Dear Sir

I have to acknowledge the receipt of your favor of May 14. in which you mention that you have finished the 6. first books of Euclid, plane trigonometry, surveying & algebra and ask whether I think a further pursuit of that branch of science would be useful to you. there are some propositions in the latter books of Euclid, & some of Archimedes, which are useful, & I have no doubt you have been made acquainted with them. trigonometry, so far as this, is most valuable to every man, there is scarcely a day in which he will not resort to it for some of the purposes of common life. the science of calculation also is indispensible as far as the extraction of the square & cube roots; Algebra as far as the quadratic equation & the use of logarithms are often of value in ordinary cases: but all beyond these is but a luxury; a delicious luxury indeed; but not to be indulged in by one who is to have a profession to follow for his subsistence. in this light I view the conic sections, curves of the higher orders, perhaps even spherical trigonometry, Algebraical operations beyond the 2d dimension, and fluxions.

Letter from Thomas Jefferson to William G. Munford, Monticello, June 18, 1799.
1 Which function is one-to-one?
1) \( f(x) = |x| \)
2) \( f(x) = 2^x \)
3) \( f(x) = x^2 \)
4) \( f(x) = \sin x \)

2 Which function is one-to-one?
1) \( k(x) = x^2 + 2 \)
2) \( g(x) = x^3 + 2 \)
3) \( f(x) = |x| + 2 \)
4) \( j(x) = x^4 + 2 \)

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

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

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

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

7 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

8 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) \( 4a^2 - 20a + 30 \)
9 Express in simplest form: \( \frac{4 - x^2}{x^2 + 7x + 12} \) \( \frac{2x - 4}{x + 3} \)

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

11 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.

12 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

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

1) \[ -5 -4 -3 -2 -1 0 1 2 3 4 5 \]
2) \[ -5 -4 -3 -2 -1 0 1 2 3 4 5 \]
3) \[ -5 -4 -3 -2 -1 0 1 2 3 4 5 \]
4) \[ -5 -4 -3 -2 -1 0 1 2 3 4 5 \]
14  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

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

16  Find, to the nearest tenth, the radian measure of 216°.

17  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?

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

19  What is the domain of the function shown below?

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

21  Perform the indicated operations and simplify completely:

\[
\frac{x^3 - 3x^2 + 6x - 18}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} + \frac{x^2 + 2x - 8}{16 - x^2}
\]
22. Which graph represents the function \( \log_2 x = y \)?

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

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

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

26. 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) \( 4x^2 - 9x - 3 = 0 \)

27. 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) \( \cos x + \sin x \)
28 Which graph represents the solution set of
\[
\frac{x + 16}{x - 2} \leq 7?
\]

1) 2) 3) 4)

29 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%.

30 A population of rabbits doubles every 60 days according to the formula
\[P = 10(2)^{\frac{t}{60}},\]
where \(P\) is the population of rabbits on day \(t\). What is the value of \(t\) when the population is 320?

1) 240 2) 300 3) 660 4) 960

31 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) \(3\pi\)

32 If \(m\angle \theta = -50\), which diagram represents \(\theta\) drawn in standard position?
33 The expression \(4 + \sum_{k=2}^{5} 3(k - x)\) is equal to

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

34 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) \(1.503\)

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

1) 
2) 
3) 
4) 

36 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) \(\binom{10}{9} \left(\frac{7}{10}\right)^9 \left(\frac{3}{10}\right)^1\)
37 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

38 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.

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

40 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\}

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

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

43 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

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

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

46 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) \( -x^3 - 2x^2 + 5x + 4 \)
47 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) \(-3 \pm 2i\)

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

49 Write an equation for the graph of the trigonometric function shown below.

50 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) \(2x^4y^2\)

51 What is the equation of the graph shown below?

52 What is the common ratio of the sequence \(\frac{1}{64}a^5b^3, \frac{3}{32}a^3b^4, \frac{9}{16}a^b^5, \ldots\)?
1) \(-\frac{3b}{2a^2}\)
2) \(-\frac{6b}{a^2}\)
3) \(-\frac{3a^2}{b}\)
4) \(-\frac{6a^2}{b}\)
53. Which calculator output shows the strongest linear relationship between $x$ and $y$?

- **Lin Reg**
  
  $y = a + bx$
  
  1) $r = .8643$
  
  2) $r = .8361$
  
  3) $r = .6022$
  
  4) $r = -.8924$

54. 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

55. 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) $\{60^\circ, 300^\circ\}$

56. 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) $3 \sin^2 x$

57. Which expression is equivalent to $\left(9x^2y^6\right)^{-\frac{1}{2}}$?

- 1) $\frac{1}{3xy^3}$
- 2) $3xy^3$
- 3) $\frac{3}{xy^3}$
- 4) $\frac{xy^3}{3}$

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

59. 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) $\log 16 + 2 \log m$

60. 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
61 If \( g(x) = \frac{1}{2} x + 8 \) and \( h(x) = \frac{1}{2} x - 2 \), what is the value of \( g(h(-8)) \)?

1) 0
2) 9
3) 5
4) 4

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

1) 5 out of 15
2) 5 out of 25
3) 20 out of 25
4) 15 out of 25

63 A math club has 30 boys and 20 girls. Which expression represents the total number of different 5-member teams, consisting of 3 boys and 2 girls, that can be formed?

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

64 The value of \( \sin(180 + x) \) is equivalent to

1) \( -\sin x \)
2) \( -\sin(90 - x) \)
3) \( \sin x \)
4) \( \sin(90 - x) \)

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

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

67 Express the exact value of \( \csc 60^\circ \), with a rational denominator.
68 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

69 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) \((8, 3)\)

70 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) \((-4, 9)\)

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

72 The area of triangle \( ABC \) is 42. If \( AB = 8 \) and \( \angle B = 61 \), the length of \( BC \) is approximately
1) 5.1
2) 9.2
3) 12.0
4) 21.7

73 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.

74 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 \( \sec P > 0 \)

75 Which expression, when rounded to three decimal places, is equal to \(-1.155\)?
1) \( \sec \left( \frac{5\pi}{6} \right) \)
2) \( \tan(49°20') \)
3) \( \sin \left( \frac{-3\pi}{5} \right) \)
4) \( \csc(-118°) \)
76 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

77 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) $-2a + 5$

78 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

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

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

81 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) $\overline{OS}$

82 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.
83 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

84 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) \( -\frac{x}{x - 2} \)

85 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.

86 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.

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

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

89 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

90 Which summation represents \( 5 + 7 + 9 + 11 + \ldots + 43 \)?
1) \( \sum \limits_{n=5}^{43} n \)
2) \( \sum \limits_{n=1}^{20} (2n + 3) \)
3) \( \sum \limits_{n=4}^{24} (2n - 3) \)
4) \( \sum \limits_{n=3}^{23} (3n - 4) \)

91 Show that \( \sec \theta \sin \theta \cot \theta = 1 \) is an identity.
92 The expression $\left(\sqrt[3]{27x^2}\right)\left(\sqrt[3]{16x^4}\right)$ is equivalent to
1) $12x\sqrt{2x}$
2) $12x^{\frac{3}{2}}x$
3) $6x^{\frac{3}{2}}2x^2$
4) $6x^{\frac{3}{2}}\sqrt{2}$

93 When $x^{-1} + 1$ is divided by $x + 1$, the quotient equals
1) $1$
2) $\frac{1}{x}$
3) $x$
4) $-\frac{1}{x}$

94 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 $0$

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

96 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.

97 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) $4$

98 What is the fourth term in the binomial expansion $(x - 2)^8$?
1) $448x^5$
2) $448x^4$
3) $-448x^5$
4) $-448x^4$

99 Which expression is equivalent to $\frac{2x^{-2}y^{-2}}{4y^{-5}}$?
1) $\frac{y^3}{2x^2}$
2) $\frac{2y^3}{x^2}$
3) $\frac{2x^2}{y^3}$
4) $\frac{x^2}{2y^3}$
100 If \( x = 3i, \ y = 2i, \) and \( z = m + i, \) the expression \( xy^2z \) equals
1) \(-12 - 12mi\)
2) \(-6 - 6mi\)
3) \(12 - 12mi\)
4) \(6 - 6mi\)

101 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) \(\{\pm 2, \pm 2i\}\)

102 What is the range of \( f(x) = |x - 3| + 2? \)
1) \(\{x | x \geq 3\}\)
2) \(\{y | y \geq 2\}\)
3) \(\{x | x \in \text{real numbers}\}\)
4) \(\{y | y \in \text{real numbers}\}\)

103 In \( \triangle DEF, \ d = 5, \ e = 8, \) and \( m\angle D = 32. \) How many distinct triangles can be drawn given these measurements?
1) 1
2) 2
3) 3
4) 0

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

105 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

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

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

108 The sum of \(3\sqrt[3]{6a^4b^2} \) and \(3\sqrt[3]{162a^4b^2}, \) expressed in simplest radical form, is
1) \(6\sqrt[3]{168a^8b^4}\)
2) \(2a^2b\sqrt[3]{21a^2b}\)
3) \(4a^3\sqrt[3]{6ab^2}\)
4) \(10a^2b\sqrt[3]{8}\)
109 The expression \((x + i)^2 - (x - i)^2\) is equivalent to
1) 0
2) \(-2\)
3) \(-2 + 4xi\)
4) \(4xi\)

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

111 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

112 The expression \(\frac{a + b}{c} - \frac{d}{b}\) is equivalent to
1) \(\frac{c + 1}{d - 1}\)
2) \(\frac{a + b}{d - b}\)
3) \(\frac{ac + b}{cd - b}\)
4) \(\frac{ac + 1}{cd - 1}\)

113 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) \(-65,535\)

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

<table>
<thead>
<tr>
<th>Travel Time (in minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 55 40 65 29</td>
</tr>
<tr>
<td>45 59 35 25 37</td>
</tr>
<tr>
<td>52 30 8 40 55</td>
</tr>
</tbody>
</table>

Determine the number of employees whose travel time is within one standard deviation of the mean.

115 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 = \(\frac{-2}{3}\)
116 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.

117 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) \( \frac{x + \sqrt{x}}{x - 1} \)

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

1) \( 8a^4 \)
2) \( 8a^8 \)
3) \( 4a^{5/3}\sqrt{a} \)
4) \( 4a^{3/5} \sqrt{a} \)

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

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

120 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

121 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.
122 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) \(\frac{15}{4}x^4y^2\)

123 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

124 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.

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

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

1) 
2) 
3) 
4) 

127 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
128 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

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

130 Which problem involves evaluating \(\binom{6}{4}\)?
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?

131 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) \(a_n = 4(2.5)^n - 1\)

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

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

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

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

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

1) 28°1'
2) 28°4'
3) 61°56'
4) 61°93'
137 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) $y = 3 \sin 4x$

138 A school cafeteria has five different lunch periods. The cafeteria staff wants to find out which items on the menu are most popular, so they give every student in the first lunch period a list of questions to answer in order to collect data to represent the school. Which type of study does this represent?

1) observation
2) controlled experiment
3) population survey
4) sample survey

139 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 $(e, 1)$.

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

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

141 There are eight people in a tennis club. Which expression can be used to find the number of different ways they can place first, second, and third in a tournament?

1) $8P_3$
2) $8C_3$
3) $8P_5$
4) $8C_5$

142 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%

143 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) $(x + 3)^2 + (y - 1)^2 = 13$
144 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

145 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 \( \{ y | y \geq 0 \} \)

146 In \( \triangle KLM \), \( KL = 20 \), \( LM = 13 \), and \( m\angle K = 40^\circ \). 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

147 Which ordered pair is in the solution set of the system of equations shown below?
\[
\begin{align*}
y^2 - x^2 + 32 &= 0 \\
3y - x &= 0
\end{align*}
\]
1) \((2, 6)\)
2) \((3, 1)\)
3) \((-1, -3)\)
4) \((-6, -2)\)

148 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’.

