1. A solution of the equation $2x^2 + 3x + 2 = 0$ is ___________.

2. The roots of the equation $x^2 + 2x + 5 = 0$ are ___________.

3. A sketch of $r(x)$ is shown below.

![Graph of r(x)](image)

An equation for $r(x)$ could be ___________.

4. If $p(x) = 2x^3 - 3x + 5$, what is the remainder of $p(x) \div (x - 5)$?

5. Which graph represents a cosine function with no horizontal shift, an amplitude of 2, and a period of $\frac{2\pi}{3}$?

6. What is the solution set of the equation

$$\frac{10}{x^2 - 2x} + \frac{4}{x} = \frac{5}{x - 2}$$?

7. Given $c(m) = m^3 - 2m^2 + 4m - 8$, the solution of $c(m) = 0$ is ___________.

8. The Fahrenheit temperature, $F(t)$, of a heated object at time $t$, in minutes, can be modeled by the function below. $F_s$ is the surrounding temperature, $F_0$ is the initial temperature of the object, and $k$ is a constant.

$$F(t) = F_s + (F_0 - F_s)e^{-kt}$$

Coffee at a temperature of 195°F is poured into a container. The room temperature is kept at a constant 68°F and $k = 0.05$. Coffee is safe to drink when its temperature is, at most, 120°F. To the nearest minute, how long will it take until the coffee is safe to drink?

9. At her job, Pat earns $25,000 the first year and receives a raise of $1000 each year. The explicit formula for the $n$th term of this sequence is $a_n = 25,000 + (n - 1)1000$. Which rule best represents the equivalent recursive formula?

10. If $\sin^2(32^\circ) + \cos^2(M) = 1$, then $M$ equals ___________.
11 The populations of two small towns at the beginning of 2018 and their annual population growth rate are shown in the table below.

<table>
<thead>
<tr>
<th>Town</th>
<th>Population</th>
<th>Annual Population Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jonesville</td>
<td>1240</td>
<td>6% increase</td>
</tr>
<tr>
<td>Williamstown</td>
<td>890</td>
<td>11% increase</td>
</tr>
</tbody>
</table>

Assuming the trend continues, approximately how many years after the beginning of 2018 will it take for the populations to be equal?

12 On a given school day, the probability that Nick oversleeps is 48% and the probability he has a pop quiz is 25%. Assuming these two events are independent, what is the probability that Nick oversleeps and has a pop quiz on the same day?

13 The mean intelligence quotient (IQ) score is 100, with a standard deviation of 15, and the scores are normally distributed. Given this information, the approximate percentage of the population with an IQ greater than 130 is closest to

14 The terminal side of $\theta$, an angle in standard position, intersects the unit circle at $P \left(-\frac{1}{3}, \frac{\sqrt{8}}{3}\right)$. What is the value of $\sec \theta$?

15 What is the inverse of the function $y = \log_3 x$?

16 The set of data in the table below shows the results of a survey on the number of messages that people of different ages text on their cell phones each month.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Text Messages per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0–10</td>
</tr>
<tr>
<td>15–18</td>
<td>4</td>
</tr>
<tr>
<td>19–22</td>
<td>6</td>
</tr>
<tr>
<td>23–60</td>
<td>25</td>
</tr>
</tbody>
</table>

If a person from this survey is selected at random, what is the probability that the person texts over 50 messages per month given that the person is between the ages of 23 and 60?

17 What are the zeros of $P(m) = (m^2 - 4)(m^2 + 1)$?

18 In 2013, approximately 1.6 million students took the Critical Reading portion of the SAT exam. The mean score, the modal score, and the standard deviation were calculated to be 496, 430, and 115, respectively. Which interval reflects 95% of the Critical Reading scores?
19 Sodium iodide-131, used to treat certain medical conditions, has a half-life of 1.8 hours. The data table below shows the amount of sodium iodide-131, rounded to the nearest thousandth, as the dose fades over time.

<table>
<thead>
<tr>
<th>Number of Half Lives</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of Sodium Iodide-131</td>
<td>139.000</td>
<td>69.500</td>
<td>34.750</td>
<td>17.375</td>
<td>8.688</td>
</tr>
</tbody>
</table>

What approximate amount of sodium iodide-131 will remain in the body after 18 hours?

