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 indispensable 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 graph best represents the inequality \( y + 6 \geq x^2 - x ? \)

1) 

2) 

3) 

4) 

2 Which graph does *not* represent a function?

1) 

2) 

3) 

4) 

3 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.
4 Which graph represents a one-to-one function?

1)  

2)  

3)  

4)  

5 What is the fourth term in the expansion of 

\((3x - 2)^5\)?

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

6 A population of rabbits doubles every 60 days according to the formula 

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

where \(P\) is the population of rabbits on day \(t\). What is the value of \(t\) when the population is 320?

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

7 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

8 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

9 Which function is one-to-one?

1) \(k(x) = x^2 + 2\)
2) \(g(x) = x^3 + 2\)
3) \(f(x) = |x| + 2\)
4) \(j(x) = x^4 + 2\)
10  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) \( \{-2,0,3\} \)

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

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

1) \( (-\infty, \infty) \)
2) \( (2, \infty) \)
3) \( [2, \infty) \)
4) \( [3, \infty) \)

13  The sides of a parallelogram measure 10 cm and 18 cm. One angle of the parallelogram measures 46 degrees. What is the area of the parallelogram, to the nearest square centimeter?

1) 65
2) 125
3) 129
4) 162

14  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

15  Given \( \triangle ABC \) with \( a = 9 \), \( b = 10 \), and \( \angle B = 70 \), 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
16. 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) \((x^2 - 4)(x - 3)\)

17. What is the principal value of \( \cos^{-1}\left(\frac{-\sqrt{3}}{2}\right) \)?
1) \(-30^\circ\)
2) \(60^\circ\)
3) \(150^\circ\)
4) \(240^\circ\)

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

19. 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) \(\log \frac{2xz}{3y}\)

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

21. 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

22. 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
23 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) $0.92$

24 Which graph represents the equation $y = \cos^{-1} x$?

25 Which graph represents a relation that is not a function?
26 What is the period of the function

\[ y = \frac{1}{2} \sin \left( \frac{x}{3} - \pi \right) \text{?} \]

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

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

\[ \text{Lin Reg} \]
\[ y = a + bx \]
\[ a = 59.026 \]
\[ b = 6.767 \]
1) \( \hat{r} = .8643 \)

\[ \text{Lin Reg} \]
\[ y = a + bx \]
\[ a = .7 \]
\[ b = 24.2 \]
2) \( \hat{r} = .8361 \)

\[ \text{Lin Reg} \]
\[ y = a + bx \]
\[ a = 2.45 \]
\[ b = .95 \]
3) \( \hat{r} = .6022 \)

\[ \text{Lin Reg} \]
\[ y = a + bx \]
\[ a = -2.9 \]
\[ b = 24.1 \]
4) \( \hat{r} = -.8924 \)

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

1) 1188
2) 1197
3) 1254
4) 1292

29 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) \( -\frac{4\sqrt{5}}{9} \)

30 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) \( 2x^2 - 6x + 4 = 0 \)

31 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
32. What is the domain of the function shown below?

![Graph of a function]

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

33. When $x^{-1} - 1$ is divided by $x - 1$, the quotient is

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

34. The expression $\log_3 \left( \frac{1}{25} \right)$ is equivalent to

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

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

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

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

37. Written in simplest form, the expression $\frac{x - 1}{2x + 4}$ is equivalent to

1) $x - 1$
2) $x - 2$
3) $\frac{x - 2}{2}$
4) $\frac{x^2 - 4}{x + 2}$
38 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) $\{60^\circ, 300^\circ\}$

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

40 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) $\{y | y \in \text{real numbers}\}$

41 What is the middle term in the expansion of $\left( \frac{x}{2} - 2y \right)^6$?
1) $20x^3y^3$
2) $-15 \frac{x^4y^2}{4}$
3) $-20x^3y^3$
4) $15 \frac{x^4y^2}{4}$

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

![Diagram of right triangle JTM]

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

43 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) $20P_3$

44 In $\triangle ABC$, $a = 3$, $b = 5$, and $c = 7$. What is $m\angle C$?
1) $22$
2) $38$
3) $60$
4) $120$
45 What is the solution set of the equation $|4a + 6| - 4a = -10$?
1) $\emptyset$
2) $\{0\}$
3) $\left\{ \frac{1}{2} \right\}$
4) $\left\{ 0, \frac{1}{2} \right\}$

46 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) $1.503$

47 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) $4x^2 - 9x - 3 = 0$

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

49 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) $(x - 6)^2 = 34$

50 The solution set of $\sqrt{3x + 16} = x + 2$ is
1) $\{-3, 4\}$
2) $\{-4, 3\}$
3) $\{3\}$
4) $\{-4\}$
51 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

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

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

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

55 What is a formula for the \( n \)th term of sequence \( B \) shown below?
\( B = 10, 12, 14, 16, . . . \)
1) \( b_n = 8 + 2n \)
2) \( b_n = 10 + 2n \)
3) \( b_n = 10(2)^n \)
4) \( b_n = 10(2)^{n-1} \)

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

57 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
58. 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

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

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

61. 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

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

63. 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) \( \log 6 + 2 \log a \)

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

65. 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) \( 4x^2 + 3x - 2 = 0 \)
66 The value of the expression \(2 \sum_{n=0}^{2} (n^2 + 2^n)\) is
1) 12
2) 22
3) 24
4) 26

67 Which equation is represented by the graph below?

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

68 When simplified, the expression \(\frac{w^{-5}}{w^{-9}}^{\frac{1}{2}}\) is equivalent to
1) \(w^{-7}\)
2) \(w^2\)
3) \(w^7\)
4) \(w^{14}\)

69 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

70 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) \((-6, -3)\)

71 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

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

Which graph represents the function \(f(x + 2)\)?
73 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

74 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

75 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

76 When \( x^{-1} + 1 \) is divided by \( x + 1 \), the quotient equals
1) 1
2) \( \frac{1}{x} \)
3) \( x \)
4) \( \frac{1}{x} \)
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77 The expression \( \log_8 64 \) is equivalent to
1) 8
2) 2
3) \( \frac{1}{2} \)
4) \( \frac{1}{8} \)

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

79 Three marbles are to be drawn at random, without replacement, from a bag containing 15 red marbles, 10 blue marbles, and 5 white marbles. Which expression can be used to calculate the probability of drawing 2 red marbles and 1 white marble from the bag?
1) \(\frac{15 \cdot \binom{2}{2} \cdot \binom{5}{1}}{\binom{30}{3}}\)
2) \(\frac{15 \cdot \binom{2}{2} \cdot \binom{5}{1}}{\binom{30}{3}}\)
3) \(\frac{15 \cdot \binom{2}{2} \cdot \binom{5}{1}}{\binom{30}{3}}\)
4) \(\frac{15 \cdot \binom{2}{2} \cdot \binom{5}{1}}{\binom{30}{3}}\)

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

81 What is the range of \( f(x) = (x + 4)^2 + 7 \)?
1) \( y \geq -4 \)
2) \( y \geq 4 \)
3) \( y = 7 \)
4) \( y \geq 7 \)
82 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

83 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) $\frac{37}{3}$

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

1) −38
2) −12
3) 26
4) 62
85 Which graph represents the function \( \log_2 x = y \)?