149 What is the range of the function shown below?
1) \( x \leq 0 \)
2) \( x \geq 0 \)
3) \( y \leq 0 \)
4) \( y \geq 0 \)

150 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
151 On the axes below, for \(-2 \leq x \leq 2\), graph 
\[ y = 2^{x+1} - 3. \]

152 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) \(-6\)

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

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

154 Which equation is graphed in the diagram below?

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

155 Expressed in simplest form, \(\frac{3y}{2y - 6} + \frac{9}{6 - 2y}\) is equivalent to

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

156 Express the product of \(\cos 30^\circ\) and \(\sin 45^\circ\) in simplest radical form.
157 Express in simplest form: \( \frac{3 \sqrt[a^6b^9]{\frac{a^5}{b^{12}}}}{64} \)

158 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) \( \frac{11!}{2! \cdot 2! \cdot 2!} \)
3) \( \frac{11!}{8!} \)
4) \( \frac{11!}{2! \cdot 2! \cdot 2!} \)

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

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

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

161 If \( \log_{a} x = 3 \log_{b} p - \left( \frac{1}{2} \log_{b} r \right) \), then the value of \( x \) is

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

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

163 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° northeast of station \( A \) and 15° 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.]
164 Solve algebraically for \( x \):
\[
\sqrt{x^2 + x - 1} + 11x = 7x + 3
\]

165 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) \(-\frac{1}{4} \)

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

167 How many negative solutions to the equation
\[
2x^3 - 4x^2 + 3x - 1 = 0
\]
exist?

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

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

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

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

171 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 \( 270^\circ \)

172 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.

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

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

174 Express \( 4xi + 5yi^3 + 6xi^3 + 2yi^4 \) in simplest \( a + bi \)
form.
175 Solve algebraically for all values of $x$:

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

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

176 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) $4n^{-1} > (6n)^{-1}$

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

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

177 Solve $|−4x + 5| < 13$ algebraically for $x$.

182 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

178 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) $\log 6 + 2 \log a$

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

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

184 Which value of $k$ satisfies the equation $8^{3k + 4} = 4^{2k - 1}$?

1) $-1$
2) $\frac{9}{4}$
3) $-2$
4) $-\frac{14}{5}$
185 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 11 12 14
Find the interquartile range for this set of data.

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

187 Find, to the nearest tenth of a square foot, the area of a rhombus that has a side of 6 feet and an angle of $50^\circ$.

188 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) $\frac{x^2}{16} - \frac{x}{6} - \frac{1}{9}$

189 In parallelogram $BFLO$, $OL = 3.8$, $LF = 7.4$, and $m\angle O = 126$. If diagonal $BL$ is drawn, what is the area of $\triangle BLF$?
1) 11.4
2) 14.1
3) 22.7
4) 28.1

190 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) $y = -2\cos \frac{1}{2}x$

191 Which equation is represented by the graph below?
1) $y = 2\cos 3x$
2) $y = 2\sin 3x$
3) $y = 2\cos \frac{2\pi}{3}x$
4) $y = 2\sin \frac{2\pi}{3}x$

192 Solve algebraically for all values of $x$:
$\log_{5x+4}(17x - 4) = 2$
193 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)

194 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

195 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)

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

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

Which graph represents the function \(f(x + 2)\)?
198 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) \( 2\sqrt{x + 2} \)

199 What is the solution set of the equation 

\[ |4a + 6| - 4a = -10 \]

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

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

<table>
<thead>
<tr>
<th>Test Score</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>96</td>
<td>1</td>
</tr>
<tr>
<td>92</td>
<td>2</td>
</tr>
<tr>
<td>84</td>
<td>5</td>
</tr>
<tr>
<td>80</td>
<td>3</td>
</tr>
<tr>
<td>76</td>
<td>6</td>
</tr>
<tr>
<td>72</td>
<td>3</td>
</tr>
<tr>
<td>68</td>
<td>2</td>
</tr>
</tbody>
</table>

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

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

202 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

203 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) \( 49 \)

204 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) \( w^{14} \)
205 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) \(16384\sqrt{10}\)

206 In simplest form, \(\sqrt{-300}\) is equivalent to
1) \(3i\sqrt{10}\)
2) \(5i\sqrt{12}\)
3) \(10i\sqrt{3}\)
4) \(12i\sqrt{5}\)

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

208 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.

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

210 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.

211 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) \(2x^2 - 6x + 4 = 0\)

212 The conjugate of \(7 - 5i\) is
1) \(-7 - 5i\)
2) \(-7 + 5i\)
3) \(7 - 5i\)
4) \(7 + 5i\)

213 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

214 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) \(4x^2 + 3x - 2 = 0\)
215 The expression $\cos^2 \theta - \cos \theta$ is equivalent to
1) $\sin^2 \theta$
2) $-\sin^2 \theta$
3) $\cos^2 \theta + 1$
4) $-\cos^2 \theta - 1$

216 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.

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

218 Twenty different cameras will be assigned to several boxes. Three cameras will be randomly selected and assigned to box A. Which expression can be used to calculate the number of ways that three cameras can be assigned to box A?
1) $20!$
2) $\frac{20!}{3!}$
3) $20C_3$
4) $20P_3$

219 Factored completely, the expression $12x^4 + 10x^3 - 12x^2$ is equivalent to
1) $x^2(4x + 6)(3x - 2)$
2) $(2x^2 + 3x)(3x^2 - 2x)$
3) $2x^2(2x - 3)(3x + 2)$
4) $2x^2(2x + 3)(3x - 2)$

220 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) $\csc^2 \theta$

221 The expression $(3 - 7i)^2$ is equivalent to
1) $-40 + 0i$
2) $-40 - 42i$
3) $58 + 0i$
4) $58 - 42i$

222 The solutions of the equation $y^2 - 3y = 9$ are
1) $\frac{3 \pm 3\sqrt{3}}{2}$
2) $\frac{3 \pm 3\sqrt{5}}{2}$
3) $\frac{-3 \pm 3\sqrt{5}}{2}$
4) $\frac{3 \pm 3\sqrt{5}}{2}$
223 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) \( f(x) = \log_2 x \)

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

225 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) \( \{-2, 0, 3\} \)

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

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

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

What is the measure of \( \angle K \), to the nearest minute?
1) \( 33^\circ 33' \)
2) \( 33^\circ 34' \)
3) \( 33^\circ 55' \)
4) \( 33^\circ 56' \)
228 Which graph represents a one-to-one function?

1)  

2)  

3)  

4)  

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

230 What is the value of \( x \) in the equation \( \log_5 x = 4 \)?

1) 1.16  
2) 20  
3) 625  
4) 1,024  

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

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

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

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

234 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  

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

236 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) \( \{x| x < -5 \text{ or } x > 2\} \)
237 The solution set of $\sqrt{3x + 16} = x + 2$ is
1) $\{-3, 4\}$
2) $\{-4, 3\}$
3) $\{3\}$
4) $\{-4\}$

238 In the diagram below of a unit circle, the ordered pair $\left(\frac{-\sqrt{2}}{2}, \frac{-\sqrt{2}}{2}\right)$ represents the point where the terminal side of $\theta$ intersects the unit circle.

What is $m\angle \theta$?
1) 45
2) 135
3) 225
4) 240

239 The solution set of the equation $\sqrt{x + 3} = 3 - x$ is
1) $\{1\}$
2) $\{0\}$
3) $\{1, 6\}$
4) $\{2, 3\}$

240 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) $\frac{4}{3}$

241 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

242 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

243 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
244 Solve for $x$: \[ \frac{4x}{x-3} = 2 + \frac{12}{x-3} \]

245 In $\triangle ABC$, $\angle A = 120$, $b = 10$, and $c = 18$. What is the area of $\triangle ABC$ to the nearest square inch?
1) 52  
2) 78  
3) 90  
4) 156

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

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

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

249 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

250 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.

251 Express $\sqrt[6]{108x^5y^8}$ in simplest radical form.
252 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) $-\frac{63}{65}$

253 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

254 Solve the following systems of equations algebraically:

\[ 5 = y - x \]
\[ 4x^2 = -17x + y + 4 \]

255 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

256 Solve algebraically for all values of $x$:

\[ 81x^3 + 2x^2 = 27 \left( \frac{5x}{3} \right) \]

257 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

258 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.
259 If \( \theta \) is an angle in standard position and its terminal side passes through the point \((-3, 2)\), find the exact value of \( \csc \theta \).

260 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

261 Solve algebraically for \( x \):
\[
\frac{1}{x + 3} - \frac{2}{3 - x} = \frac{4}{x^2 - 9}
\]

262 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.

263 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

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

265 In the diagram below of right triangle \( JTM \), \( JT = 12 \), \( JM = 6 \), and \( \angle JMT = 90 \). What is the value of \( \cot J \)?
1) \( \frac{\sqrt{3}}{3} \)
2) \( 2 \)
3) \( -\sqrt{3} \)
4) \( \frac{2\sqrt{3}}{3} \)

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

267 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) \( \cos A = \frac{8}{5} \)
268 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.

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

270 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\(^\circ\)C. After 3 minutes, the temperature of the hot chocolate is 150\(^\circ\)C. 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.]

271 Which graph best represents the inequality \( y + 6 \geq x^2 - x \)?
272 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.

273 Graph the inequality $-3|6 - x| < -15$ for $x$. Graph the solution on the line below.

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

275 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) $\{(0, 1), (1, 0), (2, 0), (3, 2)\}$

276 Write an equation of the circle shown in the graph below.

277 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) $f(\theta) = 2\sin \theta + 3$

278 Written in simplest form, the expression $\frac{x - 1}{4x + \frac{1}{2x}}$ is equivalent to
1) $x - 1$
2) $x - 2$
3) $\frac{x - 2}{2}$
4) $\frac{x^2 - 4}{x + 2}$
279 The graph below represents the function $y = f(x)$.

State the domain and range of this function.

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

281 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) $\frac{15\mathbf{C}_2 \cdot 5\mathbf{C}_1}{30\mathbf{C}_3}$

2) $\frac{15\mathbf{P}_2 \cdot 5\mathbf{P}_1}{30\mathbf{C}_3}$

3) $\frac{15\mathbf{C}_2 \cdot 5\mathbf{C}_1}{30\mathbf{P}_3}$

4) $\frac{15\mathbf{P}_2 \cdot 5\mathbf{P}_1}{30\mathbf{P}_3}$

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

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

1) $-36$

2) $-6$

3) $6$

4) $4$

283 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) $17 = \frac{446 + 16x}{26 + x}$
284 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.

285 What is the radian measure of an angle whose measure is −420°? 
1) \( -\frac{7\pi}{3} \) 
2) \( -\frac{7\pi}{6} \) 
3) \( \frac{7\pi}{6} \) 
4) \( \frac{7\pi}{3} \)

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

287 If \( \angle A \) is acute and \( \tan A = \frac{2}{3} \), then 
1) \( \cot A = \frac{2}{3} \) 
2) \( \cot A = \frac{1}{3} \) 
3) \( \cot(90° - A) = \frac{2}{3} \) 
4) \( \cot(90° - A) = \frac{1}{3} \)

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

289 In which graph is \( \theta \) coterminal with an angle of −70°?

1) 
2) 
3) 
4)
290 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?

1)

291 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) \( \frac{8!}{2! \cdot 2!} \)

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

293 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?

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

1) \(-720x^2\)
2) \(-240x\)
3) \(720x^2\)
4) \(1,080x^3\)
295 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) \( \frac{2}{3} \)

297 If \( r = 3 \sqrt{\frac{A^2B}{C}} \), then \( \log r \) can be represented by

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

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

299 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) \( x^2 - x - 3 \)
300 Which graph represents the equation \( y = \cos^{-1}x \)?