20 What is the solution to the system of equations $y = 3x - 2$ and $y = g(x)$ where $g(x)$ is defined by the function below?

\[ y = \begin{cases} 1 & \text{if } x < 0 \\ 2 & \text{if } x \geq 0 \end{cases} \]

21 If $ae^{bt} = c$, where $a$, $b$, and $c$ are positive, then $t$ equals

22 Which equation represents a parabola with a focus of $(-2,5)$ and a directrix of $y = 9$?

![Parabola graph]

23 The half-life of iodine-131 is 8 days. The percent of the isotope left in the body $d$ days after being introduced is $I = 100\left(\frac{1}{2}\right)^{\frac{d}{8}}$. When this equation is written in terms of the number $e$, the base of the natural logarithm, it is equivalent to $I = 100e^{kd}$. What is the approximate value of the constant, $k$?

24 On average, college seniors graduating in 2012 could compute their growing student loan debt using the function $D(t) = 29,400(1.068)^t$, where $t$ is time in years. Which expression is equivalent to $29,400(1.068)^t$ and could be used by students to identify an approximate daily interest rate on their loans?
25 Consider \( f(x) = 4x^2 + 6x - 3 \), and \( p(x) \) defined by the graph below.

\[ \text{The difference between the values of the maximum of } p \text{ and minimum of } f \text{ is} \]

26 Brian deposited 1 cent into an empty non-interest bearing bank account on the first day of the month. He then additionally deposited 3 cents on the second day, 9 cents on the third day, and 27 cents on the fourth day. What would be the total amount of money in the account at the end of the 20th day if the pattern continued?

27 Pedro and Bobby each own an ant farm. Pedro starts with 100 ants and says his farm is growing exponentially at a rate of 15% per month. Bobby starts with 350 ants and says his farm is steadily decreasing by 5 ants per month. Assuming both boys are accurate in describing the population of their ant farms, after how many months will they both have approximately the same number of ants?

28 For which values of \( x \), rounded to the nearest hundredth, will \( |x^2 - 9| - 3 = \log_3 x \)?

29 The sequence \( a_1 = 6, a_n = 3a_{n-1} \) can also be written as

30 The function \( p(t) = 110e^{0.03922t} \) models the population of a city, in millions, \( t \) years after 2010. As of today, consider the following two statements:
   I. The current population is 110 million.
   II. The population increases continuously by approximately 3.9% per year.
   This model supports

31 Which expression is equivalent to \((3k - 2i)^2\), where \(i\) is the imaginary unit?

32 A student studying public policy created a model for the population of Detroit, where the population decreased 25% over a decade. He used the model \( P = 714(0.75)^d \), where \( P \) is the population, in thousands, \( d \) decades after 2010. Another student, Suzanne, wants to use a model that would predict the population after \( y \) years. Suzanne's model is best represented by

33 The completely factored form of 
\( n^4 - 9n^2 + 4n^3 - 36n - 12n^2 + 108 \) is
34 The loudness of sound is measured in units called decibels (dB). These units are measured by first assigning an intensity $I_0$ to a very soft sound that is called the threshold sound. The sound to be measured is assigned an intensity, $I$, and the decibel rating, $d$, of this sound is found using $d = 10 \log \frac{I}{I_0}$. The threshold sound audible to the average person is $1.0 \times 10^{-12}$ W/m$^2$ (watts per square meter). Consider the following sound level classifications:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>45-69 dB</td>
</tr>
<tr>
<td>Loud</td>
<td>70-89 dB</td>
</tr>
<tr>
<td>Very loud</td>
<td>90-109 dB</td>
</tr>
<tr>
<td>Deafening</td>
<td>&gt;110 dB</td>
</tr>
</tbody>
</table>

How would a sound with intensity $6.3 \times 10^{-3}$ W/m$^2$ be classified?

35 Camryn puts $400 into a savings account that earns 6% annually. The amount in her account can be modeled by $C(t) = 400(1.06)^t$ where $t$ is the time in years. Which expression best approximates the amount of money in her account using a weekly growth rate?

36 The graph of the function $p(x)$ is sketched below.

Which equation could represent $p(x)$?