1) 

2) 

3) 

4) 

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

1) 

2) 

3) 

4)
87 The table below shows the first-quarter averages for Mr. Harper’s statistics class.

<table>
<thead>
<tr>
<th>Quarter Averages</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>99</td>
<td>1</td>
</tr>
<tr>
<td>97</td>
<td>5</td>
</tr>
<tr>
<td>95</td>
<td>4</td>
</tr>
<tr>
<td>92</td>
<td>4</td>
</tr>
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<td>90</td>
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<td>75</td>
<td>1</td>
</tr>
<tr>
<td>70</td>
<td>2</td>
</tr>
<tr>
<td>65</td>
<td>1</td>
</tr>
</tbody>
</table>

What is the population variance for this set of data?
1) 8.2
2) 8.3
3) 67.3
4) 69.3

88 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%

89 Expressed as a function of a positive acute angle, \( \cos(-30^\circ) \) is equal to
1) \(-\cos 55^\circ\)
2) \(\cos 55^\circ\)
3) \(-\sin 55^\circ\)
4) \(\sin 55^\circ\)

90 In which graph is \( \theta \) coterminal with an angle of \(-70^\circ\)?
1)
2)
3)
4)
91 If \(a = 3\) and \(b = -2\), what is the value of the expression \(\frac{a^2}{b^3}\)?

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

92 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

93 The value of \(\tan 126^\circ 43'\) to the nearest ten-thousandth is

1) \(-1.3407\)
2) \(-1.3408\)
3) \(-1.3548\)
4) \(-1.3549\)

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

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

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

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

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

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

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

98 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) \(16384\sqrt{10}\)
99 The expression \((3 - 7i)^2\) is equivalent to
1) \(-40 + 0i\)
2) \(-40 - 42i\)
3) \(58 + 0i\)
4) \(58 - 42i\)

100 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) \(2x^4y^2\)

101 If \(\log_{b}x = 3 \log_{b}p - \left(2 \log_{b}t + \frac{1}{2} \log_{b}r\right)\), then the value of \(x\) is
1) \(\frac{p^3}{\sqrt{t^2r}}\)
2) \(p^3t^2\)
3) \(\frac{p^3r}{\sqrt{t}}\)
4) \(\frac{p^3}{t^2\sqrt{r}}\)

102 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) \{\((0,1), (1,0), (2,0), (3,2)\}\)

103 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

104 What is the value of \(x\) in the equation \(\log_{5}x = 4\)?
1) 1.16
2) 20
3) 625
4) 1,024

105 The value of \(x\) in the equation \(4^{2x + 5} = 8^{3x}\) is
1) 1
2) 2
3) 5
4) \(-10\)

106 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) \(\frac{4}{3}\)
107 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?

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

109 If $\angle A$ is acute and $\tan A = \frac{2}{3}$, then
1) $\cot A = \frac{2}{3}$
2) $\cot A = \frac{1}{3}$
3) $\cot(90^\circ - A) = \frac{2}{3}$
4) $\cot(90^\circ - A) = \frac{1}{3}$

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

111 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 $g(x) = \frac{1}{2}x + 4$
112 Which is a graph of $y = \cot x$?

1) 

2) 

3) 

4) 

114 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

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

1) 

2) 

3) 

4) 

116 Which values of $x$ are in the solution set of the following system of equations?

$y = 3x - 6$
$y = x^2 - x - 6$

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

117 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) $\left\{x \mid -\frac{\pi}{2} < x < \frac{\pi}{2}\right\}$
4) $\left\{x \mid -\frac{3\pi}{2} < x < \frac{3\pi}{2}\right\}$
118. 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) $\frac{4(5 + \sqrt{13})}{38}$

119. Which ratio represents $\csc A$ in the diagram below?

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

120. 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

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

122. 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) $3\sin^2 x$

123. 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) $\frac{8!}{2! \cdot 2!}$
124 What is the solution of the equation $2 \log_4(5x) = 3$?

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

126 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) $2\pi$

125 Which equation is represented by the graph below?

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

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

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

129 What are the values of $\theta$ in the interval $0^\circ \leq \theta < 360^\circ$ that satisfy the equation $\tan \theta = \sqrt{3}$?

1) $60^\circ$, $240^\circ$
2) $72^\circ$, $252^\circ$
3) $72^\circ$, $108^\circ$, $252^\circ$, $288^\circ$
4) $60^\circ$, $120^\circ$, $240^\circ$, $300^\circ$
130 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

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

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

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

133 Which expression is equivalent to $\frac{x^{-1}y^{4}}{3x^{-5}y^{-1}}$?

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

134 If $r = \frac{\sqrt{A^2 + B}}{C}$, then log $r$ can be represented by
1) $\frac{1}{6} \log A + \frac{1}{3} \log B - \log C$
2) $3(\log A^2 + \log B - \log C)$
3) $\frac{1}{3} \log (A^2 + B) - C$
4) $\frac{2}{3} \log A + \frac{1}{3} \log B - \frac{1}{3} \log C$
135 The solution set of the equation $\sqrt{x + 3} = 3 - x$ is
1) $\{1\}$
2) $\{0\}$
3) $\{1, 6\}$
4) $\{2, 3\}$

136 Which graph does not represent a function?

1) 
2) 
3) 
4) 

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

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

139 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) $-\frac{63}{65}$
140 What is the common difference of the arithmetic sequence 5, 8, 11, 14?
1) 8
2) -3
3) 3
4) 9

141 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) \( \csc^2 \theta \)

142 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

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

144 Which graph shows \( y = \cos^{-1} x \)?
1) 
2) 
3) 
4) 

26
145 The expression $\sqrt[3]{64a^{16}}$ is equivalent to
1) $8a^4$
2) $8a^8$
3) $4a^5\sqrt[3]{a}$
4) $4a^3\sqrt[3]{a^5}$

146 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) $y = -3 \cos \left( \frac{\pi}{15}x \right) + 5$

147 In $\triangle ABC$, m$\angle A = 74, a = 59.2,$ and $c = 60.3$. What are the two possible values for m$\angle C,$ to the nearest tenth?
1) 73.7 and 106.3
2) 73.7 and 163.7
3) 78.3 and 101.7
4) 78.3 and 168.3

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

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

150 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
151 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) \(f(x) = \log_2(x)\)

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

153 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) \(\frac{4}{5}x\)

154 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

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

156 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 \((e, 1)\).
157 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

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

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

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

160 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

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

162 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) \( \frac{7\pi}{6} \)
163 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) 2π
2) 2
3) 8π
4) 8

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

165 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) \( \cos x + \sin x \)

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

167 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) \( a^{-2} b^{-1} \)

168 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) \( 17 = \frac{446 + 16x}{26 + x} \)

169 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
170 The expression $2i^2 + 3i^3$ is equivalent to
1) $-2 - 3i$
2) $2 - 3i$
3) $-2 + 3i$
4) $2 + 3i$

171 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

172 What is the radian measure of an angle whose measure is $-420^\circ$?
1) $\frac{7\pi}{3}$
2) $\frac{7\pi}{6}$
3) $\frac{7\pi}{6}$
4) $\frac{7\pi}{3}$

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

174 Which equation is sketched in the diagram below?
1) $y = \csc x$
2) $y = \sec x$
3) $y = \cot x$
4) $y = \tan x$

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

176 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) $x^2 - x - 3$
177 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) \(3\pi\)

178 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) \(2\sqrt{x + 2}\)

179 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) \(4\)

180 The value of \(\csc 138^\circ 23'\) rounded to four decimal places is

1) \(-1.3376\)  
2) \(-1.3408\)  
3) \(1.5012\)  
4) \(1.5057\)

181 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) \(\{x | x < -5 \text{ or } x > 2\}\)

182 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) \(33^\circ 56'\)
183 Which graph represents one complete cycle of the equation \( y = \sin 3\pi x \)?

