \]

\[ \cos^2 B = \frac{16}{41} \]

\[ \cos B = \frac{4}{\sqrt{41}} \]

\[ s \cdot C_3(3x)^2(-2)^3 = 10 \cdot 9x^2 \cdot -8 = -720x^2 \]

\[ \frac{11\pi}{12} \cdot \frac{180}{\pi} = 165 \]

\[ 4ab\sqrt{2b} - 3a\sqrt{9b^2} \cdot \sqrt{2b} + 7ab\sqrt{6b} = 4ab\sqrt{2b} - 9ab\sqrt{2b} + 7ab\sqrt{6b} = -5ab\sqrt{2b} + 7ab\sqrt{6b} \]

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

Students entering the library are more likely to spend more time studying, creating bias.
413 ANS: 3 PTS: 2 REF: 081027a2 STA: A2.A.44
TOP: Inverse of Functions KEY: equations
414 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
415 ANS: 1 PTS: 2 REF: 061004a2 STA: A2.A.52
TOP: Identifying the Equation of a Graph
416 ANS: 1
\[
4\sqrt{16x^2y^7} = 16 \cdot \frac{1}{4} \cdot \frac{2}{4} \cdot \frac{7}{4} = 2x^\frac{1}{2} y^\frac{7}{4}
\]
PTS: 2 REF: 061107a2 STA: A2.A.11 TOP: Radicals as Fractional Exponents
417 ANS:
y = 2.001x^{2.298}, 1,009. \quad y = 2.001(15)^{2.298} \approx 1009
PTS: 4 REF: fall0938a2 STA: A2.S.7 TOP: Power Regression
418 ANS:
\[(x + 5)^2 + (y - 3)^2 = 32\]
PTS: 2 REF: 081033a2 STA: A2.A.49 TOP: Writing Equations of Circles
419 ANS:
\[12 \cdot 6 = 9w\]
\[8 = w\]
PTS: 2 REF: 011130a2 STA: A2.A.5 TOP: Inverse Variation
420 ANS: 4 PTS: 2 REF: 061005a2 STA: A2.A.50
TOP: Zeros of Polynomials
421 ANS: 3
\[
\frac{3^{-2}}{(-2)^{-3}} = \frac{1}{9} = \frac{8}{9}
\]
PTS: 2 REF: 061003a2 STA: A2.N.1 TOP: Negative and Fractional Exponents
ANS: 3

\[
\begin{array}{c|c}
\text{L_1} & x^2 \\
2 & 67.31102041 \\
\end{array}
\]

PTS: 2 REF: fall0924a2 STA: A2.S.4 TOP: Dispersion
KEY: basic, group frequency distributions

ANS: 2 PTS: 2 REF: 061011a2 STA: A2.A.10 TOP: Fractional Exponents as Radicals

\[
\begin{align*}
2\tan C - 3 &= 3\tan C - 4 \\
1 &= \tan C \\
\tan^{-1} 1 &= C \\
C &= 45,225
\end{align*}
\]

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

\[
x^2 - 6x - 27 = 0, \quad \frac{-b}{a} = 6, \quad \frac{c}{a} = -27. \text{ If } a = 1 \text{ then } b = -6 \text{ and } c = -27
\]

PTS: 4 REF: 061130a2 STA: A2.A.21 TOP: Roots of Quadratics
KEY: basic

\[
\begin{align*}
\frac{2\pi}{b} &= \frac{2\pi}{1} = 6\pi \\
\frac{1}{3}
\end{align*}
\]

PTS: 2 REF: 061027a2 STA: A2.A.69 TOP: Properties of Graphs of Trigonometric Functions
KEY: period

ANS: 7.4

PTS: 2 REF: 061029a2 STA: A2.S.4 TOP: Dispersion
KEY: basic, group frequency distributions
428 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

429 ANS: 1
\[
\sqrt{12^2 - 6^2} = \sqrt{108} = \sqrt{36 \cdot 3} = 6\sqrt{3}
\]
\[
\cot J = \frac{A}{O} = \frac{6}{6\sqrt{3}} = \frac{\sqrt{3}}{3}
\]
PTS: 2 REF: 011102a2 STA: A2.A.55 TOP: Trigonometric Ratios