37 Given $f(x) = \frac{1}{2}x + 8$, which equation represents the inverse, $g(x)$?

38 Which equation is represented by the graph shown below?

39 The average depreciation rate of a new boat is approximately 8% per year. If a new boat is purchased at a price of $75,000, which model is a recursive formula representing the value of the boat $n$ years after it was purchased?
40 The depth of the water at a marker 20 feet from the shore in a bay is depicted in the graph below.

If the depth, \(d\), is measured in feet and time, \(t\), is measured in hours since midnight, what is an equation for the depth of the water at the marker?

41 For \(x > 0\), which expression is equivalent to
\[
\frac{\sqrt[3]{x^2} \cdot \sqrt{x^5}}{\sqrt[6]{x}}
\]

42 The expression \(\frac{9x^2 - 2}{3x + 1}\) is equivalent to

43 Which diagram shows an angle rotation of 1 radian on the unit circle?

44 A 7-year lease for office space states that the annual rent is $85,000 for the first year and will increase by 6% each additional year of the lease. What will the total rent expense be for the entire 7-year lease?

45 The zeros for \(f(x) = x^4 - 4x^3 - 9x^2 + 36\) are

46 What is the quotient when \(10x^3 - 3x^2 - 7x + 3\) is divided by \(2x - 1\)?

47 Judith puts $5000 into an investment account with interest compounded continuously. Which approximate annual rate is needed for the account to grow to $9110 after 30 years?

48 The weights of bags of Graseck's Chocolate Candies are normally distributed with a mean of 4.3 ounces and a standard deviation of 0.05 ounces. What is the probability that a bag of these chocolate candies weighs less than 4.27 ounces?

49 What is the solution, if any, of the equation
\[
\frac{2}{x + 3} - \frac{3}{4 - x} = \frac{2x - 2}{x^2 - x - 12}
\]

50 Which equation has \(1 - i\) as a solution?
51 After Roger’s surgery, his doctor administered pain medication in the following amounts in milligrams over four days.

<table>
<thead>
<tr>
<th>Day (n)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dosage (m)</td>
<td>2000</td>
<td>1680</td>
<td>1411.2</td>
<td>1185.4</td>
</tr>
</tbody>
</table>

How can this sequence best be modeled recursively?

52 The graph of \( p(x) \) is shown below.

What is the remainder when \( p(x) \) is divided by \( x + 4 \)?

53 What is the solution set of the equation
\[
\frac{2}{3x + 1} = \frac{1}{x} - \frac{6x}{3x + 1}.
\]

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

55 What is the solution set of the equation
\[
\frac{2}{x} - \frac{3x}{x + 3} = \frac{x}{x + 3}.
\]

56 Given the parent function \( p(x) = \cos x \), which phrase best describes the transformation used to obtain the graph of \( g(x) = \cos(x + a) - b \), if \( a \) and \( b \) are positive constants?

57 Kelly-Ann has $20,000 to invest. She puts half of the money into an account that grows at an annual rate of 0.9% compounded monthly. At the same time, she puts the other half of the money into an account that grows continuously at an annual rate of 0.8%. Which function represents the value of Kelly-Ann's investments after \( t \) years?

58 The value(s) of \( x \) that satisfy
\[
\sqrt{x^2 - 4x - 5} = 2x - 10
\]
are

59 The expression \( \frac{6x^3 + 17x^2 + 10x + 2}{2x + 3} \) equals
60 A number, minus twenty times its reciprocal, equals eight. The number is ____________.

61 The solution to the equation \(18x^2 - 24x + 87 = 0\) is ____________.

62 The solution of \(87e^{0.3x} = 5918\), to the nearest thousandth, is ____________.

63 What is the completely factored form of \(k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48\)? ____________.

64 The population of Jamesburg for the years 2010-2013, respectively, was reported as follows:
- 2010: 250,000
- 2011: 250,937
- 2012: 251,878
- 2013: 252,822

How can this sequence be recursively modeled?

65 When the expression \((x + 2)^2 + 4(x + 2) + 3\) is rewritten as the product of two binomials, the result is ____________.

66 The height above ground for a person riding a Ferris wheel after \(t\) seconds is modeled by 
\[h(t) = 150\sin\left(\frac{\pi}{45}t + 67.5\right) + 160\] feet. How many seconds does it take to go from the bottom of the wheel to the top of the wheel?