1) 

2) 

3) 

4) 

184 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) \( -5ab \sqrt{2b} + 7ab \sqrt{6b} \)

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

186 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) \( -\frac{1}{2} - \frac{3}{2}i \)
187 Factored completely, the expression
\[12x^4 + 10x^3 - 12x^2\] is equivalent to
1) \(x^2(4x + 6)(3x - 2)\)
2) \(2(2x^2 + 3x)(3x^2 - 2x)\)
3) \(2x^2(2x - 3)(3x + 2)\)
4) \(2x^2(2x + 3)(3x - 2)\)

188 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

189 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
Algebra 2/Trigonometry 2 Point Regents Exam Questions

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

191 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.

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

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

194 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.

195 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.

196 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.

197 Find the third term in the recursive sequence $a_{k+1} = 2a_k - 1$, where $a_1 = 3$. 
198 Find the sum and product of the roots of the equation $5x^2 + 11x - 3 = 0$.

199 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.

200 The graph below represents the function $y = f(x)$.

State the domain and range of this function.

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

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

![Circle Graph](image)

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

- $a_1 = -3$
- $a_n = a_{n-1} - n$

204 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.
205 The graph of the equation \( y = \left( \frac{1}{2} \right)^x \) has an asymptote. On the grid below, sketch the graph of \( y = \left( \frac{1}{2} \right)^x \) and write the equation of this asymptote.

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

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

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

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

209 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</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature in °F</td>
<td>180.2</td>
<td>165.8</td>
<td>148.3</td>
<td>135.4</td>
<td>127.7</td>
<td>110.5</td>
</tr>
</tbody>
</table>

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

210 A circle shown in the diagram below has a center of \((-5, 3)\) and passes through point \((-1, 7)\).

![Diagram of a circle with center at \((-5, 3)\) and passing through \((-1, 7)\)](image)

Write an equation that represents the circle.

211 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.
212 On the unit circle shown in the diagram below, sketch an angle, in standard position, whose degree measure is 240° and find the exact value of \( \sin 240° \).

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

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

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

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

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

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

219 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.

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

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

222 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%.
223 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.

224 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.

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

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

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

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

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

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

231 Write an equation of the circle shown in the diagram below.
232 Evaluate: \( \sum_{n=1}^{3} (-n^4 - n) \)

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

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

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

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

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

238 Write a quadratic equation such that the sum of its roots is 6 and the product of its roots is -27.

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

240 Express \( \frac{\sqrt{108x^5y^8}}{\sqrt{6x^3y^5}} \) in simplest radical form.

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

242 Express in simplest form: \( \frac{1}{\frac{2}{d} - \frac{4}{3}} \)

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

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

245 Factor completely: \( 10ax^2 - 23ax - 5a \)
Algebra 2/Trigonometry 4 Point Regents Exam Questions

246 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.

25  55  40  65  29
45  59  35  25  37
52  30   8  40  55

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

247 Graph the inequality \(-3|6-x| < -15\) for \(x\). Graph the solution on the line below.

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

249 Express in simplest form:

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

250 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.

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

252 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.

253 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.
254 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.

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

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

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

<table>
<thead>
<tr>
<th>Time ((x)) (in minutes)</th>
<th>1</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Bacteria ((y))</td>
<td>2</td>
<td>25</td>
<td>81</td>
<td>175</td>
<td>310</td>
<td>497</td>
</tr>
</tbody>
</table>

Write a power regression equation for this set of data, rounding all values to three decimal places. Using this equation, predict the bacteria’s growth, to the nearest integer, after 15 minutes.

258 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.

259 The measures of the angles between the resultant and two applied forces are 60° and 45°, and the magnitude of the resultant is 27 pounds. Find, to the nearest pound, the magnitude of each applied force.

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

261 Solve the equation \(8x^3 + 4x^2 - 18x - 9 = 0\) algebraically for all values of \(x\).
262 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.

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

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

265 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.

266 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?
267 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.

268 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 \( T_o \) is the temperature of the room and \( k \) is a constant.

\[
\ln(T - T_o) = -kt + 4.718
\]

A cup of hot chocolate is placed in a room that has a temperature of 68°. After 3 minutes, the temperature of the hot chocolate is 150°. Compute the value of \( k \) to the nearest thousandth. [Only an algebraic solution can receive full credit.] Using this value of \( k \), find the temperature, \( T \), of this cup of hot chocolate if it has been sitting in this room for a total of 10 minutes. Express your answer to the nearest degree. [Only an algebraic solution can receive full credit.]

269 Solve the following systems of equations algebraically:

\[
5 = y - x
\]

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

270 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.

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

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

272 Perform the indicated operations and simplify completely:

\[
\frac{x^3 - 3x^2 + 6x - 18}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} + \frac{x^2 + 2x - 8}{16 - x^2}
\]

273 Solve algebraically for \( x \):

\[
\log_{x+3} \left( \frac{x^3 + x - 2}{x} \right) = 2
\]
Algebra 2/Trigonometry Multiple Choice Regents Exam Questions
Answer Section

1 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

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

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

4 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

5 ANS: 1

\[ s \sum (3x)^2 (-2)^3 = 10 \cdot 9x^2 - 8 = -720x^2 \]

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

6 ANS: 2

\[ 320 = 10(2)^t \]
\[ 32 = (2)^t \]
\[ \log 32 = \log(2)^t \]
\[ \log 32 = t \log 2 \]
\[ \frac{60 \log 32}{\log 2} = t \]
\[ 300 = t \]

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

7 ANS: 4

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

PTS: 2 REF: 081001a2 STA: A2.N.2 TOP: Operations with Radicals
8 \ ANS: 1
\frac{1}{2} (7.4)(3.8) \sin 126 \approx 11.4

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

9 \ ANS: 2 \quad PTS: 2 \quad REF: 061218a2 \quad STA: A2.A.43
TOP: Defining Functions

10 \ ANS: 4 \quad PTS: 2 \quad REF: 061005a2 \quad STA: A2.A.50
TOP: Solving Polynomial Equations

11 \ ANS: 1
\frac{\sqrt{3} + 5}{\sqrt{3} - 5} \cdot \frac{\sqrt{3} + 5}{\sqrt{3} + 5} = \frac{3 + 5\sqrt{3} + 5\sqrt{3} + 25}{3 - 25} = \frac{28 + 10\sqrt{3}}{-22} = \frac{14 + 5\sqrt{3}}{11}

PTS: 2 \quad REF: 061012a2 \quad STA: A2.N.5 \quad TOP: Rationalizing Denominators

12 \ ANS: 3 \quad PTS: 2 \quad REF: fall0923a2 \quad STA: A2.A.39
TOP: Domain and Range \quad KEY: real domain

13 \ ANS: 3
K = (10)(18) \sin 46 \approx 129

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

14 \ ANS: 2
\frac{11\pi}{12} \cdot \frac{180}{\pi} = 165

PTS: 2 \quad REF: 061002a2 \quad STA: A2.M.2 \quad TOP: Radian Measure
KEY: degrees

15 \ ANS: 1
\frac{9}{\sin A} = \frac{10}{\sin 70^\circ} \quad 58^\circ + 70^\circ \ is \ possible. \quad 122^\circ + 70^\circ \ is \ not \ possible.