430 ANS: 4
\[
\frac{3 \pm \sqrt{(-3)^2 - 4(1)(-9)}}{2(1)} = \frac{3 \pm \sqrt{45}}{2} = \frac{3 \pm 3\sqrt{5}}{2}
\]
PTS: 2 REF: 061009a2 STA: A2.A.25 TOP: Quadratics with Irrational Solutions

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

432 ANS: 4
\[
x^{-\frac{2}{5}} = \frac{1}{x^{\frac{2}{5}}} = \frac{1}{\sqrt[5]{x^2}}
\]
PTS: 2 REF: 011118a2 STA: A2.A.10 TOP: Fractional Exponents as Radicals

433 ANS:
\[
\text{Sum } \frac{-b}{a} = \frac{-11}{5}, \text{ Product } \frac{c}{a} = \frac{-3}{5}
\]
PTS: 2 REF: 061030a2 STA: A2.A.20 TOP: Roots of Quadratics

434 ANS:
\[
\frac{12x^2}{y^9} \cdot \frac{3x^{-4}y^5}{(2x^3y^{-7})^2} = \frac{3y^5(2x^3y^{-7})^2}{x^4} = \frac{3y^5(4x^6y^{-14})}{x^4} = \frac{12x^6y^{-9}}{x^4} = \frac{12x^2}{y^9}
\]
PTS: 2 REF: 061134a2 STA: A2.A.9 TOP: Negative Exponents
435 ANS: 3
3x + 16 = (x + 2)^2 \quad \rightarrow 4 \text{ is an extraneous solution.}
3x + 16 = x^2 + 4x + 4
0 = x^2 + x - 12
0 = (x + 4)(x - 3)
x = -4 \quad x = 3

PTS: 2  REF: 061121a2  STA: A2.A.22  TOP: Solving Radicals
KEY: extraneous solutions

436 ANS:
b^2 - 4ac = 0
k^2 - 4(1)(4) = 0
k^2 - 16 = 0
(k + 4)(k - 4) = 0
k = \pm 4

PTS: 2  REF: 061028a2  STA: A2.A.2  TOP: Using the Discriminant
KEY: determine equation given nature of roots

437 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

438 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
439 ANS: no solution.
\[
\frac{4x}{x-3} = 2 + \frac{12}{x-3}
\]
\[
\frac{4x - 12}{x-3} = 2
\]
\[
\frac{4(x-3)}{x-3} = 2
\]
\[
4 \neq 2
\]

PTS: 2  REF: fall0930a2  STA: A2.A.23  TOP: Solving Rationals
KEY: rational solutions

440 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

441 ANS: 4  PTS: 2  REF: 081005a2  STA: A2.A.60
TOP: Unit Circle

442 ANS: 2
\[
(3-7i)(3-7i) = 9 - 21i - 21i + 49i^2 = 9 - 42i - 49 = -40 - 42i
\]

PTS: 2  REF: fall0901a2  STA: A2.N.9  TOP: Multiplication and Division of Complex Numbers

443 ANS: 3  PTS: 2  REF: fall0910a2  STA: A2.A.76  TOP: Angle Sum and Difference Identities
KEY: simplifying

444 ANS: 4  PTS: 2  REF: 011101a2  STA: A2.A.38
TOP: Defining Functions
KEY: graphs

445 ANS:
\[
\sum_{n=1}^{15} 7n
\]

PTS: 2  REF: 081029a2  STA: A2.A.34  TOP: Sigma Notation

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

PTS: 2  REF: 081035a2  STA: A2.S.10  TOP: Permutations
9

447 ANS: 1

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

\[ 6 \neq -10 \quad 8a = 4 \quad 8 - 2 \neq -10 \]

\[ a = \frac{4}{8} = \frac{1}{2} \]

PTS: 2 REF: 011106a2 STA: A2.A.1 TOP: Absolute Value Equations

448 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: Solving Quadratics

KEY: completing the square

449 ANS: 3

\[ x^2 - 3x - 10 > 0 \quad \text{or} \quad (x - 5)(x + 2) > 0 \]

\[ x - 5 > 0 \quad x + 2 > 0 \quad x < 5 \quad x < -2 \]