1) ![Graph 1](image1.png)

2) ![Graph 2](image2.png)

3) ![Graph 3](image3.png)

4) ![Graph 4](image4.png)

301 Starting with \( \sin^2 A + \cos^2 A = 1 \), derive the formula \( \tan^2 A + 1 = \sec^2 A \).

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

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

1) ![Graph 5](image5.png)

2) ![Graph 6](image6.png)

3) ![Graph 7](image7.png)

4) ![Graph 8](image8.png)

304 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) \( b_n = 10(2)^{n-1} \)
305. Which graph shows \( y = \cos^{-1} x \)?

306. 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) \( -\frac{4\sqrt{5}}{9} \)

307. 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) \( -5ab\sqrt{2b} + 7ab\sqrt{6b} \)

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

309. What is the common difference of the arithmetic sequence 5, 8, 11, 14?
   1) \( \frac{8}{5} \)
   2) \( -3 \)
   3) 3
   4) 9
310 Express \( \frac{5}{3 - \sqrt{2}} \) with a rational denominator, in simplest radical form.

311 Which graph does not represent a function?

1) 2) 3) 4)  

312 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.

313 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) \( \frac{17 + 5\sqrt{3}}{14} \)

314 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.

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

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

316 Solve the equation \( 2\tan C - 3 = 3\tan C - 4 \) algebraically for all values of \( C \) in the interval \( 0^\circ \leq C < 360^\circ \).
317 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.

318 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) \( x^2 + 6x - 5 \)

319 If \( a = 3 \) and \( b = -2 \), what is the value of the expression \( \frac{a^2 - 9}{b^3} \)?
1) \( -\frac{9}{8} \)
2) \( -1 \)
3) \( -\frac{8}{9} \)
4) \( \frac{8}{9} \)

320 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.

321 The table below shows the results of an experiment involving the growth of bacteria.

<table>
<thead>
<tr>
<th>Time (x) (in minutes)</th>
<th>Number of Bacteria (y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>81</td>
</tr>
<tr>
<td>7</td>
<td>175</td>
</tr>
<tr>
<td>9</td>
<td>310</td>
</tr>
<tr>
<td>11</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.

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

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

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

325 Solve algebraically for \( x \): \( \log_{x+3} \frac{x^3 + x - 2}{x} = 2 \)
326. 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) $a_n = 54 \left( \frac{1}{3} \right)^{n-1}$

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

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

2) $2x^8y^{28}$

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

4) $4x^8y^{28}$

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

329. 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.

330. Factor the expression $12t^8 - 75t^4$ completely.

331. 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) $(-6, -3)$

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

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

$$a_1 = -3$$

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

334. 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) $6$

335. Solve algebraically for $x$: $16^{2x+3} = 64^{x+2}$
336 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

337 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.

338 The expression $\log_{8}64$ is equivalent to

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

339 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) $60^\circ$, $120^\circ$, $240^\circ$, $300^\circ$
345 Samantha constructs the scatter plot below from a set of data.

Based on her scatter plot, which regression model would be most appropriate?
1) exponential
2) linear
3) logarithmic
4) power

346 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) = –\(\frac{1}{2} x + 4\)

347 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

348 Express \(\left(\frac{2}{3}x - 1\right)^2\) as a trinomial.

349 What is the product of \(\left(\frac{2}{5}x - \frac{3}{4}y^2\right)\) and \(\left(\frac{2}{5}x + \frac{3}{4}y^2\right)\)?
1) \(\frac{4}{25}x^2 - \frac{9}{16}y^4\)
2) \(\frac{4}{25}x - \frac{9}{16}y^2\)
3) \(\frac{2}{5}x^2 - \frac{3}{4}y^4\)
4) \(\frac{4}{5}x\)

350 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) \(2\pi\)

351 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) \(\frac{5}{18}\)
352 Which equation is represented by the graph below?

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

353 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

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

355 Which graph does not represent a function?

1) 
2) 
3) 
4) 

356 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

357 The product of \( i^7 \) and \( i^5 \) is equivalent to
1) 1
2) \(-1\)
3) \(i\)
4) \(-i\)
358 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 sketch](image)

359 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) \((x - 6)^2 = 34\)

360 How many distinct triangles can be formed if \( \angle A = 35\), \( a = 10 \), and \( b = 13 \)?
1) 1
2) 2
3) 3
4) 0

361 The expression \( x \cdot \frac{2}{3} \) is equivalent to
1) \( \frac{2}{3} x \)
2) \( \frac{2}{3} x^2 \)
3) \( \frac{1}{\sqrt[3]{x^5}} \)
4) \( \frac{1}{\sqrt[3]{x^2}} \)

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

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

364 Solve the equation \( 8x^3 + 4x^2 - 18x - 9 = 0 \) algebraically for all values of \( x \).
365 Express in simplest form: \( \frac{1}{2} - \frac{4}{d} - \frac{1}{d} + \frac{3}{2d} \)

366 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.

367 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>99</td>
</tr>
<tr>
<td>97</td>
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<tr>
<td>95</td>
</tr>
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<td>92</td>
</tr>
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<td>90</td>
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<td>87</td>
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<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

368 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.

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

![Diagram](image)

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

370 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) \( \frac{\sqrt{3}}{a} \)
371 Which equation is represented by the graph below?

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

372 When \( x^{-1} - 1 \) is divided by \( x - 1 \), the quotient is

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

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

374 The roots of the equation \(2x^2 + 7x - 3 = 0\) are

1) \(-\frac{1}{2}\) and \(-3\)
2) \(\frac{1}{2}\) and \(3\)
3) \(-7 \pm \frac{\sqrt{73}}{4}\)
4) \(\frac{7 \pm \sqrt{73}}{4}\)

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

376 Find the total number of different twelve-letter arrangements that can be formed using the letters in the word *PENNSYLVANIA*.
377 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 sin240°.

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

1) -30°
2) 60°
3) 150°
4) 240°

379 The expression \((x^2 - 1)^{-\frac{2}{3}}\) is equivalent to

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

380 If a function is defined by the equation \(f(x) = 4^x\), which graph represents the inverse of this function?

381 Factor completely: \(10ax^2 - 23ax - 5a\)
382 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

383 The expression $2i^2 + 3i^3$ is equivalent to

1) $-2 - 3i$
2) $2 - 3i$
3) $-2 + 3i$
4) $2 + 3i$

384 Which equation is sketched in the diagram below?

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

385 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) $\sin 55^\circ$

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

387 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

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

1) 12
2) 22
3) 24
4) 26
389 Which graph represents a relation that is not a function?

[Graphs 1, 2, 3, 4]

390 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) \( 6\pi \)
<table>
<thead>
<tr>
<th>1</th>
<th>ANS: 2</th>
<th>PTS: 2</th>
<th>REF: 011225a2</th>
<th>STA: A2.A.43</th>
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<tbody>
<tr>
<td>TOP: Defining Functions</td>
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<td></td>
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<tr>
<td>2</td>
<td>ANS: 2</td>
<td>PTS: 2</td>
<td>REF: 061218a2</td>
<td>STA: A2.A.43</td>
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<tr>
<td>TOP: Defining Functions</td>
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</tr>
<tr>
<td>3</td>
<td>ANS: [7. \quad 4 - \sqrt{2x - 5} = 1]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[-\sqrt{2x - 5} = -3]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[2x - 5 = 9]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[2x = 14]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>[x = 7]</td>
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<td>TOP: Solving Radicals</td>
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<tr>
<td>KEY: basic</td>
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<tr>
<td>4</td>
<td>ANS: 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[\tan 30 = \frac{\sqrt{3}}{3}. \quad \arccos \frac{\sqrt{3}}{k} = 30]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[\frac{\sqrt{3}}{k} = \cos 30]</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[k = 2]</td>
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<td>PTS: 2</td>
<td>REF: 061323a2</td>
<td>STA: A2.A.64</td>
<td>TOP: Using Inverse Trigonometric Functions</td>
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<tr>
<td>KEY: advanced</td>
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<td></td>
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</tr>
<tr>
<td>5</td>
<td>ANS: 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[2x - 1 &gt; 5. \quad 2x - 1 &lt; -5]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[2x &gt; 6 \quad 2x &gt; -4]</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>[x &gt; 3 \quad x &lt; -2]</td>
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<td>PTS: 2</td>
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<td>STA: A2.A.1</td>
<td>TOP: Absolute Value Inequalities</td>
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<td>KEY: graph</td>
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<td>6</td>
<td>ANS: 4</td>
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<td>TOP: Using the Discriminant</td>
<td>KEY: determine nature of roots given equation</td>
<td></td>
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</tbody>
</table>
8  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

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

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

11 ANS:
\[3C_4 \cdot 0.28^4 \cdot 0.72^1 + 3C_5 \cdot 0.28^5 \cdot 0.72^0 \approx 0.024\]
PTS: 4  REF: 011437a2  STA: A2.S.15  TOP: Binomial Probability
KEY: at least or at most

12 ANS: 3
\[5000 \left(1 + \frac{0.03}{4}\right)^{4 \cdot 5} = 5000(1.0075)^{20} \approx 5805.92\]
PTS: 2  REF: 011410a2  STA: A2.A.12  TOP: Evaluating Exponential Expressions

13 ANS: 3
\[\frac{4x - 5}{3} > 1 \text{ or } \frac{4x - 5}{3} < -1\]
\[4x - 5 > 3 \quad 4x - 5 < -3\]
\[4x > 8 \quad 4x < 2\]
\[x > 2 \quad x < \frac{1}{2}\]
PTS: 2  REF: 061209a2  STA: A2.A.1  TOP: Absolute Value Inequalities
KEY: graph

14 ANS: 1
\[2 \cdot \frac{180}{\pi} = \frac{360}{\pi}\]
PTS: 2  REF: 011220a2  STA: A2.M.2  TOP: Radian Measure
KEY: degrees
15 ANS:
\[ g(10) = \left( a(10)\sqrt{1-x} \right)^2 = 100a^2(-9) = -900a^2 \]

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

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

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

KEY: radians

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

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

KEY: advanced


KEY: modeling

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

20 ANS: 4
\[ \binom{5}{3} \binom{\frac{3}{8}}{\frac{5}{8}} = \binom{\frac{225}{512}}{2} \]

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

KEY: spinner

21 ANS:
\[ \frac{-2(x^2 + 6)}{x^4} \cdot \frac{x^2(x-3) + 6(x-3)}{x^2 - 4x} \cdot \frac{2(x-4)}{x^1 - 3x^3} \cdot \frac{x^2 + 2x - 8}{16 - x^2} \]
\[ = \frac{(x^2 + 6)(x-3)}{x(x-4)} \cdot \frac{2(x-2)}{x^3(x-3)} \cdot \frac{(4+x)(4-x)}{(x+4)(x-2)} \]
\[ \frac{-2(x^2 + 6)}{x^4} \]

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

KEY: division

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

\[
\begin{align*}
800. \quad x &= 4^{2.5} = 32. \quad \frac{3}{2} = 125 \quad \frac{x}{y} = \frac{32}{\frac{1}{25}} = 800 \\
y &= 125 \left(\frac{2}{3}\right) = \frac{1}{25}
\end{align*}
\]

PTS: 4 \hspace{1em} REF: 011237a2 \hspace{1em} STA: A2.A.28 \hspace{1em} TOP: Logarithmic Equations

KEY: advanced

24 ANS: 3 \hspace{1em} PTS: 2 \hspace{1em} REF: 061219a2 \hspace{1em} STA: A2.N.8

TOP: Conjugates of Complex Numbers

25 ANS: 1

\[
\frac{6!P_6}{3!2!} = \frac{720}{12} = 60
\]