A = 58

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

16 \ 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 \quad REF: 061214a2 \quad STA: A2.A.7 \quad TOP: Factoring by Grouping

17 \ ANS: 3 \quad PTS: 2 \quad REF: 081007a2 \quad STA: A2.A.64
TOP: Using Inverse Trigonometric Functions \quad KEY: basic
20 \log x - (3 \log y + \log z) = \log x^2 - \log y^3 - \log z = \log \frac{x^2}{y^3z}

\text{TOP: Domain and Range}

\text{TOP: Sigma Notation}

1 \choose 4 = 210

\text{TOP: Combinations}

\text{TOP: Analysis of Data}

\text{TOP: Correlation Coefficient}

\text{TOP: Graphing Trigonometric Functions}

\text{TOP: Defining Functions}

\text{TOP: Summations}

(4) shows the strongest linear relationship, but if r < 0, b < 0.
29 ANS: 3
\[
\left( \frac{2}{3} \right)^2 + \cos^2 A = 1 \quad \sin 2A = 2 \sin A \cos A \\
\cos^2 A = \frac{5}{9} = 2 \left( \frac{2}{3} \right) \left( \frac{\sqrt{5}}{3} \right) \\
\cos A = +\frac{\sqrt{5}}{3}, \sin A \text{ is acute.} = \frac{4\sqrt{5}}{9}
\]

PTS: 2       REF: 011107a2     STA: A2.A.77     TOP: Double Angle Identities
KEY: evaluating

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

PTS: 2       REF: 011121a2     STA: A2.A.21     TOP: Roots of Quadratics
KEY: basic

31 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

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

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

PTS: 2       REF: 081018a2     STA: A2.A.9     TOP: Negative Exponents


35 ANS: 2       PTS: 2       REF: 061011a2     STA: A2.A.10     TOP: Fractional Exponents as Radicals

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

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

37 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
2\cos \theta = 1
\cos \theta = \frac{1}{2}
\theta = \cos^{-1} \frac{1}{2} = 60, 300

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

\text{KEY: basic}

\text{39 ANS: 1}

\cos \left( \text{Ex} \right) = 1.154700538

\text{PTS: 2} \quad \text{REF: 011203a2} \quad \text{STA: A2.A.66} \quad \text{TOP: Determining Trigonometric Functions}

\text{TOP: Domain and Range} \quad \text{KEY: real domain}

\text{41 ANS: 3}

_6C_3 \left( \frac{x}{2} \right)^3 (-2y)^3 = 20 \cdot \frac{x^3}{8} \cdot -8y^3 = -20x^3y^3

\text{PTS: 2} \quad \text{REF: 061215a2} \quad \text{STA: A2.A.36} \quad \text{TOP: Binomial Expansions}

\text{42 ANS: 1}

\sqrt{12^2 - 6^2} = \sqrt{108} = \sqrt{36 \cdot 3} = 6\sqrt{3} \; \cot J = \frac{A}{O} = \frac{6}{6\sqrt{3}} = \frac{\sqrt{3}}{3}

\text{PTS: 2} \quad \text{REF: 011120a2} \quad \text{STA: A2.A.55} \quad \text{TOP: Trigonometric Ratios}

\text{TOP: Differentiating Permutations and Combinations}
44 ANS: 4
\[ 7^2 = 3^2 + 5^2 - 2(3)(5) \cos A \]
\[ 49 = 34 - 30 \cos A \]
\[ 15 = -30 \cos A \]
\[ -\frac{1}{2} = \cos A \]
\[ 120 = \cos A \]

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

45 ANS: 1
\[ 4a + 6 = 4a - 10 \quad 4a + 6 = -4a + 10 \]
\[ 6 \neq -10 \]
\[ 8a = 4 \]
\[ a = \frac{4}{8} = \frac{1}{2} \]

PTS: 2 REF: 011106a2 STA: A2.A.1 TOP: Absolute Value Equations

46 ANS: 1

\[
\begin{align*}
\text{L1} & \quad \text{L2} \\
125 & \quad 125 \\
120 & \quad 120 \\
118 & \quad 118 \\
116 & \quad 116 \\
\text{L3} & \quad 3 \\
\end{align*}
\]

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

47 ANS: 3
\[ \text{sum of the roots, } -\frac{b}{a} = -\frac{-9}{4} = \frac{9}{4} \quad \text{product of the roots, } \frac{c}{a} = \frac{3}{4} \]

PTS: 2 REF: 061208a2 STA: A2.A.21 TOP: Roots of Quadratics
KEY: basic

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

PTS: 2 REF: 061006a2 STA: A2.N.6 TOP: Square Roots of Negative Numbers
49 ANS: 2
\[ x^2 + 2 = 6x \]
\[ x^2 - 6x = -2 \]
\[ x^2 - 6x + 9 = -2 + 9 \]
\[ (x - 3)^2 = 7 \]

PTS: 2 REF: 011116a2 STA: A2.A.24 TOP: Completing the Square

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

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

51 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

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

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

53 ANS: 1
\[ \sqrt[4]{16x^2y^7} = 16 \cdot \frac{1}{4} \cdot x \cdot y^{\frac{7}{4}} = 2x \cdot y^{\frac{7}{4}} \]

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

54 ANS: 2
\[ \frac{10}{\sin 35^\circ} = \frac{13}{\sin B} \]
\[ B \approx 48, 132 \]

PTS: 2 REF: 011113a2 STA: A2.A.75 TOP: Law of Sines - The Ambiguous Case
55 ANS: 1
common difference is 2. \( b_n = x + 2n \)

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

\[ 8 = x \]

PTS: 2 REF: 081014a2 STA: A2.A.29 TOP: Sequences

56 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

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

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

58 ANS: 3
\( 68\% \times 50 = 34 \)

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

59 ANS: 4
\[ \frac{\frac{x}{5}}{\frac{x}{5}} = \frac{1}{\frac{x}{5}} = \frac{1}{\frac{x}{5}} \]

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

60 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

61 ANS: 1
\[ \frac{180}{\pi} = \frac{360}{\pi} \]

PTS: 2 REF: 011220a2 STA: A2.M.2 TOP: Radian Measure
KEY: degrees
ANS: 1
\[6x - 7 \leq 5 \quad 6x - 7 \geq -5\]
\[6x \leq 12 \quad 6x \geq 2\]
\[x \leq 2 \quad x \geq \frac{1}{3}\]