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

\[ x > 5 \]

PTS: 2 REF: 011115a2 STA: A2.A.4 TOP: Quadratic Inequalities

KEY: one variable

450 ANS: 3

\[ x = 5^4 = 625 \]

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

KEY: basic

451 ANS: 2

\[ f^{-1}(x) = \log_a x \]

PTS: 2 REF: fall0916a2 STA: A2.A.54 TOP: Graphing Logarithmic Functions

452 ANS: 1

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

454 ANS: 4  PTS: 2  REF: fall0925a2  STA: A2.S.10  
TOP: Permutations

455 ANS:

\[ y = 0 \]

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

456 ANS: 4  
\[ 6x - x^3 - x^2 = -x(x^2 + x - 6) = -x(x + 3)(x - 2) \]

PTS: 2  REF: fall0917a2  STA: A2.A.7  TOP: Factoring Polynomials
KEY: single variable

457 ANS: 1  PTS: 2  REF: 061013a2  STA: A2.A.38  
TOP: Defining Functions

458 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

459 ANS:

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

PTS: 2  REF: fall0931a2  STA: A2.M.2  TOP: Radian Measure
KEY: degrees
460 ANS: 1

PTS: 2 REF: fall0915a2 STA: A2.S.5 TOP: Normal Distributions
KEY: interval

461 ANS:

\[12t^8 - 75t^4 = 3t^4(4t^4 - 25) = 3t^4(2r^2 + 5)(2r^2 - 5)\]

PTS: 2 REF: 061133a2 STA: A2.A.7 TOP: Factoring the Difference of Perfect Squares

462 ANS: 3

Cofunctions tangent and cotangent are complementary

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

463 ANS: 3 PTS: 2 REF: 061114a2 STA: A2.A.38 TOP: Defining Functions KEY: graphs

464 ANS:

\[
sin(45 + 30) = \sin 45 \cos 30 + \cos 45 \sin 30 = \frac{\sqrt{2}}{2} \cdot \frac{\sqrt{3}}{2} + \frac{\sqrt{2}}{2} \cdot \frac{1}{2} = \frac{\sqrt{6}}{4} + \frac{\sqrt{2}}{4} = \frac{\sqrt{6} + \sqrt{2}}{4}
\]

PTS: 4 REF: 061136a2 STA: A2.A.76 TOP: Angle Sum and Difference Identities KEY: evaluating

465 ANS:

No. TENNESSEE: \[\frac{9P_9}{4! \cdot 2! \cdot 2!} = \frac{362,880}{96} = 3,780\]

VERMONT: \[\gamma_7P_7 = 5,040\]

PTS: 4 REF: 061038a2 STA: A2.S.10 TOP: Permutations

466 ANS: 1

\[9C_3a^6(-4b)^3 = -5376a^6b^3\]

PTS: 2 REF: 06126a2 STA: A2.A.36 TOP: Binomial Expansions

467 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
\[
75000 = 25000e^{0.0475t}
\]
\[
3 = e^{0.0475t}
\]
\[
\ln 3 = \ln e^{0.0475t}
\]
\[
\ln 3 = 0.0475t \cdot \ln e
\]
\[
23.1 \approx t
\]

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

\[
2.5 \cdot \frac{180}{\pi} \approx 143.2^\circ
\]

PTS: 2  REF: 011129a2  STA: A2.M.2  TOP: Radian Measure

\[
\frac{10}{\sin 35^\circ} = \frac{13}{\sin B} \quad 35^\circ + 48^\circ < 180^\circ
\]
\[
B \approx 48, 132^\circ
\]

PTS: 2  REF: 011113a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case

\[
\frac{1}{2} \cdot (4) - 3 = -1 \quad g(-1) = 2(-1) + 5 = 3
\]

PTS: 2  REF: fall0902a2  STA: A2.A.42  TOP: Compositions of Functions

\[
S = \frac{-b}{a} = \frac{-(-3)}{4} = \frac{3}{4} \quad P = \frac{c}{a} = \frac{-8}{4} = -2
\]