PTS: 2 \hspace{1em} REF: 011324a2 \hspace{1em} STA: A2.S.10 \hspace{1em} TOP: Permutations

KEY: basic

26 ANS: 3

sum of the roots, \(-\frac{b}{a}\) = \(-\frac{9}{4}\) = \frac{9}{4} \quad \text{product of the roots,} \quad \frac{c}{a} = \frac{3}{4}

PTS: 2 \hspace{1em} REF: 061208a2 \hspace{1em} STA: A2.A.21 \hspace{1em} TOP: Roots of Quadratics

KEY: basic

27 ANS: 2 \hspace{1em} PTS: 2 \hspace{1em} REF: 011208a2 \hspace{1em} STA: A2.A.67

TOP: Proving Trigonometric Identities

28 ANS: 3

\[
\begin{align*}
\frac{x + 16}{x - 2} - \frac{7(x - 2)}{x - 2} &\leq 0 \quad -6x + 30 = 0 \quad x - 2 = 0. \quad \text{Check points such that} \quad x < 2, \quad 2 < x < 5, \quad \text{and} \quad x > 5. \quad \text{If} \quad x = 1, \\
\frac{-6x + 30}{x - 2} &\leq 0 \quad -6x = -30 \quad x = 2 \\
\frac{-6(1) + 30}{1 - 2} &= \frac{24}{-1} = -24, \quad \text{which is less than} \quad 0. \quad \text{If} \quad x = 3, \quad \frac{-6(3) + 30}{3 - 2} = \frac{12}{1} = 12, \quad \text{which is greater than} \quad 0. \quad \text{If} \quad x = 6, \\
\frac{-6(6) + 30}{6 - 2} &= \frac{-6}{4} = -\frac{3}{2}, \quad \text{which is less than} \quad 0.
\end{align*}
\]

PTS: 2 \hspace{1em} REF: 011424a2 \hspace{1em} STA: A2.A.23 \hspace{1em} TOP: Rational Inequalities

29 ANS:

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

PTS: 2 \hspace{1em} REF: 061229a2 \hspace{1em} STA: A2.A.12 \hspace{1em} TOP: Evaluating Exponential Expressions
30 ANS: 2

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

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

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

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

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

\[
300 = t
\]

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

31 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

32 ANS: 4 PTS: 2 REF: 061206a2 STA: A2.A.60

TOP: Unit Circle

33 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

34 ANS: 1

![LinReg](image)

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

35 ANS: 2 PTS: 2 REF: 011407a2 STA: A2.A.43

TOP: Defining Functions

36 ANS: 1 PTS: 2 REF: 061223a2 STA: A2.S.15

TOP: Binomial Probability KEY: modeling
37 ANS: 2
Top 6.7% = 1.5 s.d. + σ = 1.5(104) + 576 = 732

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

38 ANS:
30700 = 50e^{3t}
614 = e^{3t}
ln 614 = ln e^{3t}
ln 614 = 3t ln e
ln 614 = 3t
2.14 ≈ t

PTS: 2 REF: 011333a2 STA: A2.A.6 TOP: Exponential Growth

39 ANS: 1
5 \cdot \frac{180}{\pi} ≈ 286

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

40 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

41 ANS:
\begin{align*}
a_1 &= 3. \quad a_2 = 2(3) - 1 = 5. \quad a_3 = 2(5) - 1 = 9.
\end{align*}

PTS: 2 REF: 061233a2 STA: A2.A.33 TOP: Recursive Sequences
42 ANS:
\[2 \sin^2 x + 5 \sin x - 3 = 0\]
\[(2 \sin x - 1)(\sin x + 3) = 0\]
\[\sin x = \frac{1}{2}\]
\[x = \frac{\pi}{6}, \frac{5\pi}{6}\]

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

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

44 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

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

PTS: 2
REF: 011228a2
STA: A2.A.4
TOP: Quadratic Inequalities
KEY: one variable

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

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

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

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

PTS: 2
REF: 061328a2
STA: A2.A.20
TOP: Roots of Quadratics
49 ANS: 
\[ y = -3 \sin 2x. \] The period of the function is \( \pi \), the amplitude is 3 and it is reflected over the \( x \)-axis.

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

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

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

51 ANS: 2
\[ \frac{-3}{32}a^3b^4 = \frac{6b}{a^2} \]

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

53 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

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

\[ A = 58^\circ \]

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

55 ANS: 4
\[ 2 \cos \theta = 1 \]
\[ \cos \theta = \frac{1}{2} \]
\[ \theta = \cos^{-1} \frac{1}{2} = 60^\circ, 300^\circ \]

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

KEY: basic

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

KEY: variables

57 ANS: 1  PTS: 2  REF: 011306a2  STA: A2.A.8  TOP: Negative and Fractional Exponents
ANS: 
\[3x^2 - 11x + 6 = 0\]. Sum \(\frac{-b}{a} = \frac{11}{3}\). Product \(\frac{c}{a} = \frac{6}{3} = 2\)

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

ANS: 3
\[
\log_4m^2 = \log_4 + \log m^2 = \log_4 + 2\log m
\]

KEY: splitting logs

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

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

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

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

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

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

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

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

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

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

PTS: 2  REF: 061334a2  STA: A2.A.58  TOP: Reciprocal Trigonometric Relationships
67 ANS: \[
\frac{2\sqrt{3}}{3}. \text{ If } \sin 60 = \frac{\sqrt{3}}{2}, \text{ then } \csc 60 = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}
\]

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

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

\begin{align*}
15 &= \frac{3}{5} p \\
25 &= p
\end{align*}

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

69 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

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

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

KEY: equations

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

PTS: 2 REF: 011332a2 STA: A2.A.25 TOP: Quadratics with Irrational Solutions
72 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

73 ANS:
y = 215.983(1.652)^x.  \quad 215.983(1.652)^7 \approx 7250

PTS: 4  REF: 011337a2  STA: A2.S.7  TOP: Exponential Regression

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

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

75 ANS: 1
\begin{align*}
\cos \left( \frac{5\pi}{6} \right) &= -0.866 \\
\sin \left( \frac{5\pi}{6} \right) &= 0.5 \\
\tan \left( \frac{5\pi}{6} \right) &= -1.571
\end{align*}

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

76 ANS: 2
\frac{8\pi}{5} \cdot \frac{180}{\pi} = 288

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

77 ANS: 1
(4a + 4) - (2a + 1) = 2a + 3

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

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

79 ANS: 1
5x + 29 = (x + 3)^2 \quad (-5) + 3 shows an extraneous solution.

5x + 29 = x^2 + 6x + 9
0 = x^2 + x - 20
0 = (x + 5)(x - 4)
x = -5, 4

PTS: 2  REF: 061213a2  STA: A2.A.22  TOP: Solving Radicals
KEY: extraneous solutions
80 ANS:
\[
\frac{1}{2} \left( -x^n - x \right)_{n=1} \quad \text{ANS: -104.}
\]
PTS: 2 REF: 011230a2 STA: A2.N.10 TOP: Sigma Notation
KEY: basic

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

82 ANS:
\[ y = 180.377(0.954)^x \]
PTS: 2 REF: 061231a2 STA: A2.S.7 TOP: Exponential Regression

83 ANS: 4
\[
\frac{4 \cdot 0 + 6 \cdot 1 + 10 \cdot 2 + 0 \cdot 3 + 4k + 2 \cdot 5}{4 + 6 + 10 + 0 + k + 2} = 2
\]
\[
\frac{4k + 36}{k + 22} = 2
\]
\[
4k + 36 = 2k + 44
\]
\[
k = 8
\]
\[
k = 4
\]

84 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: 061221a2 STA: A2.S.3 TOP: Average Known with Missing Data

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

86 ANS:
\[
\binom{25}{20} = 53,130
\]
PTS: 2 REF: 011232a2 STA: A2.S.11 TOP: Combinations
87 ANS:
5 \csc \theta = 8
\csc \theta = \frac{8}{5}
\sin \theta = \frac{5}{8}
\theta \approx 141\degree

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

88 ANS:
\frac{13}{x} = 10 - x \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

89 ANS: 1
\frac{6}{\sin 35\degree} = \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

90 ANS: 2
\text{TOP: Sigma Notation}

91 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.58 TOP: Reciprocal Trigonometric Relationships

92 ANS: 4
\left(3\sqrt{27x^2}\right) \left(3\sqrt{16x^4}\right) = 3\sqrt{3^3 \cdot 2^4 \cdot x^6} = 3 \cdot 2 \cdot x^3 \sqrt{2} = 6x^3\sqrt{2}

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

93 ANS: 2
\frac{x^{-1} + 1}{x + 1} = \frac{\frac{1}{x} + 1}{x + 1} = \frac{\frac{1 + x}{x}}{x + 1} = \frac{1}{x}

PTS: 2 REF: 011211a2 STA: A2.A.9 TOP: Negative Exponents
94 ANS: 2
Since the coefficient of $t$ is greater than 0, $r > 0$.

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

95 ANS: 4

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

96 ANS:
\[
\frac{27}{\sin 75} = \frac{F_1}{\sin 60}, \quad \frac{27}{\sin 75} = \frac{F_2}{\sin 45},
\]

$F_1 \approx 24 \quad F_1 \approx 20$

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

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

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

98 ANS: 3
\[
8C_3 \cdot x^{8-3} \cdot (-2)^3 = 56x^5 \cdot (-8) = -448x^5
\]

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

99 ANS: 1

TOP: Negative Exponents
\[ (3i)(2i)^2(m + i) \]
\[ (3i)(4i^2)(m + i) \]
\[ (3i)(-4)(m + i) \]
\[ (-12i)(m + i) \]
\[ -12mi - 12i^2 \]
\[ -12mi + 12 \]

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

\[ 3x^5 - 48x = 0 \]
\[ 3x(x^4 - 16) = 0 \]
\[ 3x(x^2 + 4)(x^2 - 4) = 0 \]
\[ 3x(x^2 + 4)(x + 2)(x - 2) = 0 \]

PTS: 2  REF: 011216a2  STA: A2.A.26  TOP: Solving Polynomial Equations

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

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

\[ x^2(x + 2) - (x + 2) \]
\[ (x^2 - 1)(x + 2) \]
\[ (x + 1)(x - 1)(x + 2) \]

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

\[ \frac{1}{7 - \sqrt{11}} \cdot \frac{7 + \sqrt{11}}{7 + \sqrt{11}} = \frac{7 + \sqrt{11}}{49 - 11} = \frac{7 + \sqrt{11}}{38} \]

PTS: 2  REF: 011404a2  STA: A2.N.5  TOP: Rationalizing Denominators
108 ANS: 3
\[ \sqrt[3]{6a^4b^2} + \frac{3}{\sqrt[3]{(27 \cdot 6)a^4b^2}} \]
\[ \frac{a^3\sqrt{6ab^2} + 3a^3\sqrt{6ab^2}}{4a^3\sqrt{6ab^2}} \]

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

109 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

110 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

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

112 ANS: 3
\[a + \frac{b}{c} \frac{ac + b}{cd - b} = \frac{ac + b}{c} \frac{c}{cd - b} = \frac{ac + b}{cd - b}\]

PTS: 2   REF: 011405a2   STA: A2.A.17   TOP: Complex Fractions

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

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

114 ANS:
\[\sigma_x = 14.9. \quad \bar{x} = 40. \quad \text{There are 8 scores between 25.1 and 54.9.}\]

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

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

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

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

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

117 ANS: 4

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

PTS: 2    REF: 061325a2    STA: A2.A.15    TOP: Rationalizing Denominators

KEY: index = 2

118 ANS: 3

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

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

KEY: index > 2

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

120 ANS: 3

1000 = 500e^{.05t}

\[ 2 = e^{.05t} \]

\[ \ln 2 = \ln e^{.05t} \]

\[ \frac{\ln 2}{.05} = \frac{.05t \cdot \ln e}{.05} \]