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

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

KEY: splitting logs

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

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

ANS: 3

<table>
<thead>
<tr>
<th>( n )</th>
<th>( n^2 + 2^n )</th>
<th>( 0^2 + 2^0 = 1 )</th>
<th>( 1^2 + 2^2 = 3 )</th>
<th>( 2^2 + 2^2 = 8 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 \times 12 = 24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PTS: 2   REF: fall0911a2   STA: A2.N.10   TOP: Sigma Notation
KEY: basic

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

PTS: 2   REF: 081011a2   STA: A2.A.8   TOP: Negative and Fractional Exponents
69 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

70 ANS: 1  PTS: 2  REF: 081022a2  STA: A2.A.46
TOP: Transformations with Functions and Relations

71 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

72 ANS: 2  PTS: 2  REF: fall0926a2  STA: A2.A.46
TOP: Transformations with Functions and Relations

73 ANS: 1

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

74 ANS: 3
\[ f(4) = \frac{1}{2}(4) - 3 = -1 \]
\[ g(-1) = 2(-1) + 5 = 3 \]

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

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

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

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

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

PTS: 2  REF: fall0909a2  STA: A2.A.18  TOP: Evaluating Logarithmic Expressions
78 ANS: 3 PTS: 2 REF: 061219a2 STA: A2.N.8
TOP: Conjugates of Complex Numbers

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

80 ANS: 4 PTS: 2 REF: 061206a2 STA: A2.A.60
TOP: Unit Circle

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

82 ANS: 1
13^2 = 15^2 + 14^2 - 2(15)(14)\cos C
169 = 421 - 420\cos C
-252 = -420\cos C
252
420 = \cos C
53 \approx C

KEY: find angle

83 ANS: 3
27r^{4-1} = 64
r^3 = \frac{64}{27}

r = \frac{4}{3}

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

84 ANS: 1
\begin{array}{|c|c|c|c|c|}
\hline
n & 3 & 4 & 5 & \Sigma \\
\hline
-3^2 + r & -6 & -12 & -20 & -38 \\
\hline
\end{array}

PTS: 2 REF: 061118a2 STA: A2.N.10 TOP: Sigma Notation
KEY: basic

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

86 ANS: 2
f^{-1}(x) = \log_a x

PTS: 2 REF: fall0916a2 STA: A2.A.54 TOP: Graphing Logarithmic Functions
87 ANS: 3

\[
\Sigma \text{List: L1, L2}
\]
\[
\sigma^2 \approx 67.31102041
\]
PTS: 2 REF: fall0924a2 STA: A2.S.4 TOP: Dispersion
KEY: variance

88 ANS: 3

34.1\% + 19.1\% = 53.2\%

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

89 ANS: 2

\[
\cos(-305^\circ + 360^\circ) = \cos(55^\circ)
\]

PTS: 2 REF: 061104a2 STA: A2.A.57 TOP: Reference Angles

90 ANS: 4

PTS: 2 REF: 081005a2 STA: A2.A.60
TOP: Unit Circle

91 ANS: 3

\[
\frac{3^{-2}}{(-2)^{-3}} = \frac{1}{9} \cdot \frac{1}{-8} = -\frac{1}{9}
\]

PTS: 2 REF: 061003a2 STA: A2.N.1 TOP: Negative and Fractional Exponents

92 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

93 ANS: 2

PTS: 2 REF: 061115a2 STA: A2.A.66 TOP: Determining Trigonometric Functions

94 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
95 ANS: 4
\[
\frac{3 \pm \sqrt{(-3)^2 - 4(1)(-9)}}{2(1)} = \frac{3 \pm \sqrt{45}}{2} = \frac{3 \pm 3\sqrt{5}}{2}
\]

PTS: 2          REF: 061009a2      STA: A2.A.25      TOP: Quadratic Formula

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

PTS: 2          REF: 061015a2      STA: A2.A.27      TOP: Exponential Equations

KEY: common base shown

97 ANS: 3          PTS: 2          REF: fall0910a2      STA: A2.A.76      TOP: Angle Sum and Difference Identities

KEY: simplifying

98 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

99 ANS: 2
\[
(3 - 7i)(3 - 7i) = 9 - 21i - 21i + 49i^2 = 9 - 42i - 49 = -40 - 42i
\]

PTS: 2          REF: fall0901a2      STA: A2.N.9      TOP: Multiplication and Division of Complex Numbers

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

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


KEY: antilogarithms

102 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
103 ANS: 4

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

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

104 ANS: 3

\[x = 5^4 = 625\]

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

KEY: basic

105 ANS: 2

\[4^{2x+5} = 8^{3x}\]
\[
\left(2^2\right)^{2x+5} = \left(2^3\right)^{3x}
\]
\[2^{4x+10} = 2^{9x}\]
\[4x + 10 = 9x\]
\[10 = 5x\]
\[2 = x\]

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

KEY: common base not shown

106 ANS: 4

\[9^{3x+1} = 27^{x+2}\]
\[
\left(3^2\right)^{3x+1} = \left(3^3\right)^{x+2}
\]
\[3^{6x+2} = 3^{3x+6}\]
\[6x + 2 = 3x + 6\]
\[3x = 4\]
\[x = \frac{4}{3}\]

PTS: 2 
REF: 081008a2 STA: A2.A.27 TOP: Exponential Equations

KEY: common base not shown

107 ANS: 3 
PTS: 2

REF: 011119a2 STA: A2.A.52 TOP: Families of Functions
108 ANS: 4
\[
\frac{10}{4} = 2.5
\]

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

109 ANS: 3
Cofunctions tangent and cotangent are complementary

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

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

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

112 ANS: 3

\[
\cos^2 \theta - \cos 2\theta = \cos^2 \theta - (\cos^2 \theta - \sin^2 \theta) = \sin^2 \theta
\]

PTS: 2     REF: 061024a2     STA: A2.A.77     TOP: Double Angle Identities
KEY: simplifying

113 ANS: 1
\[
b^2 - 4ac = 3^2 - 4(9)(-4) = 9 + 144 = 153
\]

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

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

PTS: 2     REF: 061209a2     STA: A2.A.1     TOP: Absolute Value Inequalities
KEY: graph
116 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

117 ANS: 3  PTS: 2  REF: 061022a2  STA: A2.A.63
TOP: Domain and Range

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

PTS: 2  REF: 061116a2  STA: A2.N.5  TOP: Rationalizing Denominators

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

120 ANS: 2
\[ _{15}C_2 = 6,435 \]

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

121 ANS: 4  PTS: 2  REF: 061026a2  STA: A2.A.29
TOP: Sequences

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

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

124 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
125  ANS: 3

126  ANS: 2
\[ \frac{2\pi}{b} = \frac{2\pi}{3} \]

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

128  ANS: 4
\[ 6x - x^3 - x^2 = -x(x^2 + x - 6) = -x(x + 3)(x - 2) \]

129  ANS: 1
\[ \tan \theta - \sqrt{3} = 0 \]
\[ \tan \theta = \sqrt{3} \]
\[ \theta = \tan^{-1} \sqrt{3} \]
\[ \theta = 60, 240 \]