PTS: 2  REF: fall0912a2  STA: A2.A.21  TOP: Roots of Quadratics

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

PTS: 2  REF: 011122a2  STA: A2.A.15  TOP: Rationalizing Denominators
\[
\frac{\pi}{3} + \frac{\pi}{3} = \frac{2\pi}{3} = \frac{1}{3}
\]

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

475 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

476 ANS: 3   PTS: 2   REF: 061001a2   STA: A2.A.30
TOP: Sequences

477 ANS: 4   PTS: 2   REF: 061120a2   STA: A2.A.19
TOP: Properties of Logarithms
KEY: splitting logs

478 ANS: 3   PTS: 2   REF: 061022a2   STA: A2.A.63
TOP: Domain and Range

479 ANS: 3

\[a_n = 5(-2)^{n-1}\]
\[a_{15} = 5(-2)^{15-1} = 81,920\]

FOR REF: 011050a2   STA: A2.A.32   TOP: Sequences

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

481 ANS:

\[y = x^2 - 6. \quad f^{-1}(x) \text{ is not a function.}\]
\[x = y^2 - 6\]
\[x + 6 = y^2\]
\[\pm \sqrt{x + 6} = y\]

PTS: 2   REF: 061132a2   STA: A2.A.44   TOP: Inverse of Functions
KEY: equations
\[
\cos K = \frac{5}{6}
\]

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

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

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

483 ANS: 4
\[
s = \theta r = 2 \cdot 4 = 8
\]

PTS: 2  
REF: fall0922a2  
STA: A2.A.61  
TOP: Arc Length  
KEY: arc length

484 ANS: 3  
PTS: 2  
REF: fall0923a2  
STA: A2.A.39  
TOP: Domain and Range  
KEY: real domain, radical

485 ANS: 3
\[
\text{period} = \frac{2\pi}{b} = \frac{2\pi}{3\pi} = \frac{2}{3}
\]

PTS: 2  
REF: 081026a2  
STA: A2.A.70  
TOP: Graphing Trigonometric Functions  
KEY: recognize

486 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
(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.

\[ \begin{align*}
0.167 &= 10 \cdot C_8 \cdot 0.6^8 \cdot 0.4^2 + 10 \cdot C_9 \cdot 0.6^9 \cdot 0.4^3 + 10 \cdot C_{10} \cdot 0.6^{10} \cdot 0.4^0 \\
&\approx 0.167
\end{align*} \]

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

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

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

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

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

\[ \theta = 60, 240 \]

\[ y \geq x^2 - x - 6 \]

\[ y \geq (x - 3)(x + 2) \]
\[ 4^x + 4^x = 2^{-6}. \quad 2x^2 + 8x = -6 \]

\[ (2^x)^2 + 4^x = 2^{-6} \quad 2x^2 + 8x + 6 = 0 \]

\[ 2^{x^2 + 8x} = 2^{-6} \quad x^2 + 4x + 3 = 0 \]

\[ (x + 3)(x + 1) = 0 \]

\[ x = -3 \quad x = -1 \]

PTS: 2       REF: 061015a2     STA: A2.A.27     TOP: Exponential Equations

KEY: common base shown

494 ANS: 4       PTS: 2       REF: 011111a2     STA: A2.N.8

TOP: Conjugates of Complex Numbers

495 ANS:
\[ e^{3\ln 2} = e^{\ln 2^3} = e^{\ln 8} = 8 \]

PTS: 2       REF: 061131a2     STA: A2.A.12     TOP: Evaluating Exponential Expressions

TOP: Analysis of Data

497 ANS: 1
\[ \cos^2 \theta - \cos 2\theta = \cos^2 \theta - (\cos^2 \theta - \sin^2 \theta) = \sin^2 \theta \]

PTS: 2       REF: 061024a2     STA: A2.A.77     TOP: Double Angle Identities

KEY: simplifying

498 ANS: 1
\[ 6x - 7 \leq 5 \quad 6x - 7 \geq -5 \]

\[ 6x \leq 12 \quad 6x \geq 2 \]

\[ x \leq 2 \quad x \geq \frac{1}{3} \]

PTS: 2       REF: fall0905a2     STA: A2.A.1     TOP: Absolute Value Inequalities