67 Which diagram represents an angle, \(\alpha\), measuring \(\frac{13\pi}{20}\) radians drawn in standard position, and its reference angle, \(\theta\)?

68 The completely factored form of \(2d^4 + 6d^3 - 18d^2 - 54d\) is ____________.

69 A 4th degree polynomial has zeros \(-5\), \(3\), \(i\), and \(-i\). Which graph could represent the function defined by this polynomial?

70 The function \(N(t) = 100e^{-0.03t}\) models the number of grams in a sample of cesium-137 that remain after \(t\) years. On which interval is the sample's average rate of decay the fastest?

71 The expression \(6 - (3x - 2i)^2\) is equivalent to ____________.

72 The expression \(\frac{4x^3 + 5x + 10}{2x + 3}\) is equivalent to ____________.

73 If \((a^3 + 27) = (a + 3)(a^2 + ma + 9)\), then \(m\) equals ____________.
74 A group of students was trying to determine the proportion of candies in a bag that are blue. The company claims that 24% of candies in bags are blue. A simulation was run 100 times with a sample size of 50, based on the premise that 24% of the candies are blue. The approximately normal results of the simulation are shown in the dot plot below.

The simulation results in a mean of 0.254 and a standard deviation of 0.060. Based on this simulation, what is a plausible interval containing the middle 95% of the data?

75 The value of a new car depreciates over time. Greg purchased a new car in June 2011. The value, \(V\), of his car after \(t\) years can be modeled by the equation

\[
\log_{0.8}\left(\frac{V}{17000}\right) = t.
\]

What is the average decreasing rate of change per year of the value of the car from June 2012 to June 2014, to the nearest ten dollars per year?

76 A manufacturing plant produces two different-sized containers of peanuts. One container weighs \(x\) ounces and the other weighs \(y\) pounds. If a gift set can hold one of each size container, which expression represents the number of gift sets needed to hold 124 ounces?

77 What is the inverse of \(f(x) = -6(x - 2)\)?

78 Which expression is equivalent to

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

where \(i\) is the imaginary unit and \(x\) is a real number?

79 A study conducted in 2004 in New York City found that 212 out of 1334 participants had hypertension. Kim ran a simulation of 100 studies based on these data. The output of the simulation is shown in the diagram below.

At a 95% confidence level, the proportion of New York City residents with hypertension and the margin of error are closest to
80 The Ferris wheel at the landmark Navy Pier in Chicago takes 7 minutes to make one full rotation. The height, $H$, in feet, above the ground of one of the six-person cars can be modeled by $H(t) = 70 \sin \left( \frac{2\pi}{7} (t - 1.75) \right) + 80$, where $t$ is time, in minutes. Using $H(t)$ for one full rotation, this car's minimum height, in feet, is

81 The graph of $y = f(x)$ is shown below.

Which expression defines $f(x)$?

82 The solutions to $x + 3 - \frac{4}{x-1} = 5$ are

83 The function $f(x) = \frac{x-3}{x^2+2x-8}$ is undefined when $x$ equals

84 Factored completely, $m^5 + m^3 - 6m$ is equivalent to

85 Which expression(s) are equivalent to $\frac{x^2 - 4x}{2x}$, where $x \neq 0$?
   I. $\frac{x}{2} - 2$  II. $\frac{x-4}{2}$  III. $\frac{x-1}{2} - \frac{3}{2}$

86 Which graph has the following characteristics?
   • three real zeros
   • as $x \to -\infty$, $f(x) \to -\infty$
   • as $x \to \infty$, $f(x) \to \infty$

87 To the nearest tenth, the value of $x$ that satisfies $2^x = -2x + 11$ is

88 How many solutions exist for $\frac{1}{1-x^2} = -|3x - 2| + 5$?

89 The solution to the equation $4x^2 + 98 = 0$ is

90 If the terminal side of angle $\theta$, in standard position, passes through point $(-4,3)$, what is the numerical value of $\sin \theta$?

91 According to a pricing website, Indroid phones lose 58% of their cash value over 1.5 years. Which expression can be used to estimate the value of a $300 Indroid phone in 1.5 years?
92 Data for the students enrolled in a local high school are shown in the Venn diagram below.