13.9 \approx t

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

121 ANS:

\[
C_3\left(\frac{1}{4}\right)^3 \left(\frac{3}{4}\right)^4 = 35\left(\frac{1}{64}\right)\left(\frac{81}{256}\right) = \frac{2835}{16384} \approx 0.173
\]

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

KEY: exactly

122 ANS: 3

\[
C_3\left(\frac{x}{2}\right)^3 (-2y)^3 = 20 \cdot \frac{x^3}{8} \cdot (-8y^3) = -20x^3y^3
\]

PTS: 2    REF: 061215a2    STA: A2.A.36    TOP: Binomial Expansions

123 ANS: 3

20 \cdot 2 = -5t

\[-8 = t\]

PTS: 2    REF: 011412a2    STA: A2.A.5    TOP: Inverse Variation
124 ANS:
\[
88. \quad \frac{100}{\sin 33^\circ} = \frac{x}{\sin 32^\circ} \quad \sin 66^\circ \approx \frac{T}{97.3} \\
x \approx 97.3 \quad t \approx 88 
\]

PTS: 4 \quad REF: 011236a2 \quad STA: A2.A.73 \quad TOP: Law of Sines
KEY: advanced

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

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

126 ANS: 3

PTS: 2 \quad REF: 011207a2 \quad STA: A2.A.71 \quad TOP: Graphing Trigonometric Functions

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

PTS: 2 \quad REF: 061310a2 \quad STA: A2.A.5 \quad TOP: Inverse Variation

128 ANS: 3
\[
\frac{-b}{a} = \frac{-(-4)}{1} = 4. \text{ If the sum is 4, the roots must be 7 and } -3. 
\]

PTS: 2 \quad REF: 011418a2 \quad STA: A2.A.21 \quad TOP: Roots of Quadratics
KEY: advanced
129 ANS:
\[ x^4 + 4x^3 + 4x^2 + 16x = 0 \]
\[ x(x^3 + 4x^2 + 4x + 16) = 0 \]
\[ x(x^2 + 4)(x + 4) = 0 \]
\[ x = 0, \pm 2i, -4 \]


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

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

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

132 ANS:
\[ 2x - 1 = 27 \]
\[ 2x - 1 = 81 \]
\[ 2x = 82 \]
\[ x = 41 \]

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

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

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

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

PTS: 2  REF: 011234a2  STA: A2.A.49  TOP: Writing Equations of Circles

135 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
\[
\sin S = \frac{8}{17}
\]

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

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

136 ANS: 2

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

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

137 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

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

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

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

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

142 ANS: 3

\[
34.1\% + 19.1\% = 53.2\%
\]

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

143 ANS: 4
PTS: 2
REF: 061318a2
STA: A2.A.49
TOP: Equations of Circles

144 ANS: 2

\[
x \pm \sigma
\]

\[
153 \pm 22
\]

\[
131 - 175
\]

PTS: 2
REF: 011307a2
STA: A2.S.5
TOP: Normal Distributions
KEY: interval

145 ANS: 1
PTS: 2
REF: 011416a2
STA: A2.A.39
TOP: Domain and Range
KEY: real domain
\[
\frac{13}{\sin 40} = \frac{20}{\sin M}. \quad 81 + 40 < 180. \quad (180 - 81) + 40 < 180
\]
\[ M \approx 81 \]

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

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

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

KEY: equations

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

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

KEY: arc length

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

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

KEY: arithmetic

\[ \text{ANS:} \]

PTS: 2  
REF: 011234a2  
STA: A2.A.53  
TOP: Graphing Exponential Functions
152 ANS: 3 
\[ \frac{4}{-2} = -2 \]

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

153 ANS: 4 
\[ \frac{x^2 + 9x - 22}{x^2 - 121} + (2 - x) = \frac{(x + 11)(x - 2)}{(x + 11)(x - 11)} \cdot \frac{-1}{x - 2} = \frac{-1}{x - 11} \]

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

154 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

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


156 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

157 ANS: 
\[ a^2 b^3 \cdot 4 \]

PTS: 2 REF: 011231a2 STA: A2.A.13 TOP: Simplifying Radicals
KEY: index > 2


159 ANS: 2

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

PTS: 2 REF: 011413a2 STA: A2.A.64 TOP: Using Inverse Trigonometric Functions
KEY: advanced
\[
\begin{align*}
\log 9 - \log 20 &= \log 3^2 - \log (10 \cdot 2) \\
\log 3^2 - \log (10 \cdot 2) &= 2 \log 3 - (\log 10 + \log 2) \\
\log 3^2 - \log (10 \cdot 2) &= 2b - (1 + a) \\
2 \log 3 - (\log 10 + \log 2) &= 2b - a - 1
\end{align*}
\]

**PTS:** 2  
**REF:** 011326a2  
**STA:** A2.A.19  
**TOP:** Properties of Logarithms  
**KEY:** expressing logs algebraically

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

\[x = -5, 2\]

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

\[
\begin{align*}
\frac{100}{\sin 32} &= b \left( \frac{100}{\sin 105} \right) \\
\frac{100}{\sin 32} &= \frac{a}{\sin 43}
\end{align*}
\]

\[b \approx 182.3 \quad a \approx 128.7\]

**PTS:** 4  
**REF:** 011338a2  
**STA:** A2.A.73  
**TOP:** Law of Sines  
**KEY:** basic

\[
\begin{align*}
\sqrt{x^2 + x - 1} &= -4x + 3 \\
x^2 + x - 1 &= 16x^2 - 24x + 9 \\
0 &= 15x^2 - 25x + 10 \\
0 &= 3x^2 - 5x + 2 \\
0 &= (3x - 2)(x - 1)
\end{align*}
\]

\[x = \frac{2}{3}, x \neq 1\]

**PTS:** 6  
**REF:** 011339a2  
**STA:** A2.A.22  
**TOP:** Solving Radicals  
**KEY:** extraneous solutions
165 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

166 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

167 ANS: 4

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

168 ANS:

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

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

KEY: Parallelograms

169 ANS:

\[ \frac{31 - 19}{7 - 4} = \frac{12}{3} = 4 \quad x + (4 - 1)4 = 19 \quad a_n = 7 + (n - 1)4 \]
\[ x + 12 = 19 \]
\[ x = 7 \]

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

170 ANS:

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

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

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

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

PTS: 2 REF: 011331a2 STA: A2.S.4 TOP: Dispersion KEY: range, quartiles, interquartile range, variance

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

174 ANS: 

\[ 4xi + 5yi^8 + 6xi^3 + 2yi^4 = 4xi + 5y - 6xi + 2y = 7y - 2xi \]

PTS: 2 REF: 011433a2 STA: A2.N.7 TOP: Imaginary Numbers

175 ANS: 

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

\[ (x+3)^2 = (2x+3)(x+5) \]

\[ x^2 + 6x + 9 = 2x^2 + 13x + 15 \]

\[ x^2 + 7x + 6 = 0 \]

\[ (x+6)(x+1) = 0 \]

\[ x = -1 \]


176 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

177 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
178 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

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

180 ANS:

\[ \frac{15}{\sin 103} = \frac{a}{\sin 42} \cdot \frac{1}{2} \]

\[ (15)(10.3) \sin 35 \approx 44 \]

\[ a \approx 10.3 \]

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

181 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

182 ANS: 1

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

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

183 ANS:

\[ a + 15 + 2a = 90 \]

\[ 3a + 15 = 90 \]

\[ 3a = 75 \]

\[ a = 25 \]

PTS: 2  REF: 011330a2  STA: A2.A.58  TOP: Cofunction Trigonometric Relationships
\[ 8^{3k + 4} = 4^{2k - 1} \]
\[ (2^3)^{3k + 4} = (2^2)^{2k - 1} \]
\[ 2^{9k + 12} = 2^{4k - 2} \]
\[ 9k + 12 = 4k - 2 \]
\[ 5k = -14 \]
\[ k = -\frac{14}{5} \]

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

KEY: common base not shown

185 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: Dispersion

KEY: range, quartiles, interquartile range, variance

186 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

187 ANS:
\[ K = ab\sin C = 6 \cdot 6 \sin 50 \approx 27.6 \]

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

KEY: Parallelograms

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

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

189 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

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

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

\[(x + 4)^2 = 17x - 4\]

\[x^2 + 8x + 16 = 17x - 4\]

\[x^2 - 9x + 20 = 0\]

\[(x - 4)(x - 5) = 0\]

\[x = 4, 5\]
Algebra 2/Trigonometry Regents at Random
Answer Section

193  ANS:  3  PTS:  2  REF:  fall0923a2  STA:  A2.A.39
   TOP:  Domain and Range  KEY:  real domain
194  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
195  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
196  ANS:  2  PTS:  2  REF:  fall0926a2  STA:  A2.A.46
   TOP:  Transformations with Functions and Relations
197  ANS:  1
   \[
   \begin{array}{|c|c|c|c|c|}
   \hline
   n & 3 & 4 & 5 & \Sigma \\
   \hline
   -r^2 + r & -3^2 + 3 = -6 & -4^2 + 4 = -12 & -5^2 + 5 = -20 & -38 \\
   \hline
   \end{array}
   \]
   PTS:  2  REF:  061118a2  STA:  A2.N.10  TOP:  Sigma Notation
   KEY:  basic
198  ANS:  4
   \[ \frac{2x + 4}{\sqrt{x + 2}} \cdot \frac{\sqrt{x + 2}}{\sqrt{x + 2}} = \frac{2(x + 2)\sqrt{x + 2}}{x + 2} = 2\sqrt{x + 2} \]
   PTS:  2  REF:  011122a2  STA:  A2.A.15  TOP:  Rationalizing Denominators
   KEY:  index = 2
199  ANS:  1
   \[ 4a + 6 = 4a - 10 \]
   \[ 4a + 6 = -4a + 10 \]
   \[ 4\left(\frac{1}{2}\right) + 6 - 4\left(\frac{1}{2}\right) = -10 \]
   \[ 6 \neq -10 \]
   \[ 8a = 4 \]
   \[ a = \frac{4}{8} = \frac{1}{2} \]
   \[ 8 - 2 \neq -10 \]
   PTS:  2  REF:  011106a2  STA:  A2.A.1  TOP:  Absolute Value Equations
200  ANS:  7.4
   PTS:  2  REF:  061029a2  STA:  A2.S.4  TOP:  Dispersion
   KEY:  basic, group frequency distributions
201 ANS: 3 PTS: 2 REF: 011110a2 STA: A2.A.30
TOP: Sequences

202 ANS: 3
\[ b^2 - 4ac = (-10)^2 - 4(1)(25) = 100 - 100 = 0 \]

PTS: 2 REF: 011102a2 STA: A2.A.2 TOP: Using the Discriminant
KEY: determine nature of roots given equation

203 ANS: 2 PTS: 2 REF: 061122a2 STA: A2.A.24
TOP: Completing the Square

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

PTS: 2 REF: 081011a2 STA: A2.A.8 TOP: Negative and Fractional Exponents

205 ANS: 1
\[ a_n = -\sqrt{5}(-\sqrt{2})^{n-1} \]
\[ a_{15} = -\sqrt{5}(-\sqrt{2})^{15-1} = -\sqrt{5}(-\sqrt{2})^{14} = -\sqrt{5} \cdot 2^7 = -128\sqrt{5} \]