KEY: graph

499 ANS:
\[ 26.2\% \cdot \binom{10}{8} \cdot 0.65^8 \cdot 0.35^2 + \binom{10}{9} \cdot 0.65^9 \cdot 0.35^1 + \binom{10}{10} \cdot 0.65^{10} \cdot 0.35^0 \approx 0.262 \]


KEY: at least or at most
\[ \frac{51}{243} \cdot 5 \binom{1}{3} \left( \frac{2}{3} \right)^2 = \frac{40}{243} \]
\[ 5 \binom{1}{3} \left( \frac{2}{3} \right)^4 = \frac{10}{243} \]
\[ 5 \binom{1}{3} \left( \frac{2}{3} \right)^5 = \frac{1}{243} \]

KEY: at least or at most

\[ \frac{\sqrt{3} + 5 \cdot \sqrt{3} + 5}{\sqrt{3} - 5} = \frac{3 + 5\sqrt{3} + 5\sqrt{3} + 25}{3 - 25} = \frac{28 + 10\sqrt{3}}{-22} = \frac{14 + 5\sqrt{3}}{11} \]

PTS: 2  REF: 061012a2  STA: A2.N.5  TOP: Rationalizing Denominators

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

KEY: find angle

\[ \binom{3}{5} = 3 \cdot 2 \cdot \binom{2}{3} \]

PTS: 2  REF: 011119a2  STA: A2.A.52  TOP: Families of Functions
506 ANS: \[ \pm \frac{3}{2}, -\frac{1}{2} \]
\[ 8x^3 + 4x^2 - 18x - 9 = 0 \]
\[ 4x^2(2x + 1) - 9(2x + 1) = 0 \]
\[ (4x^2 - 9)(2x + 1) = 0 \]
\[ 4x^2 - 9 = 0 \text{ or } 2x + 1 = 0 \]
\[ (2x + 3)(2x - 3) = 0 \quad x = \frac{1}{2} \]
\[ x = \pm \frac{3}{2} \]

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

508 ANS: \[ \frac{-b}{a} = -\frac{6}{2} = -3, \quad \frac{c}{a} = \frac{4}{2} = 2 \]

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

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

511 ANS: \[ \pm \frac{3}{2}, -\frac{1}{2} \]
\[ 8x^3 + 4x^2 - 18x - 9 = 0 \]
\[ 4x^2(2x + 1) - 9(2x + 1) = 0 \]
\[ (4x^2 - 9)(2x + 1) = 0 \]
\[ 4x^2 - 9 = 0 \text{ or } 2x + 1 = 0 \]
\[ (2x + 3)(2x - 3) = 0 \quad x = \frac{1}{2} \]
\[ x = \pm \frac{3}{2} \]

PTS: 4 REF: fall0937a2 STA: A2.A.26 TOP: Solving Polynomial Equations

PTS: 3

PTS: 2 REF: 061116a2 STA: A2.N.5 TOP: Rationalizing Denominators

PTS: 2 REF: 011121a2 STA: A2.A.21 TOP: Roots of Quadratics

KEY: basic

PTS: 2 REF: 081017a2 STA: A2.A.73 TOP: Law of Cosines

KEY: angle, without calculator

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

PTS: 2 REF: 061127a2 STA: A2.S.6 TOP: Regression
512 ANS:

\[-3|6-x| < -15\]

\[|6-x| > 5\]

\[6 - x > 5\] or \[6 - x < -5\]

\[1 > x\] or \[11 < x\]

PTS: 2  REF: 061137a2  STA: A2.A.1  TOP: Absolute Value Inequalities
KEY: graph

513 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

514 ANS: 2

\[
\begin{array}{c}
\text{lan}(126^\circ 43')
\\
-1.349788784
\end{array}
\]

PTS: 2  REF: 061115a2  STA: A2.A.66  TOP: Determining Trigonometric Functions

515 ANS:

\[32x^5 - 80x^4 + 80x^3 - 40x^2 + 10x - 1. \quad 5 C_0 (2x)^5 (-1)^0 = 32x^5. \quad 5 C_1 (2x)^4 (-1)^1 = -80x^4. \quad 5 C_2 (2x)^3 (-1)^2 = 80x^3. \]

\[5 C_3 (2x)^2 (-1)^3 = -40x^2. \quad 5 C_4 (2x)^1 (-1)^4 = 10x. \quad 5 C_5 (2x)^0 (-1)^5 = -1\]