130  ANS: 4
PTS: 2  REF: 061101a2  STA: A2.S.1  TOP: Analysis of Data

131  ANS: 2
PTS: 2  REF: 081003a2  STA: A2.A.51  TOP: Domain and Range
\[
-7 \pm \sqrt{7^2 - 4(2)(-3)} \over 2(2) = -7 \pm \sqrt{73} \over 4
\]

PTS: 2  REF: 081009a2  STA: A2.A.25  TOP: Quadratic Formula

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


136 ANS: 4  PTS: 2  REF: 011101a2  STA: A2.A.38  TOP: Defining Functions  KEY: graphs

137 ANS: 3  PTS: 2  REF: 011110a2  STA: A2.A.30  TOP: Sequences


139 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

140 ANS: 3  PTS: 2  REF: 061001a2  STA: A2.A.30  TOP: Sequences

141 ANS: 3
\[
\frac{\sin^2 \theta + \cos^2 \theta}{1 - \sin^2 \theta} = \frac{1}{\cos^2 \theta} = \sec^2 \theta
\]

PTS: 2  REF: 061123a2  STA: A2.A.58  TOP: Reciprocal Trigonometric Relationships

142 ANS: 3
\[
75000 = 25000e^{0.0475t}
3 = e^{0.0475t}
\ln3 = \ln e^{0.0475t}
\ln3 = 0.0475 \cdot \ln e
0.0475 \approx t
\]

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

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

144 ANS: 3  PTS: 2  REF: 061119a2  STA: A2.A.65  TOP: Graphing Trigonometric Functions
\[ \sqrt[3]{4^3 a^{15}} a = 4a^{3} \sqrt[3]{a} \]

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

\[ \frac{2\pi}{b} = 30 \]
\[ b = \frac{\pi}{15} \]

PTS: 2  
REF: 011227a2  
STA: A2.A.72  
TOP: Identifying the Equation of a Trigonometric Graph

\[ \frac{59.2}{\sin 74} = \frac{60.3}{\sin C} \]
\[ 180 - 78.3 = 101.7 \]
\[ C \approx 78.3 \]

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

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

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

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

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

152 ANS: 2  
sum: \( \frac{-b}{a} = \frac{4}{6} = \frac{2}{3} \);  
product: \( \frac{c}{a} = \frac{-12}{6} = -2 \)

PTS: 2  
REF: 011209a2  
STA: A2.A.20  
TOP: Roots of Quadratics
The binomials are conjugates, so use FL.

\[ S_n = \frac{n}{2} [2a + (n - 1)d] = \frac{21}{2} [2(18) + (21 - 1)2] = 798 \]

\[ x^2 - 2x + y^2 + 6y = -3 \]
\[ x^2 - 2x + 1 + y^2 + 9 = -3 + 1 + 9 \]
\[ (x - 1)^2 + (y + 3)^2 = 7 \]
164 ANS: 4
\[ \binom{5}{3} \left( \frac{5}{8} \right)^2 \left( \frac{3}{8} \right)^1 = \frac{225}{512} \]

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

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

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

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

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

169 ANS: 4
\[ \binom{15}{5} = 3,003. \quad \binom{25}{5} = 53,130. \quad \binom{25}{15} = 3,268,760. \]

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

170 ANS: 1
\[ 2i^2 + 3i^3 = 2(-1) + 3(-i) = -2 - 3i \]

PTS: 2  REF: 081004a2  STA: A2.N.7  TOP: Imaginary Numbers

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

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

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

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

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

PTS: 2  REF: 061213a2  STA: A2.A.22  TOP: Solving Radicals
KEY: extraneous solutions
174 ANS: 1

\[ s = \theta r = \frac{2\pi}{8} \cdot 6 = \frac{3\pi}{2} \]

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

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

176 ANS: 2 PTS: 2 REF: 011114a2 STA: A2.N.3
TOP: Operations with Polynomials

177 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

178 ANS: 4

\[ \frac{2x + 4}{\sqrt{x + 2}} = \frac{\sqrt{x + 2}}{\sqrt{x + 2}} = 2 \]

PTS: 2 REF: 011122a2 STA: A2.A.15 TOP: Rationalizing Denominators
KEY: index = 2

179 ANS: 4

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

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

180 ANS: 4

PTS: 2 REF: 061217a2 STA: A2.A.66 TOP: Determining Trigonometric Functions
\[
x^2 - 3x - 10 > 0 \quad \text{or} \quad (x - 5)(x + 2) > 0 \quad x - 5 < 0 \text{ and } x + 2 < 0
\]
\[
x - 5 > 0 \text{ and } x + 2 > 0 \quad x < 5 \text{ and } x < -2
\]
\[
x > 5 \quad x > -2 \quad x > 2
\]

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

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

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

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

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

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

PTS: 2 REF: 081026a2 STA: A2.A.70 TOP: Graphing Trigonometric Functions
KEY: recognize

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

PTS: 2 REF: fall0918a2 STA: A2.A.14 TOP: Operations with Radicals
KEY: with variables | index = 2
\[
\begin{align*}
\frac{\pi}{3} + \frac{\pi}{3} &= \frac{2\pi}{3} = \frac{1}{3} \\
\end{align*}
\]

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

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

187 ANS: 4  
12x^4 + 10x^3 - 12x^2 = 2x^2(6x^2 + 5x - 6) = 2x^2(2x + 3)(3x - 2)

PTS: 2  
REF: 061008a2  
STA: A2.A.7  
TOP: Factoring Polynomials  
KEY: single variable

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

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

15 = \frac{3}{5}p

25 = p

PTS: 2  
REF: 011226a2  
STA: A2.A.5  
TOP: Inverse Variation
Algebra 2/Trigonometry 2 Point Regents Exam Questions
Answer Section

190 ANS:

\[ y = \frac{1}{x} \]

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

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

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

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

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

KEY: radians

193 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

194 ANS:
7.4

PTS: 2  REF: 061029a2  STA: A2.S.4  TOP: Dispersion

KEY: basic, group frequency distributions
195 ANS: 
\[12 \cdot 6 = 9w\]
\[8 = w\]

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

196 ANS: 
\[
\begin{array}{c}
\binom{9}{2} \times \binom{20}{3} = 41040.
\end{array}
\]

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

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

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

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

PTS: 2 REF: 061030a2 STA: A2.A.20 TOP: Roots of Quadratics

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

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

KEY: percent

200 ANS: 
\[D: -5 \leq x \leq 8. \quad R: -3 \leq y \leq 2\]

PTS: 2 REF: 011132a2 STA: A2.A.51 TOP: Domain and Range

KEY: one variable

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

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

KEY: one variable

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

PTS: 2 REF: fall0929a2 STA: A2.A.49 TOP: Writing Equations of Circles
203 ANS:
-3, -5, -8, -12