![Venn Diagram]

If a student from the high school is selected at random, what is the probability that the student is a sophomore given that the student is enrolled in Algebra II?

93 The solution set for the equation \( \sqrt{56 - x} = x \) is

94 A recursive formula for the sequence 18, 9, 4.5, \ldots is

95 Which expression is equivalent to

\[
\frac{2x^4 + 8x^3 - 25x^2 - 6x + 14}{x + 6},
\]

96 Written in simplest form, \( \frac{c^2 - d^2}{d^2 + cd - 2c^2} \) where \( c \neq d \), is equivalent to

97 The probability that Gary and Jane have a child with blue eyes is 0.25, and the probability that they have a child with blond hair is 0.5. The probability that they have a child with both blue eyes and blond hair is 0.125. Given this information, the events blue eyes and blond hair are

I: dependent
II: independent
III: mutually exclusive

98 Which equation represents a parabola with the focus at (0,−1) and the directrix of \( y = 1 \)?

99 What is the solution to \( 8(2^{x+3}) = 48 \)?

100 Mr. Farison gave his class the three mathematical rules shown below to either prove or disprove. Which rules can be proved for all real numbers?

I \( (m + p)^2 = m^2 + 2mp + p^2 \)
II \( (x + y)^3 = x^3 + 3xy + y^3 \)
III \( (a^2 + b^2)^2 = (a^2 - b^2)^2 + (2ab)^2 \)

101 Which equation represents a parabola with a focus of (0,4) and a directrix of \( y = 2 \)?

102 Given \( \cos \theta = \frac{7}{25} \), where \( \theta \) is an angle in standard position terminating in quadrant IV, and \( \sin^2 \theta + \cos^2 \theta = 1 \), what is the value of \( \tan \theta \)?
103 Gabriel performed an experiment to see if planting 13 tomato plants in black plastic mulch leads to larger tomatoes than if 13 plants are planted without mulch. He observed that the average weight of the tomatoes from tomato plants grown in black plastic mulch was 5 ounces greater than those from the plants planted without mulch. To determine if the observed difference is statistically significant, he rerandomized the tomato groups 100 times to study these random differences in the mean weights. The output of his simulation is summarized in the dotplot below.

Given these results, what is an appropriate inference that can be drawn?

104 When factoring to reveal the roots of the equation \( x^3 + 2x^2 - 9x - 18 = 0 \), which equations can be used?
   I. \( x^2(x + 2) - 9(x + 2) = 0 \)
   II. \( x(x^2 - 9) + 2(x^2 - 9) = 0 \)
   III. \( (x - 2)(x^2 - 9) = 0 \)

105 The solutions to the equation \(-\frac{1}{2}x^2 = -6x + 20\) are

106 Where \( i \) is the imaginary unit, the expression \((x + 3i)^2 - (2x - 3i)^2\) is equivalent to

107 The parabola described by the equation \( y = \frac{1}{12}(x - 2)^2 + 2 \) has the directrix at \( y = -1 \). The focus of the parabola is

108 What are the solution(s) to the system of equations shown below?
   \[
   \begin{align*}
   x^2 + y^2 &= 5 \\
   y &= 2x
   \end{align*}
   \]

109 If \( \cos \theta = -\frac{3}{4} \) and \( \theta \) is in Quadrant III, then \( \sin \theta \) is equivalent to
110 There are 440 students at Thomas Paine High School enrolled in U.S. History. On the April report card, the students’ grades are approximately normally distributed with a mean of 79 and a standard deviation of 7. Students who earn a grade less than or equal to 64.9 must attend summer school. The number of students who must attend summer school for U.S. History is closest to

111 When a ball bounces, the heights of consecutive bounces form a geometric sequence. The height of the first bounce is 121 centimeters and the height of the third bounce is 64 centimeters. To the nearest centimeter, what is the height of the fifth bounce?