PTS: 4  REF: 011136a2  STA: A2.A.36  TOP: Binomial Expansions

516 ANS: 2  PTS: 2  REF: 011126a2  STA: A2.A.49  TOP: Equations of Circles

517 ANS:

\[0, 60, 180, 300. \quad \sin 2\theta = \sin \theta\]

\[\sin 2\theta - \sin \theta = 0\]

\[2\sin \theta \cos \theta - \sin \theta = 0\]

\[\sin \theta (2\cos \theta - 1) = 0\]

\[\sin \theta = 0 \quad 2\cos \theta - 1 = 0\]

\[\theta = 0, 180 \quad \cos \theta = \frac{1}{2}\]

\[\theta = 60, 300\]

PTS: 4  REF: 061037a2  STA: A2.A.68  TOP: Trigonometric Equations
KEY: double angle identities
518 ANS: 2  PTS: 2  REF: 081010a2  STA: A2.A.55  TOP: Trigonometric Ratios

519 ANS:
D: $-5 \leq x \leq 8$.  R: $-3 \leq y \leq 2$

PTS: 2  REF: 011132a2  STA: A2.A.51  TOP: Domain and Range

KEY: graph

520 ANS: 3  PTS: 2  REF: 061007a2  STA: A2.S.9  TOP: Differentiating Permutations and Combinations

521 ANS: 3  PTS: 2  REF: fall0911a2  STA: A2.N.10  TOP: Sigma Notation

\[
\begin{array}{c|cccc}
  n & 0 & 1 & 2 & \Sigma \\
  \hline
  n^2 + 2^n & 0^2 + 2^0 = 1 & 1^2 + 2^2 = 3 & 2^2 + 2^2 = 8 & 12 \\
  2 \times 12 = 24
\end{array}
\]

522 ANS: 2  PTS: 2  REF: 061122a2  STA: A2.A.24  TOP: Solving Quadratics  KEY: completing the square

523 ANS:
\[
x = \frac{1}{3}, -1 \quad \log_{x,3} \left( \frac{x^3 + x - 2}{x} \right) = 2
\]
\[
\frac{x^3 + x - 2}{x} = (x + 3)^2
\]
\[
\frac{x^3 + x - 2}{x} = x^2 + 6x + 9
\]
\[
x^3 + x - 2 = x^3 + 6x^2 + 9x
\]
\[
0 = 6x^2 + 8x + 2
\]
\[
0 = 3x^2 + 4x + 1
\]
\[
0 = (3x + 1)(x + 1)
\]
\[
x = \frac{1}{3}, -1
\]

PTS: 6  REF: 081039a2  STA: A2.A.28  TOP: Logarithmic Equations  KEY: basic

524 ANS: 3  PTS: 2  REF: 061119a2  STA: A2.A.65  TOP: Graphing Trigonometric Functions

525 ANS: 1
\[
a_n = -\sqrt{5}(-\sqrt{2})^{a-1}
\]
\[
a_{15} = -\sqrt{5}(-\sqrt{2})^{15-1} = -\sqrt{5}(-\sqrt{2})^{14} = -\sqrt{5} \cdot 2^7 = -128\sqrt{5}
\]

PTS: 2  REF: 061109a2  STA: A2.A.32  TOP: Sequences
ANS: 2
\[ x^2 + 2 = 6x \]
\[ x^2 - 6x = -2 \]
\[ x^2 - 6x + 9 = -2 + 9 \]
\[ (x - 3)^2 = 7 \]

PTS: 2  REF: 011116a2  STA: A2.A.24  TOP: Solving Quadratics
KEY: completing the square

ANS: 2
The roots are \(-1, 2, 3\).