PTS: 2 REF: fall0934a2 STA: A2.A.33 TOP: Recursive Sequences

204 ANS:

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

205 ANS:

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

206 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

207 ANS:

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

PTS: 2 REF: 011129a2 STA: A2.M.2 TOP: Radian Measure
KEY: degrees
208 \hspace{1cm} \text{ANS:} \hspace{1cm} \frac{5(3 + \sqrt{2})}{7} \cdot \frac{3 + \sqrt{2}}{3 - \sqrt{2}} = \frac{5(3 + \sqrt{2})}{9 - 2} = \frac{5(3 + \sqrt{2})}{7}

\begin{align*}
\text{PTS: 2} & \quad \text{REF: fall0928a2} \quad \text{STA: A2.N.5} \quad \text{TOP: Rationalizing Denominators} \\
\end{align*}

209 \hspace{1cm} \text{ANS:} \hspace{1cm} y = 180.377(0.954)^x

\begin{align*}
\text{PTS: 2} & \quad \text{REF: 061231a2} \quad \text{STA: A2.S.7} \quad \text{TOP: Exponential Regression} \\
\end{align*}

210 \hspace{1cm} \text{ANS:} \hspace{1cm} (x + 5)^2 + (y - 3)^2 = 32

\begin{align*}
\text{PTS: 2} & \quad \text{REF: 081033a2} \quad \text{STA: A2.A.49} \quad \text{TOP: Writing Equations of Circles} \\
\end{align*}

211 \hspace{1cm} \text{ANS:} \hspace{1cm} K = ab \sin C = 24 \cdot 30 \sin 57 \approx 604

\begin{align*}
\text{PTS: 2} & \quad \text{REF: 061034a2} \quad \text{STA: A2.A.74} \quad \text{TOP: Using Trigonometry to Find Area} \\
\text{KEY: parallelograms} & \\
\end{align*}

212 \hspace{1cm} \text{ANS:}

\begin{align*}
\text{PTS: 2} & \quad \text{REF: 061033a2} \quad \text{STA: A2.A.60} \quad \text{TOP: Unit Circle} \\
\text{KEY: basic} & \\
\end{align*}

213 \hspace{1cm} \text{ANS:} \hspace{1cm} 7. \hspace{1cm} 4 - \sqrt{2x - 5} = 1 \\
\hspace{1cm} -\sqrt{2x - 5} = -3 \\
\hspace{1cm} 2x - 5 = 9 \\
\hspace{1cm} 2x = 14 \\
\hspace{1cm} x = 7

\begin{align*}
\text{PTS: 2} & \quad \text{REF: 011229a2} \quad \text{STA: A2.A.22} \quad \text{TOP: Solving Radicals} \\
\text{KEY: basic} & \\
\end{align*}
214 ANS:
\[
\frac{\sin^2 A}{\cos^2 A} + \frac{\cos^2 A}{\cos^2 A} = \frac{1}{\cos^2 A} \\
\tan^2 A + 1 = \sec^2 A
\]

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

215 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 KEY: binomial TOP: Factoring the Difference of Perfect Squares

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

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

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

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

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

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

219 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
220 ANS: \[
\frac{a^2 b^3}{4}
\]
PTS: 2 REF: 011231a2 STA: A2.A.13 TOP: Simplifying Radicals
KEY: index > 2

221 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

222 ANS:
\[A = 750e^{(0.03)(8)} \approx 953\]
PTS: 2 REF: 061229a2 STA: A2.A.12 TOP: Evaluating Exponential Expressions

223 ANS:
\[y = 10.596(1.586)^x\]
PTS: 2 REF: 081031a2 STA: A2.S.7 TOP: Exponential Regression

224 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

225 ANS:
\[\sum_{n=1}^{15} 7n\]
PTS: 2 REF: 081029a2 STA: A2.A.34 TOP: Sigma Notation

226 ANS:
\[230 - (1^3 - 1) + (2^3 - 1) + (3^3 - 1) + (4^3 - 1) + (5^3 - 1) = 10 + 0 + 7 + 26 + 63 + 124 = 230\]
PTS: 2 REF: 011131a2 STA: A2.N.10 TOP: Sigma Notation
KEY: basic

227 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

228 ANS:
\[5\sqrt{3x^3} - 2\sqrt{27x^3} = 5\sqrt{x^2} \cdot \sqrt{3x} - 2\sqrt{9x^2} \cdot \sqrt{3x} = 5x \sqrt{3x} - 6x \sqrt{3x} = -x \sqrt{3x}\]
PTS: 2 REF: 061032a2 STA: A2.N.2 TOP: Operations with Radicals
229 ANS:
\[2 \tan C - 3 = 3 \tan C - 4 \]
\[1 = \tan C \]
\[\tan^{-1} 1 = C \]
\[C = 45,225\]

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

230 ANS:
\[\frac{12P^{12}_{12}}{3! \cdot 2!} = \frac{479,001,600}{12} = 39,916,800\]

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

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

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

232 ANS:
\[-104\]

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

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

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

234 ANS:
\[\cos \theta \cdot \frac{1}{\cos \theta} = 1 - \cos^2 \theta = \sin^2 \theta\]

PTS: 2 REF: 061230a2 STA: A2.A.58 TOP: Reciprocal Trigonometric Relationships

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

PTS: 2 REF: 081034a2 STA: A2.N.3 TOP: Operations with Polynomials
236 ANS: 
\[ 197^\circ 40' \times \frac{180}{\pi} \approx 197^\circ 40'. \]

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

237 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

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

PTS: 4 REF: 061130a2 STA: A2.A.21 TOP: Roots of Quadratics
KEY: basic

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

PTS: 2 REF: 061131a2 STA: A2.A.12 TOP: Evaluating Exponential Expressions

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

KEY: with variables | index = 2

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

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

242 ANS:
\[ \frac{1}{d} + \frac{4}{2d} = \frac{d - 8}{2d} = \frac{d - 8}{2d} \times \frac{2d}{5d} = \frac{d - 8}{5} \]

PTS: 2 REF: 061035a2 STA: A2.A.17 TOP: Complex Fractions
243 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

244 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

245 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
Algebra 2/Trigonometry 4 Point Regents Exam Questions
Answer Section

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

PTS: 4 \quad \text{REF: 061237a2} \quad \text{STA: A2.S.4} \quad \text{TOP: Dispersion}

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

PTS: 2 \quad \text{REF: 061137a2} \quad \text{STA: A2.A.1} \quad \text{TOP: Absolute Value Inequalities}

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

PTS: 4 \quad \text{REF: 081037a2} \quad \text{STA: A2.A.76} \quad \text{TOP: Angle Sum and Difference Identities}

249 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 \quad \text{REF: 061236a2} \quad \text{STA: A2.A.16} \quad \text{TOP: Multiplication and Division of Rationals}
\[
\begin{align*}
51 C_3 \left(\frac{1}{3}\right)^3 \left(\frac{2}{3}\right)^2 &= \frac{40}{243} \\
5 C_4 \left(\frac{1}{3}\right)^4 \left(\frac{2}{3}\right)^1 &= \frac{10}{243} \\
5 C_5 \left(\frac{1}{3}\right)^5 \left(\frac{2}{3}\right)^0 &= \frac{1}{243}
\end{align*}
\]