112 The expression \( \frac{x^3 + 2x^2 + x + 6}{x + 2} \) is equivalent to

113 If \( x - 1 \) is a factor of \( x^3 - kx^2 + 2x \), what is the value of \( k \)?

114 A fast-food restaurant analyzes data to better serve its customers. After its analysis, it discovers that the events \( D \), that a customer uses the drive-thru, and \( F \), that a customer orders French fries, are independent. The following data are given in a report:

\[
P(F) = 0.8 \\
P(F \cap D) = 0.456
\]

Given this information, \( P(F|D) \) is

115 The function below models the average price of gas in a small town since January 1st.
\[
G(t) = -0.0049t^4 + 0.0923t^3 - 0.56t^2 + 1.166t + 3.23,
\]
where \( 0 \leq t \leq 10 \).
If \( G(t) \) is the average price of gas in dollars and \( t \) represents the number of months since January 1st, the absolute maximum \( G(t) \) reaches over the given domain is about

116 A polynomial equation of degree three, \( p(x) \), is used to model the volume of a rectangular box. The graph of \( p(x) \) has \( x \) intercepts at \(-2, 10, \) and \(14 \). Which statements regarding \( p(x) \) could be true?
A. The equation of \( p(x) = (x - 2)(x + 10)(x + 14) \).
B. The equation of \( p(x) = -(x + 2)(x - 10)(x - 14) \).
C. The maximum volume occurs when \( x = 10 \).
D. The maximum volume of the box is approximately 56.

117 The heights of women in the United States are normally distributed with a mean of 64 inches and a standard deviation of 2.75 inches. The percent of women whose heights are between 64 and 69.5 inches, to the nearest whole percent, is

118 What is the solution set of the following system of equations?
\[
\begin{align*}
y &= 3x + 6 \\
y &= (x + 4)^2 - 10
\end{align*}
\]
119 Selected values for the functions \( f \) and \( g \) are shown in the tables below.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) )</th>
<th>( x )</th>
<th>( g(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3.12</td>
<td>-4.88</td>
<td>-2.01</td>
<td>-1.01</td>
</tr>
<tr>
<td>0</td>
<td>-6</td>
<td>0</td>
<td>0.58</td>
</tr>
<tr>
<td>1.23</td>
<td>-4.77</td>
<td>8.52</td>
<td>2.53</td>
</tr>
<tr>
<td>8.52</td>
<td>2.53</td>
<td>13.11</td>
<td>3.01</td>
</tr>
<tr>
<td>9.01</td>
<td>3.01</td>
<td>16.52</td>
<td>3.29</td>
</tr>
</tbody>
</table>

A solution to the equation \( f(x) = g(x) \) is

120 A payday loan company makes loans between $100 and $1000 available to customers. Every 14 days, customers are charged 30% interest with compounding. In 2013, Remi took out a $300 payday loan. Which expression can be used to calculate the amount she would owe, in dollars, after one year if she did not make payments?

121 The focal length, \( F \), of a camera’s lens is related to the distance of the object from the lens, \( J \), and the distance to the image area in the camera, \( W \), by the formula below.

\[
\frac{1}{J} + \frac{1}{W} = \frac{1}{F}
\]

When this equation is solved for \( J \) in terms of \( F \) and \( W \), \( J \) equals

122 The profit function, \( p(x) \), for a company is the cost function, \( c(x) \), subtracted from the revenue function, \( r(x) \). The profit function for the Acme Corporation is \( p(x) = -0.5x^2 + 250x - 300 \) and the revenue function is \( r(x) = -0.3x^2 + 150x \). The cost function for the Acme Corporation is

123 If \( A = -3 + 5i \), \( B = 4 - 2i \), and \( C = 1 + 6i \), where \( i \) is the imaginary unit, then \( A - BC \) equals

124 Iridium-192 is an isotope of iridium and has a half-life of 73.83 days. If a laboratory experiment begins with 100 grams of Iridium-192, the number of grams, \( A \), of Iridium-192 present after \( t \) days would be \( A = 100 \left( \frac{1}{2} \right)^{\frac{t}{73.83}} \). Which equation approximates the amount of Iridium-192 present after \( t \) days?

125 The Rickerts decided to set up an account for their daughter to pay for her college education. The day their daughter was born, they deposited $1000 in an account that pays 1.8% compounded annually. Beginning with her first birthday, they deposit an additional $750 into the account on each of her birthdays. Which expression correctly represents the amount of money in the account \( n \) years after their daughter was born?
126 Which equation represents the equation of the parabola with focus \((-3, 3)\) and directrix \(y = 7\)?