PTS: 2  REF: 081023a2  STA: A2.A.50  TOP: Zeros of Polynomials

ANS: 3
\[ \frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta} = \frac{1}{\cos^2 \theta} = \sec^2 \theta \]

PTS: 2  REF: 061123a2  STA: A2.A.58  TOP: Reciprocal Trigonometric Relationships

ANS: 3
\[ \frac{12}{\sin 32^\circ} = \frac{10}{\sin B} \Rightarrow C \approx 180 - (32 + 26.2) \approx 121.8. \frac{12}{\sin 32^\circ} = \frac{c}{\sin 121.8^\circ} \]
\[ B = \sin^{-1} \left( \frac{10 \sin 32^\circ}{12} \right) \approx 26.2 \]
\[ c = \frac{12 \sin 121.8^\circ}{\sin 32^\circ} \approx 19.2 \]

PTS: 4  REF: 011137a2  STA: A2.A.73  TOP: Law of Sines
KEY: basic

ANS: 3
\[ \frac{3}{\sqrt{3a^2 b}} = \frac{3}{a \sqrt{3b}} \Rightarrow \frac{\sqrt{3b}}{\sqrt{3b}} = \frac{3 \sqrt{3b}}{3ab} = \frac{\sqrt{3b}}{ab} \]

PTS: 2  REF: 081019a2  STA: A2.A.15  TOP: Rationalizing Denominators
KEY: index = 2
\[
\begin{align*}
\left\{ \frac{9}{2}, \frac{1}{2} \right\} \text{ and } \left\{ \frac{11}{2}, \frac{11}{2} \right\}.
\quad y = x + 5 \\
4x^2 + 17x - 4 = x + 5 \\
y = 4x^2 + 17x - 4 \\
4x^2 + 16x - 9 = 0 \\
(2x + 9)(2x - 1) = 0 \\
x = \frac{9}{2} \text{ and } x = \frac{1}{2} \\
y = \frac{9}{2} + 5 = \frac{1}{2} \quad \text{and} \quad y = \frac{1}{2} + 5 = \frac{11}{2}.
\end{align*}
\]

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

ANS: 4

\[y = 2 \sin \theta + 3\]

\[f(\theta) = 2 \sin \theta + 3\]

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

ANS: 3

\[K = (10)(18) \sin 46 \approx 129\]

PTS: 2 \quad REF: 081021a2 \quad STA: A2.A.74 \quad TOP: Using Trigonometry to Find Area

ANS: 4

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

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

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

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

\[3x = 4\]

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

PTS: 2 \quad REF: 081008a2 \quad STA: A2.A.27 \quad TOP: Exponential Equations

KEY: common base not shown

ANS: 1 \quad PTS: 2 \quad REF: 011112a2 \quad STA: A2.A.64

TOP: Using Inverse Trigonometric Functions

KEY: advanced

ANS: 2 \quad PTS: 2 \quad REF: 011114a2 \quad STA: A2.N.3

TOP: Operations with Polynomials

KEY: subtraction

ANS: 4 \quad PTS: 2 \quad REF: 061112a2 \quad STA: A2.A.39

TOP: Domain and Range

KEY: real domain, quadratic
common difference is 2. \( b_n = x + 2n \)

\[
10 = x + 2(1) \\
8 = x
\]

540 ANS: 2

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

541 ANS: 2

PTS: 2

TOP: Conjugates of Complex Numbers

542 ANS:

\[
0.468. \ 8C_6 \left( \frac{2}{3} \right)^6 \left( \frac{1}{3} \right)^2 \approx 0.27313. \ 8C_7 \left( \frac{2}{3} \right)^7 \left( \frac{1}{3} \right)^1 \approx 0.15607. \ 8C_8 \left( \frac{2}{3} \right)^8 \left( \frac{1}{3} \right)^0 \approx 0.03902.
\]

543 ANS: 2

\[ x^2 - x - 6 = 3x - 6 \]

\[ x^2 - 4x = 0 \]

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

\[ x = 0, 4 \]

544 ANS: 3

\[ 27r^{4-1} = 64 \]

\[ r^3 = \frac{64}{27} \]

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

545 ANS:

\[
\frac{1}{d} + \frac{3}{2d} = \frac{d - 8}{2d} \quad \text{and} \quad \frac{1}{d} + \frac{3}{2d} = \frac{d - 8}{2d} + \frac{2d^2}{2d} = \frac{d - 8}{5}
\]