250 ANS: 
\[
\begin{align*}
\frac{51}{243}, 5 C_3 \left(\frac{1}{3}\right)^3 \left(\frac{2}{3}\right)^2 &= \frac{40}{243} \\
5 C_4 \left(\frac{1}{3}\right)^4 \left(\frac{2}{3}\right)^1 &= \frac{10}{243} \\
5 C_5 \left(\frac{1}{3}\right)^5 \left(\frac{2}{3}\right)^0 &= \frac{1}{243}
\end{align*}
\]

KEY: at least or at most

251 ANS: 
\[
\begin{align*}
3 \pm \sqrt{7}, 2x^2 - 12x + 4 &= 0 \\
x^2 - 6x + 2 &= 0 \\
x^2 - 6x &= -2 \\
x^2 - 6x + 9 &= -2 + 9 \\
(x - 3)^2 &= 7 \\
x - 3 &= \pm \sqrt{7} \\
x &= 3 \pm \sqrt{7}
\end{align*}
\]

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

252 ANS: 
\[
\begin{align*}
88. \frac{100}{\sin 33} &= \frac{x}{\sin 32} \cdot \sin 66 \approx \frac{T}{97.3} \\
x &\approx 97.3 \\
t &\approx 88
\end{align*}
\]

KEY: advanced

253 ANS: 
\[
\begin{align*}
0.468. 8 C_6 \left(\frac{2}{3}\right)^6 \left(\frac{1}{3}\right)^2 &\approx 0.27313 \\
8 C_7 \left(\frac{2}{3}\right)^7 \left(\frac{1}{3}\right)^1 &\approx 0.15607 \\
8 C_8 \left(\frac{2}{3}\right)^8 \left(\frac{1}{3}\right)^0 &\approx 0.03902
\end{align*}
\]

KEY: at least or at most

254 ANS: 
\[
\begin{align*}
\text{No. TENNESSEE: } \frac{9 P_9}{4! \cdot 2!} &= \frac{362,880}{96} = 3,780. \text{ VERMONT: } 7 P_7 = 5,040
\end{align*}
\]

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

\[ 32x^5 - 80x^4 + 80x^3 - 40x^2 + 10x - 1 = 0 \]

\[ C_0(2x)^5(-1)^0 = 32x^5 \quad C_1(2x)^4(-1)^1 = -80x^4 \quad C_2(2x)^3(-1)^2 = 80x^3 \]

\[ C_3(2x)^2(-1)^3 = -40x^2 \quad C_4(2x)^1(-1)^4 = 10x \quad C_5(2x)^0(-1)^5 = -1 \]

PTS: 4 REF: 011136a2 STA: A2.A.36 TOP: Binomial Expansions

256 ANS:

\[ 800 \cdot 4^{2.5} = 32 \cdot \frac{3}{2} = 125 \quad \frac{x}{y} = \frac{32}{1} = 800 \]

\[ y = 125 \cdot \frac{2}{3} = \frac{1}{25} \]

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

KEY: advanced

257 ANS:

\[ y = 2.001x^{2.298}, 1.009 \quad y = 2.001(15)^{2.298} \approx 1009 \]

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

258 ANS:

\[ 26.2\% \cdot C_8 \cdot 0.65^8 \cdot 0.35^2 + C_9 \cdot 0.65^9 \cdot 0.35^1 + C_{10} \cdot 0.65^{10} \cdot 0.35^0 \approx 0.262 \]

PTS: 4 REF: 081038a2 STA: A2.A.73 TOP: Binomial Probability

KEY: at least or at most

259 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
260 ANS:
\[
\frac{1}{3} \left( \frac{1}{x+3} - \frac{2}{3-x} \right) = \frac{4}{x^2 - 9}
\]
\[
\frac{1}{x+3} + \frac{2}{x-3} = \frac{4}{x^2 - 9}
\]
\[
\frac{x-3+2(x+3)}{(x+3)(x-3)} = \frac{4}{(x+3)(x-3)}
\]
\[
x - 3 + 2x + 6 = 4
\]
\[
3x = 1
\]
\[
x = \frac{1}{3}
\]

PTS: 4 REF: 081036a2 STA: A2.A.23 TOP: Solving Rationals

KEY: rational solutions

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

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

262 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
263 ANS: 
0, 60, 180, 300. 
\[ \sin 2\theta = \sin \theta \]
\[ \sin 2\theta - \sin \theta = 0 \]
\[ 2 \sin \theta \cos \theta - \sin \theta = 0 \]
\[ \sin \theta (2 \cos \theta - 1) = 0 \]
\[ \sin \theta = 0 \quad 2 \cos \theta - 1 = 0 \]
\[ \theta = 0, 180 \quad \cos \theta = \frac{1}{2} \]
\[ \theta = 60, 300 \]

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

264 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

265 ANS: 
\[ \frac{12}{\sin 32} = \frac{10}{\sin B} \]
\[ C \approx 180 - (32 + 26.2) \approx 121.8. \]
\[ \frac{12}{\sin 32} = \frac{c}{\sin 121.8} \]
\[ B = \sin^{-1} \frac{10 \sin 32}{12} \approx 26.2 \]
\[ c = \frac{12 \sin 121.8}{\sin 32} \approx 19.2 \]

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

266 ANS: 
\[ 0.167 \cdot _{10}C_8 \cdot 0.6^8 \cdot 0.4^2 + _{10}C_9 \cdot 0.6^9 \cdot 0.4^1 + _{10}C_{10} \cdot 0.6^{10} \cdot 0.4^0 \approx 0.167 \]

KEY: at least or at most
Algebra 2/Trigonometry 6 Point Regents Exam Questions
Answer Section

267 ANS:

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

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

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

268 ANS:

\[ \ln(T - T_0) = -kt + 4.718 \]
\[ \ln(150 - 68) = -k(3) + 4.718 \]
\[ \ln(T - 68) = 3.678 \]
\[ 4.407 \approx -3k + 4.718 \]
\[ T - 68 \approx 39.6 \]
\[ k \approx 0.104 \]
\[ T \approx 108 \]


269 ANS:

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

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

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

$C \approx 33$


KEY: advanced

271 ANS:

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

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

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

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

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

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

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

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

KEY: common base not shown

272 ANS:

\[ \frac{-2(x^2 + 6)}{x^4} \cdot \frac{x^2(x - 3) + 6(x - 3)}{x^2 - 4x} \cdot \frac{2x - 4}{x^4 - 3x^3} \cdot \frac{x^2 + 2x - 8}{16 - x^2} \]

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

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

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

KEY: division
273 ANS:

\[ x = -\frac{1}{3}, -1 \]

\[ \log_{x+3} \frac{x^3 + x - 2}{x} = 2 \]

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

\[ \frac{x^3 + x - 2}{x} = x^2 + 6x + 9 \]

\[ x^3 + x - 2 = x^3 + 6x^2 + 9x \]

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

\[ 0 = 3x^2 + 4x + 1 \]

\[ 0 = (3x + 1)(x + 1) \]

\[ x = -\frac{1}{3}, -1 \]