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

206 ANS: 3
\[ \sqrt{-300} = \sqrt{100} \sqrt{-1} \sqrt{3} \]

PTS: 2 REF: 061006a2 STA: A2.N.6 TOP: Square Roots of Negative Numbers

207 ANS: 3
\[ 2\pi \cdot \frac{5}{12} = \frac{10\pi}{12} = \frac{5\pi}{6} \]

PTS: 2 REF: 061125a2 STA: A2.M.1 TOP: Radian Measure

208 ANS:
\[ 12 \cdot 6 = 9w \]
\[ 8 = w \]

PTS: 2 REF: 011130a2 STA: A2.A.5 TOP: Inverse Variation

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

PTS: 2 REF: 061030a2 STA: A2.A.20 TOP: Roots of Quadratics
210 ANS: $\frac{12}{\sin 32^\circ} = \frac{10}{\sin B}$
\[ C \approx 180 - (32 + 26.2) \approx 121.8. \quad \frac{12}{\sin 32^\circ} = \frac{c}{\sin 121.8^\circ} \]
\[ B = \sin^{-1} \left( \frac{10 \sin 32^\circ}{12} \right) \approx 26.2 \]
\[ c = \frac{12 \sin 121.8^\circ}{\sin 32^\circ} \approx 19.2 \]

PTS: 4 REF: 011137a2 STA: A2.A.73 TOP: Law of Sines
KEY: basic

211 ANS: 3
\[ \frac{-b}{a} = \frac{-6}{2} = -3, \quad \frac{c}{a} = \frac{4}{2} = 2 \]

PTS: 2 REF: 011112a2 STA: A2.A.21 TOP: Roots of Quadratics
KEY: basic

212 ANS: 4 PTS: 2 REF: 011111a2 STA: A2.N.8 TOP: Conjugates of Complex Numbers

213 ANS: 4
\[ s = \theta r = 2 \cdot 4 = 8 \]

PTS: 2 REF: fall0922a2 STA: A2.A.61 TOP: Arc Length
KEY: arc length

214 ANS: 3
\[ S = \frac{-b}{a} = \frac{-(-3)}{4} = \frac{3}{4}, \quad P = \frac{c}{a} = \frac{-8}{4} = -2 \]

PTS: 2 REF: fall0912a2 STA: A2.A.21 TOP: Roots of Quadratics
KEY: basic

215 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

216 ANS:
\[ \frac{2.5}{\sin x} = \frac{101.43}{\sin 125^\circ} \]
\[ x \approx 12 \]

PTS: 6 REF: fall0939a2 STA: A2.A.73 TOP: Vectors
12x^4 + 10x^3 - 12x^2 = 2x^2(6x^2 + 5x - 6) = 2x^2(2x + 3)(3x - 2)

\[
\frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta} = \frac{1}{\cos^2 \theta} = \sec^2 \theta
\]

(3 - 7i)(3 - 7i) = 9 - 21i - 21i + 49i^2 = 9 - 42i - 49 = -40 - 42i

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

\[x^2 - 6x - 27 = 0, \quad \frac{-b}{a} = 6, \quad \frac{c}{a} = -27. \quad \text{If } a = 1 \text{ then } b = -6 \text{ and } c = -27\]
227 ANS: 1

\[
\cos K = \frac{5}{6} \approx 33^\circ 33'
\]

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

228 ANS: 3

(1) and (4) fail the horizontal line test and are not one-to-one. Not every element of the range corresponds to only one element of the domain. (2) fails the vertical line test and is not a function. Not every element of the domain corresponds to only one element of the range.

PTS: 2    REF: 081020a2    STA: A2.A.43    TOP: Defining Functions

229 ANS:

\[
\frac{23}{2} \cos^2 B + \sin^2 B = 1 \quad \tan B = \frac{\sin B}{\cos B} = \frac{5}{\sqrt{41}} = \frac{5}{4} \\
\cos^2 B + \left(\frac{5}{\sqrt{41}}\right)^2 = 1 \\
\cos^2 B + \frac{25}{41} = \frac{41}{41} \\
\cos^2 B = \frac{16}{41} \\
\cos B = \frac{4}{\sqrt{41}} \\
\tan(A + B) = \frac{2}{3} + \frac{5}{4} = \frac{8 + 15}{12} = \frac{23}{12} = \frac{23}{2} \\
1 - \left(\frac{2}{3}\right)\left(\frac{5}{4}\right) = \frac{12}{12} - \frac{10}{12} = \frac{2}{12} = \frac{2}{2}
\]

PTS: 4    REF: 081037a2    STA: A2.A.76    TOP: Angle Sum and Difference Identities

KEY: evaluating

230 ANS: 3

\[ x = 5^4 = 625 \]

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

KEY: basic
\[ b^2 - 4ac = 0 \]
\[ k^2 - 4(1)(4) = 0 \]
\[ k^2 - 16 = 0 \]
\[ (k + 4)(k - 4) = 0 \]
\[ k = \pm 4 \]

PTS: 2  REF: 061028a2  STA: A2.A.2  TOP: Using the Discriminant
KEY: determine equation given nature of roots

232 ANS: 1
\[ gC_3a^6(-4b)^3 = -5376a^6b^3 \]

PTS: 2  REF: 061126a2  STA: A2.A.36  TOP: Binomial Expansions

233 ANS:
\[ y = x^2 - 6. \ f^{-1}(x) \text{ is not a function.} \]
\[ x = y^2 - 6 \]
\[ x + 6 = y^2 \]
\[ \pm \sqrt{x+6} = y \]

PTS: 2  REF: 061132a2  STA: A2.A.44  TOP: Inverse of Functions
KEY: equations

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

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

235 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
236 ANS: 3
\[ x^2 - 3x - 10 > 0 \]
or
\[ (x - 5)(x + 2) > 0 \]
\[ x - 5 < 0 \text{ and } x + 2 < 0 \]
\[ x - 5 > 0 \text{ and } x + 2 > 0 \]
\[ x < 5 \text{ and } x < -2 \]
\[ x > 5 \text{ and } x > -2 \]
\[ x < -2 \]

PTS: 2  REF: 011115a2  STA: A2.A.4  TOP: Quadratic Inequalities
KEY: one variable

237 ANS: 3
\[ 3x + 16 = (x + 2)^2 \]
\[-4 \text{ is an extraneous solution.} \]

\[ 3x + 16 = x^2 + 4x + 4 \]
\[ 0 = x^2 + x - 12 \]
\[ 0 = (x + 4)(x - 3) \]
\[ x = -4 \]
\[ x = 3 \]

PTS: 2  REF: 061121a2  STA: A2.A.22  TOP: Solving Radicals
KEY: extraneous solutions

238 ANS: 3  PTS: 2  REF: 011104a2  STA: A2.A.64  TOP: Using Inverse Trigonometric Functions
KEY: unit circle

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

240 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  REF: 081008a2  STA: A2.A.27  TOP: Exponential Equations
KEY: common base not shown

241 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
242 ANS: 2
\[ x^2 - x - 6 = 3x - 6 \]
\[ x^2 - 4x = 0 \]
\[ x(x - 4) = 0 \]
\[ x = 0, 4 \]

PTS: 2 REF: 081015a2 STA: A2.A.3 TOP: Quadratic-Linear Systems
KEY: equations

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

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

244 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

245 ANS: 2
\[ K = \frac{1}{2} (10)(18) \sin 120 = 45 \sqrt{3} \approx 78 \]

PTS: 2 REF: fall0907a2 STA: A2.A.74 TOP: Using Trigonometry to Find Area
KEY: basic

246 ANS: 1
\[ 2 \log x - (3 \log y + \log z) = \log x^2 - \log y^3 - \log z = \log \frac{x^2}{y^3 z} \]

PTS: 2 REF: 061010a2 STA: A2.A.19 TOP: Properties of Logarithms
\[
\begin{align*}
\sin 2\theta &= \sin \theta \\
\sin 2\theta - \sin \theta &= 0 \\
2\sin \theta \cos \theta - \sin \theta &= 0 \\
\sin(2\cos \theta - 1) &= 0 \\
\sin \theta &= 0, \quad 2\cos \theta - 1 = 0 \\
\theta &= 0, \quad 180 \cos \theta = \frac{1}{2} \\
\theta &= 60, \quad 300
\end{align*}
\]

PTS: 4  REF: 061037a2  STA: A2.A.68  TOP: Trigonometric Equations  KEY: double angle identities

248  ANS: 1  PTS: 2  REF: 061013a2  STA: A2.A.38  TOP: Defining Functions

249  ANS: 1

\[
\begin{align*}
y &= 10.596(1.586)^x
\end{align*}
\]

PTS: 2  REF: fall0915a2  STA: A2.S.5  TOP: Normal Distributions  KEY: interval

250  ANS:

\[
y = 10.596(1.586)^x
\]

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

251  ANS:

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


252  ANS: 1

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

PTS: 2  REF: 011214a2  STA: A2.A.76  TOP: Angle Sum and Difference Identities  KEY: evaluating
253 ANS: 1
\[ 13^2 = 15^2 + 14^2 - 2(15)(14)\cos C \]
\[ 169 = 421 - 420\cos C \]
\[ -252 = -420\cos C \]
\[ \frac{252}{420} = \cos C \]
\[ 53 \approx C \]

KEY: find angle

254 ANS:
\[ \left( -\frac{9}{2}, \frac{1}{2} \right) \text{ and } \left( \frac{1}{2}, \frac{11}{2} \right) \]
\[ y = x + 5 \quad \text{ and } \quad 4x^2 + 17x - 4 = x + 5 \]
\[ y = 4x^2 + 17x - 4 \quad \text{ and } \quad 4x^2 + 16x - 9 = 0 \]
\[ (2x + 9)(2x - 1) = 0 \]
\[ x = -\frac{9}{2} \text{ and } x = \frac{1}{2} \]
\[ y = -\frac{9}{2} + 5 = \frac{1}{2} \text{ and } y = \frac{1}{2} + 5 = \frac{11}{2} \]

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

255 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

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

PTS: 6  REF: 061239a2  STA: A2.A.27  TOP: Exponential Equations
KEY: common base not shown
257 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

258 ANS:
\[(x + 5)^2 + (y - 3)^2 = 32\]
PTS: 2 REF: 081033a2 STA: A2.A.49 TOP: Writing Equations of Circles

259 ANS:
\[ \frac{\sqrt{13}}{2} \cdot \sin \theta = \frac{y}{\sqrt{x^2 + y^2}} = \frac{2}{\sqrt{(-3)^2 + 2^2}} = \frac{2}{\sqrt{13}}. \quad \csc \theta = \frac{\sqrt{13}}{2}. \]
PTS: 2 REF: fall0933a2 STA: A2.A.62 TOP: Determining Trigonometric Functions

260 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

261 ANS:
\[ \frac{1}{3} \cdot \frac{1}{x + 3} - \frac{2}{3 - x} = \frac{4}{x^2 - 9} \]
\[ \frac{1}{x + 3} + \frac{2}{x - 3} = \frac{4}{x^2 - 9} \]
\[ \frac{x - 3 + 2(x + 3)}{(x + 3)(x - 3)} = \frac{4}{(x + 3)(x - 3)} \]
\[ x - 3 + 2x + 6 = 4 \]
\[ 3x = 1 \]
\[ x = \frac{1}{3} \]
PTS: 4 REF: 081036a2 STA: A2.A.23 TOP: Solving Rationals
KEY: rational solutions

262 ANS:
\[ a = \sqrt{10^2 + 6^2 - 2(10)(6)\cos 80} \approx 10.7. \quad \angle C \text{ is opposite the shortest side.} \quad \frac{6}{\sin C} = \frac{10.7}{\sin 80} \]
\[ C \approx 33 \]
KEY: advanced
\[ 10 \binom{4}{9} = 210 \]

PTS: 2 \hspace{0.5cm} REF: 061113a2 \hspace{0.5cm} STA: A2.S.11 \hspace{0.5cm} TOP: Combinations

\[ \sum_{n=1}^{15} 7n \]