PTS: 2

TOP: Complex Fractions
\[
\cos(-305^\circ + 360^\circ) = \cos(55^\circ)
\]

547 ANS:
7. \( f(-3) = (-3)^2 - 6 = 3. \ g(x) = 2^3 - 1 = 7. \)

548 ANS:
\[ K = \frac{1}{2} (10)(18) \sin 120 = 45\sqrt{3} \approx 78 \]

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

550 ANS: 2
\[ 15C_8 = 6,435 \]

551 ANS:
\[ 6y^3 - \frac{37}{10} y^2 - \frac{1}{5} y = \left( \frac{1}{2} y^2 - \frac{1}{3} y \right) \left( 12y + \frac{3}{5} \right) = 6y^3 + \frac{3}{10} y^2 - 4y^2 - \frac{1}{5} y = 6y^3 - \frac{37}{10} y^2 - \frac{1}{5} y \]

552 ANS: 2
\[ _{15}C_8 = 6,435 \]

553 ANS:
\[ 10ax^2 - 23ax - 5a = a(10x^2 - 23x - 5) = a(5x + 1)(2x - 5) \]

554 ANS: 1
\[ _{10}C_4 = 210 \]

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

24
556 ANS: 3       PTS: 2       REF: fall0913a2     STA: A2.A.65
TOP: Graphing Trigonometric Functions

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

558 ANS:
y = 10.596(1.586)^x

559 ANS:
\[ 2\pi \cdot \frac{5}{12} = \frac{10\pi}{12} = \frac{5\pi}{6} \]

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

561 ANS:
\[ 4^{2x+5} = 8^{3x} \]
\[ \left(2^2\right)^{2x+5} = \left(2^3\right)^{3x} \]
\[ 2^{4x+10} = 2^{9x} \]
\[ 4x + 10 = 9x \]
\[ 10 = 5x \]
\[ x = 2 \]

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

PTS: 2       REF: 011131a2     STA: A2.N.10     TOP: Sigma Notation
KEY: basic
563 ANS: 1

564 ANS:

\[
\begin{align*}
\sin^2 A + \cos^2 A &= 1 \\
\cos^2 A &= \frac{1}{\cos^2 A}
\end{align*}
\]

\[
\begin{align*}
\tan^2 A + 1 &= \sec^2 A
\end{align*}
\]

565 ANS:

\[
\begin{align*}
2 \log x - (3 \log y + \log z) &= \log x^2 - \log y^3 - \log z = \log \frac{x^2}{y^3z}
\end{align*}
\]

566 ANS: 1

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

TOP: Differentiating Permutations and Combinations

567 ANS: 1

568 ANS:

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

KEY: multiplication
\[ \cos^2 A = \frac{5}{9} \]

\[ \cos A = \pm \frac{\sqrt{5}}{3} \], \( \sin A \) is acute.

\[ \sin 2A = 2\sin A\cos A \]

\[ \sin 2A = \frac{2\sqrt{3}}{2} \]

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

\[ \frac{3}{2} \]
575 ANS: Controlled experiment because Howard is comparing the results obtained from an experimental sample against a control sample.

PTS: 2 REF: 081030a2 STA: A2.S.1 TOP: Analysis of Data

576 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

577 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

578 ANS: 3

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

PTS: 2 REF: 081009a2 STA: A2.A.25 TOP: Solving Quadratics
KEY: quadratic formula

579 ANS: 4

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

580 ANS: 2

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

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

581 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

582 ANS: 1

8 × 8 × 7 × 1 = 448. The first digit cannot be 0 or 5. The second digit cannot be 5 or the same as the first digit. The third digit cannot be 5 or the same as the first or second digit.

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

583 ANS: 1

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

PTS: 2 REF: 081004a2 STA: A2.N.7 TOP: Imaginary Numbers
(4) fails the horizontal line test. Not every element of the range corresponds to only one element of the domain.

<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: fall0906a2    STA: A2.A.43    TOP: Defining Functions
ANS: 4

PTS: 2    REF: 061118a2    STA: A2.N.10    TOP: Sigma Notation
KEY: basic