PTS: 2 \hspace{0.5cm} REF: 081029a2 \hspace{0.5cm} STA: A2.A.34 \hspace{0.5cm} TOP: Sigma Notation

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

PTS: 2 \hspace{0.5cm} REF: 011120a2 \hspace{0.5cm} STA: A2.A.55 \hspace{0.5cm} TOP: Trigonometric Ratios

\[ \tan(126.43') = -1.540788784 \]

PTS: 2 \hspace{0.5cm} REF: 061115a2 \hspace{0.5cm} STA: A2.A.66 \hspace{0.5cm} TOP: Determining Trigonometric Functions

\[ 10 C_8 \cdot 0.65^8 \cdot 0.35^2 + 10 C_9 \cdot 0.65^9 \cdot 0.35^1 + 10 C_{10} \cdot 0.65^{10} \cdot 0.35^0 \approx 0.262 \]

PTS: 4 \hspace{0.5cm} REF: 081038a2 \hspace{0.5cm} STA: A2.S.15 \hspace{0.5cm} TOP: Binomial Probability

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

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

\[ k \approx 0.104 \quad T - 68 \approx 39.6 \]

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

PTS: 6 \hspace{0.5cm} REF: 011139a2 \hspace{0.5cm} STA: A2.A.28 \hspace{0.5cm} TOP: Logarithmic Equations
271 ANS: 1
\[ y \geq x^2 - x - 6 \]
\[ y \geq (x - 3)(x + 2) \]

PTS: 2 REF: 061017a2 STA: A2.A.4 TOP: Quadratic Inequalities
KEY: two variables

272 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

273 ANS:
\[ -3|6-x| < -15 \]
\[ |6-x| > 5 \]
\[ 6-x > 5 \text{ or } 6-x < -5 \]
\[ 1 > x \text{ or } 11 < x \]

PTS: 2 REF: 061137a2 STA: A2.A.1 TOP: Absolute Value Inequalities
KEY: graph

274 ANS: 4 PTS: 2 REF: 061112a2 STA: A2.A.39
TOP: Domain and Range KEY: real domain

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

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

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

PTS: 2 REF: fall0929a2 STA: A2.A.49 TOP: Writing Equations of Circles

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

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

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

PTS: 2 REF: fall0920a2 STA: A2.A.17 TOP: Complex Fractions
279 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

280 ANS:

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

PTS: 2 REF: fall0931a2 STA: A2.M.2 TOP: Radian Measure

281 ANS: 1 PTS: 2 REF: 011117a2 STA: A2.S.9 TOP: Differentiating Permutations and Combinations

282 ANS: 2 The roots are \(-1, 2, 3\).

PTS: 2 REF: 081023a2 STA: A2.A.50 TOP: Solving Polynomial Equations

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

284 ANS:
\[K = absinC = 24 \cdot 30\sin 57 \approx 604\]

PTS: 2 REF: 061034a2 STA: A2.A.74 TOP: Using Trigonometry to Find Area

285 ANS: 1
\[-420 \left(\frac{\pi}{180}\right) = -\frac{7\pi}{3}\]

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

286 ANS: 2 PTS: 2 REF: 081024a2 STA: A2.N.8 TOP: Conjugates of Complex Numbers

287 ANS: 3 Cofunctions tangent and cotangent are complementary

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

288 ANS: 3
\[a_n = 5(-2)^n - 1\]
\[a_{15} = 5(-2)^{15}-1 = 81,920\]

PTS: 2 REF: 011105a2 STA: A2.A.32 TOP: Sequences

289 ANS: 4 PTS: 2 REF: 081005a2 STA: A2.A.60 TOP: Unit Circle
290 ANS: 3 PTS: 2 REF: 011119a2 STA: A2.A.52
TOP: Families of Functions

291 ANS: 4 PTS: 2 REF: fall0925a2 STA: A2.S.10
TOP: Permutations

292 ANS:
\[6y^3 - \frac{37}{10} y^2 - \frac{1}{5} y \cdot \left( \frac{1}{2} y^2 - \frac{3}{5} y \right) \left( 12y + \frac{3}{5} \right) = 6y^3 + \frac{3}{10} y^2 - 4y^2 - \frac{1}{5} y = 6y^3 - \frac{37}{10} y^2 - \frac{1}{5} y\]

PTS: 2 REF: 061128a2 STA: A2.N.3 TOP: Operations with Polynomials

293 ANS:
\[0.167 \cdot \binom{10}{8} \cdot 0.6^8 \cdot 0.4^2 + \binom{10}{9} \cdot 0.6^9 \cdot 0.4^1 + \binom{10}{10} \cdot 0.6^{10} \cdot 0.4^0 = 0.167\]

KEY: at least or at most

294 ANS: 1
\[\binom{5}{3} (3x)^3 (-2)^3 = 10 \cdot 9x^2 \cdot -8 = -720x^2\]

PTS: 2 REF: fall0919a2 STA: A2.A.36 TOP: Binomial Expansions

295 ANS: 2

\[
\frac{\pi}{3} + \frac{\pi}{2} = \frac{2\pi}{3} = \frac{1}{3}
\]

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

296 ANS: 4
\[2 \log_4 (5x) = 3\]
\[\log_4 (5x) = \frac{3}{2}\]
\[5x = 4^{\frac{3}{2}}\]
\[5x = 8\]
\[x = \frac{8}{5}\]

PTS: 2 REF: fall0921a2 STA: A2.A.28 TOP: Logarithmic Equations
KEY: advanced

297 ANS: 4 PTS: 2 REF: 061120a2 STA: A2.A.19
TOP: Properties of Logarithms
KEY: splitting logs
\[
\frac{\sin^2 A}{\cos^2 A} + \frac{\cos^2 A}{\cos^2 A} = \frac{1}{\cos^2 A} + 1 = \sec^2 A
\]

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

\[
e^{\ln 2} = e^{\ln 2^3} = e^{\ln 8} = 8
\]

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

\[
n_n = x + 2n
\]

\[
10 = x + 2(1)
\]

\[
8 = x
\]

\[
\left(\frac{2}{3}\right)^2 + \cos^2 A = 1 \quad \sin 2A = 2 \sin A \cos A
\]

\[
\cos^2 A = \frac{5}{9} \quad = 2\left(\frac{2}{3}\right)\left(\frac{\sqrt{5}}{3}\right)
\]

\[
\cos A = +\frac{\sqrt{5}}{3}, \sin A \text{ is acute.} \quad = \frac{4\sqrt{5}}{9}
\]

\[
\text{KEY: evaluating}
\]
\[ 4ab\sqrt{2b} - 3a\sqrt{9b^2} \sqrt{2b} + 7ab\sqrt{6b} = 4ab\sqrt{2b} - 9ab\sqrt{2b} + 7ab\sqrt{6b} = -5ab\sqrt{2b} + 7ab\sqrt{6b} \]

**PTS:** 2  
**REF:** fall0918a2  
**STA:** A2.A.14  
**TOP:** Operations with Radicals  
**KEY:** with variables | index = 2

\[ 7^2 = 3^2 + 5^2 - 2(3)(5)\cos A \]

\[ 49 = 34 - 30\cos A \]

\[ 15 = -30\cos A \]

\[ -\frac{1}{2} = \cos A \]

\[ 120 = A \]

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

\[ \frac{5(3 + \sqrt{2})}{7} \cdot \frac{5}{3 - \sqrt{2}} \times \frac{3 + \sqrt{2}}{9 - 2} = \frac{5(3 + \sqrt{2})}{7} \]

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

\[ \frac{\sqrt{3} + 5}{\sqrt{3} - 5} \cdot \frac{\sqrt{3} + 5}{\sqrt{3} + 5} = \frac{3 + 5\sqrt{3} + 5\sqrt{3} + 25}{3 - 25} = \frac{28 + 10\sqrt{3}}{-22} = \frac{14 + 5\sqrt{3}}{11} \]

**PTS:** 2  
**REF:** 061012a2  
**STA:** A2.N.5  
**TOP:** Rationalizing Denominators
\[
\binom{51}{243} \cdot \binom{1}{3}^3 \left( \frac{2}{3} \right)^2 = \frac{40}{243}
\]
\[
\binom{51}{243} \cdot \binom{1}{3}^4 \left( \frac{2}{3} \right)^1 = \frac{10}{243}
\]
\[
\binom{51}{243} \cdot \binom{1}{3}^5 \left( \frac{2}{3} \right)^0 = \frac{1}{243}
\]

KEY: at least or at most

315 ANS: 4  PTS: 2  REF: 011124a2  STA: A2.A.18
TOP: Evaluating Logarithmic Expressions

\[
\tan C - 3 = 3 \tan C - 4
\]
\[
1 = \tan C
\]
\[
\tan^{-1} 1 = C
\]
\[
C = 45, 225
\]

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

317 ANS: 4  PTS: 2  REF: 011127a2  STA: A2.S.1
TOP: Analysis of Data

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

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

319 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

320 ANS:
\[
0.468. \binom{2}{3}^6 \left( \frac{1}{3} \right)^2 \approx 0.27313. \binom{2}{3}^7 \left( \frac{1}{3} \right)^1 \approx 0.15607. \binom{2}{3}^8 \left( \frac{1}{3} \right)^0 \approx 0.03902.
\]

KEY: at least or at most
321 ANS: 
\[ y = 2.001x^{2.298}, \quad 1,009. \quad y = 2.001(15)^{2.298} \approx 1009 \]

PTS: 4 \quad REF: fall0938a2 \quad STA: A2.S.7 \quad TOP: Power Regression

322 ANS: 1 \quad PTS: 2 \quad REF: fall0914a2 \quad STA: A2.A.9 
TOP: Negative and Fractional Exponents

323 ANS: 3 
\[ 4x^2 + 4x = 2^{-6}. \quad 2x^2 + 8x = -6 \]
\( (2^2)^{-\frac{1}{2}} \cdot (x) = 2^{-6} \quad 2x^2 + 8x + 6 = 0 \)
\( 2^{2x^2 + 8x} = 2^{-6} \quad x^2 + 4x + 3 = 0 \)
\( x = -3 \quad x = -1 \)

PTS: 2 \quad REF: 061015a2 \quad STA: A2.A.27 \quad TOP: Exponential Equations
KEY: common base shown

324 ANS: 
\[ 2.5 \cdot \frac{180}{\pi} \approx 143.2^\circ \]

PTS: 2 \quad REF: 011129a2 \quad STA: A2.M.2 \quad TOP: Radian Measure
KEY: degrees

325 ANS: 
\[ x = -\frac{1}{3}, -1 \quad \log_{x+3} \frac{x^3 + x - 2}{x} = 2 \]
\[ \frac{x^3 + x - 2}{x} = (x + 3)^2 \]
\[ \frac{x^3 + x - 2}{x} = x^2 + 6x + 9 \]
\[ x^3 + x - 2 = x^3 + 6x^2 + 9x \]
\[ 0 = 6x^2 + 8x + 2 \]
\[ 0 = 3x^2 + 4x + 1 \]
\[ 0 = (3x + 1)(x + 1) \]
\[ x = -\frac{1}{3}, -1 \]

PTS: 6 \quad REF: 081039a2 \quad STA: A2.A.28 \quad TOP: Logarithmic Equations
KEY: basic

326 ANS: 4 \quad PTS: 2 \quad REF: 061026a2 \quad STA: A2.A.29 
TOP: Sequences
327  ANS: $1$
\[
\sqrt[4]{16x^2y^7} = 16^{\frac{1}{4}}x^\frac{2}{4}y^\frac{7}{4} = 2x^\frac{2}{2}y^\frac{7}{4}
\]

PTS: 2  REF: 061107a2  STA: A2.A.11  TOP: Radicals as Fractional Exponents

328  ANS:
\[
\frac{12x^2}{y^9} \cdot \frac{3x^{-4}y^{5}}{(2x^3y^{-7})^{-2}} = \frac{3y^5(2x^3y^{-7})^2}{x^4} = \frac{3y^5(4x^6y^{-14})}{x^4} = \frac{12x^6y^{-9}}{y^9} = \frac{12x^2}{y^9}
\]

PTS: 2  REF: 061134a2  STA: A2.A.9  TOP: Negative Exponents

329  ANS:
\[
\begin{array}{c}
\text{2,298.65.}
\end{array}
\]

PTS: 2  REF: fall0932a2  STA: A2.A.12  TOP: Evaluating Exponential Expressions

330  ANS:
\[
12t^8 - 75t^4 = 3t^4(4t^4 - 25) = 3t^4(2t^2 + 5)(2t^2 - 5)
\]

PTS: 2  REF: 061133a2  STA: A2.A.7  TOP: Factoring the Difference of Perfect Squares  KEY: binomial

331  ANS: $1$

PTS: 2  REF: 081022a2  STA: A2.A.46  TOP: Transformations with Functions and Relations

332  ANS:
\[
3 \pm \sqrt{7}.
\]
\[
2x^2 - 12x + 4 = 0
\]
\[
x^2 - 6x + 2 = 0
\]
\[
x^2 - 6x = -2
\]
\[
x^2 - 6x + 9 = -2 + 9
\]
\[
(x - 3)^2 = 7
\]
\[
x - 3 = \pm \sqrt{7}
\]
\[
x = 3 \pm \sqrt{7}
\]

PTS: 4  REF: fall0936a2  STA: A2.A.24  TOP: Completing the Square

333  ANS:
\[-3, -5, -8, -12\]

PTS: 2  REF: fall0934a2  STA: A2.A.33  TOP: Recursive Sequences
334 ANS: 3
\[ f(4) = \frac{1}{2} (4) - 3 = -1 \quad g(-1) = 2(-1) + 5 = 3 \]

PTS: 2 REF: fall0902a2 STA: A2.A.42 TOP: Compositions of Functions
KEY: numbers

335 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

336 ANS: 3
\[
75000 = 25000e^{0.0475 t} \\
3 = e^{0.0475 t} \\
\ln 3 = \ln e^{0.0475 t} \\
\frac{\ln 3}{0.0475} = \frac{0.0475 t \cdot \ln e}{0.0475} \\
23.1 \approx t
\]

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

337 ANS:
\[
\binom{3}{2} \cdot \binom{20}{2} = 41040
\]

PTS: 2 REF: fall0935a2 STA: A2.S.12 TOP: Sample Space

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

PTS: 2 REF: fall0909a2 STA: A2.A.18 TOP: Evaluating Logarithmic Expressions
339 ANS: 1

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

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

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

\[ \theta = 60, 240 \]

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

KEY: basic

340 ANS:

7. \( f(-3) = (-3)^2 - 6 = 3. \) \( g(x) = 2^3 - 1 = 7. \)

PTS: 2  REF: 061135a2  STA: A2.A.42  TOP: Compositions of Functions

KEY: numbers

341 ANS: 2

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

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

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

\[ 4x + 10 = 9x \]

\[ 10 = 5x \]

\[ 2 = x \]

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

KEY: common base not shown

342 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

343 ANS: 3

\[ \frac{59.2}{\sin 74} = \frac{60.3}{\sin C} \]

\[ 180 - 78.3 = 101.7 \]

\[ C \approx 78.3 \]

PTS: 2  REF: 081006a2  STA: A2.A.75  TOP: Law of Sines - The Ambiguous Case
ANS: 3

\[ K = (10)(18) \sin 46 \approx 129 \]

PTS: 2  REF: 081021a2  STA: A2.A.74  TOP: Using Trigonometry to Find Area
KEY: parallelograms

ANS: 3  PTS: 2  REF: 061127a2  STA: A2.S.6
TOP: Regression

ANS: 3  PTS: 2  REF: 081027a2  STA: A2.A.44
TOP: Inverse of Functions  KEY: equations

ANS: 2

\[ 15C_8 = 6,435 \]

PTS: 2  REF: 081012a2  STA: A2.S.11  TOP: Combinations

ANS:

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

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

ANS: 1

The binomials are conjugates, so use FL.

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

ANS: 2

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


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

ANS: 2

PTS: 2  REF: 061108a2  STA: A2.A.52
TOP: Identifying the Equation of a Graph

ANS: 4

Students entering the library are more likely to spend more time studying, creating bias.

PTS: 2  REF: fall0904a2  STA: A2.S.2  TOP: Analysis of Data

ANS:

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

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

ANS: 4  PTS: 2  REF: 011101a2  STA: A2.A.38
TOP: Defining Functions  KEY: graphs
356 ANS: 2  PTS: 2  REF: 061021a2  STA: A2.S.8
TOP: Correlation Coefficient

357 ANS: 1  PTS: 2  REF: 061019a2  STA: A2.N.7
TOP: Imaginary Numbers

358 ANS:

\[
\begin{align*}
y &= 0
\end{align*}
\]

359 ANS: 2  PTS: 2  REF: 061031a2  STA: A2.A.53  TOP: Graphing Exponential Functions
\[
\begin{align*}
x^2 + 2 &= 6x \\
x^2 - 6x &= -2 \\
x^2 - 6x + 9 &= -2 + 9 \\
(x - 3)^2 &= 7
\end{align*}
\]

360 ANS: 2  PTS: 2  REF: 011116a2  STA: A2.A.24  TOP: Completing the Square
\[
\begin{align*}
\frac{10}{\sin 35} &= \frac{13}{\sin B} \\
35 + 48 &< 180 \\
B &\approx 48, 132 \\
35 + 132 &< 180
\end{align*}
\]

\[
\begin{align*}
\frac{2}{5} &= \frac{1}{2^5} = \frac{1}{5\sqrt{x^2}}
\end{align*}
\]

361 ANS: 4  PTS: 2  REF: 011118a2  STA: A2.A.10  TOP: Fractional Exponents as Radicals
27r^{4−1} = 64
r^3 = \frac{64}{27}
\[ r = \frac{4}{3} \]

PTS: 2  REF: 081025a2  STA: A2.A.31  TOP: Sequences

6x − 7 ≤ 5  6x − 7 ≥ −5
6x ≤ 12  6x ≥ 2
\[ x ≤ 2 \quad \text{and} \quad x ≥ \frac{1}{3} \]

PTS: 2  REF: fall0905a2  STA: A2.A.1  TOP: Absolute Value Inequalities

\[
\pm \frac{3}{2} − \frac{1}{2}, \quad 8x^3 + 4x^2 − 18x − 9 = 0
\]
\[ 4x^2(2x + 1) − 9(2x + 1) = 0 \]
\[ (4x^2 − 9)(2x + 1) = 0 \]
\[ 4x^2 − 9 = 0 \text{ or } 2x + 1 = 0 \]
\[ (2x + 3)(2x − 3) = 0 \quad x = −\frac{1}{2} \]
\[ x = ±\frac{3}{2} \]

PTS: 4  REF: fall0937a2  STA: A2.A.26  TOP: Solving Polynomial Equations

\[
\frac{1}{d} + \frac{3}{2d} = \frac{d − 8}{2d} \times \frac{2d + 3d}{2d^2} = \frac{d − 8}{5}
\]

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

\[
\frac{9P_9}{4! \cdot 2! \cdot 2!} = \frac{362,880}{96} = 3,780 \quad \text{VERMONT: } P_7 = 5,040
\]

PTS: 4  REF: 061038a2  STA: A2.S.10  TOP: Permutations
367 ANS: 3

![I-Var Stats L1, L2](image)

\( 6x^2 \) 67.31102041

PTS: 2 REF: fall0924a2 STA: A2.S.4 TOP: Dispersion
KEY: range, quartiles, interquartile range, variance

368 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

369 ANS: 2 PTS: 2 REF: 081010a2 STA: A2.A.55
TOP: Trigonometric Ratios

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

PTS: 2 REF: 081019a2 STA: A2.A.15 TOP: Rationalizing Denominators
KEY: index = 2

371 ANS: 3

![Graphing Trigonometric Functions](image)

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

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

PTS: 2 REF: 081018a2 STA: A2.A.9 TOP: Negative Exponents

373 ANS:
\[
32x^5 - 80x^4 + 80x^3 - 40x^2 + 10x - 1. \ C_0(2x)^5(-1)^0 = 32x^5. \ C_1(2x)^4(-1)^1 = -80x^4. \ C_2(2x)^3(-1)^2 = 80x^3.
\]
\[
C_3(2x)^2(-1)^3 = -40x^2. \ C_4(2x)^1(-1)^4 = 10x. \ C_5(2x)^0(-1)^5 = -1
\]

PTS: 4 REF: 011136a2 STA: A2.A.36 TOP: Binomial Expansions
\[
\frac{-7 \pm \sqrt{7^2 - 4(2)(-3)}}{2(2)} = \frac{-7 \pm \sqrt{73}}{4}
\]

PTS: 2  REF: 081009a2  STA: A2.A.25  TOP: Quadratic Formula

375 ANS: 2  PTS: 2  REF: 011126a2  STA: A2.A.49
TOP: Equations of Circles

376 ANS:

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

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

377 ANS:

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

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

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

379 ANS: 2  PTS: 2  REF: 061011a2  STA: A2.A.10
TOP: Fractional Exponents as Radicals

\[f^{-1}(x) = \log_4 x\]

PTS: 2  REF: fall0916a2  STA: A2.A.54  TOP: Graphing Logarithmic Functions

380 ANS:

\[
10ax^2 - 23ax - 5a = a(10x^2 - 23x - 5) = a(5x + 1)(2x - 5)
\]

PTS: 2  REF: 081028a2  STA: A2.A.7  TOP: Factoring Polynomials
KEY: multiple variables
\[ \frac{11\pi}{12} \cdot \frac{180}{\pi} = 165 \]

PTS: 2  
REF: 061002a2  
STA: A2.M.2  
TOP: Radian Measure  
KEY: degrees

383  
\[ 2i^2 + 3i^3 = 2(-1) + 3(-i) = -2 - 3i \]

PTS: 2  
REF: 081004a2  
STA: A2.N.7  
TOP: Imaginary Numbers

384  
\[ \begin{align*}
\text{Plate 1} & \quad \text{Plate 2} \\
\text{Plate 3} & \quad \text{Plate 4}
\end{align*} \]

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

\[ \cos(-305^\circ + 360^\circ) = \cos(55^\circ) \]

PTS: 2  
REF: 061104a2  
STA: A2.A.57  
TOP: Reference Angles

386  
\[ \frac{4}{5 - \sqrt{13}} \cdot \frac{5 + \sqrt{13}}{5 + \sqrt{13}} = \frac{4(5 + \sqrt{13})}{25 - 13} = \frac{5 + \sqrt{13}}{3} \]

PTS: 2  
REF: 061116a2  
STA: A2.N.5  
TOP: Rationalizing Denominators

\[ 2 \times 12 = 24 \]

PTS: 2  
REF: fall0911a2  
STA: A2.N.10  
TOP: Sigma Notation  
KEY: basic

389  
\[ 2 \times 12 = 24 \]

PTS: 2  
REF: 061114a2  
STA: A2.A.38  
TOP: Defining Functions  
KEY: graphs

390  
\[ \frac{2\pi}{b} = \frac{2\pi}{\frac{1}{3}} = 6\pi \]

PTS: 2  
REF: 061027a2  
STA: A2.A.69  
TOP: Properties of Graphs of Trigonometric Functions  
KEY: period