127 If \(f(x) = a^x\) where \(a > 1\), then the inverse of the function is

128 What is the equation of the directrix for the parabola \(-8(y - 3) = (x + 4)^2\)?

129 Given that \(\sin^2 \theta + \cos^2 \theta = 1\) and \(\sin \theta = \frac{-\sqrt{2}}{5}\), what is a possible value of \(\cos \theta\)?

130 The function \(f(x) = a \cos bx + c\) is plotted on the graph shown below.

What are the values of \(a\), \(b\), and \(c\)?

131 A ball is dropped from a height of 32 feet. It bounces and rebounds 80% of the height from which it was falling. What is the total downward distance, in feet, the ball traveled up to the 12th bounce?

132 What is the solution set for \(x\) in the equation below?

\[
\sqrt{x + 1} - 1 = x
\]

133 Given \(i\) is the imaginary unit, \((2 - yi)^2\) in simplest form is

134 Julia deposits $2000 into a savings account that earns 4% interest per year. The exponential function that models this savings account is \(y = 2000(1.04)^t\), where \(t\) is the time in years. Which equation correctly represents the amount of money in her savings account in terms of the monthly growth rate?

135 Which statement(s) are true for all real numbers?

I. \((x - y)^2 = x^2 + y^2\)

II. \((x + y)^3 = x^3 + 3xy + y^3\)

136 Given \(f^{-1}(x) = \frac{-3}{4}x + 2\), which equation represents \(f(x)\)?
137 Which equation represents the set of points equidistant from line $\ell$ and point $R$ shown on the graph below?

```
\[ y = \frac{x^3 + 2x^2 - 9x - 18}{x^3 - x^2 - 6x} \]
```

138 A rabbit population doubles every 4 weeks. There are currently five rabbits in a restricted area. If $t$ represents the time, in weeks, and $P(t)$ is the population of rabbits with respect to time, about how many rabbits will there be in 98 days?

139 The scores on a mathematics college-entry exam are normally distributed with a mean of 68 and standard deviation 7.2. Students scoring higher than one standard deviation above the mean will not be enrolled in the mathematics tutoring program. How many of the 750 incoming students can be expected to be enrolled in the tutoring program?

140 For all values of $x$ for which the expression is defined, $\frac{x^3 + 2x^2 - 9x - 18}{x^3 - x^2 - 6x}$, in simplest form, is equivalent to

141 The distribution of the diameters of ball bearings made under a given manufacturing process is normally distributed with a mean of 4 cm and a standard deviation of 0.2 cm. What proportion of the ball bearings will have a diameter less than 3.7 cm?

142 Perry invested in property that cost him $1500. Five years later it was worth $3000, and 10 years from his original purchase, it was worth $6000. Assuming the growth rate remains the same, which type of function could he create to find the value of his investment 30 years from his original purchase?

143 Evan graphed a cubic function, $f(x) = ax^3 + bx^2 + cx + d$, and determined the roots of $f(x)$ to be $\pm 1$ and 2. What is the value of $b$, if $a = 1$?

144 The voltage used by most households can be modeled by a sine function. The maximum voltage is 120 volts, and there are 60 cycles every second. Which equation best represents the value of the voltage as it flows through the electric wires, where $t$ is time in seconds?

145 A study of the annual population of the red-winged blackbird in Ft. Mill, South Carolina, shows the population, $B(t)$, can be represented by the function $B(t) = 750(1.16)^t$, where the $t$ represents the number of years since the study began. In terms of the monthly rate of growth, the population of red-winged blackbirds can be best approximated by the function
146 The graph of \( y = \log_{2}x \) is translated to the right 1 unit and down 1 unit. The coordinates of the \( x \)-intercept of the translated graph are

147 Given \( f(9) = -2 \), which function can be used to generate the sequence \(-8, -7.25, -6.5, -5.75, \ldots\)?

148 A parabola has its focus at (1,2) and its directrix is \( y = -2 \). The equation of this parabola could be

149 Which statement(s) about statistical studies is true?
I. A survey of all English classes in a high school would be a good sample to determine the number of hours students throughout the school spend studying.
II. A survey of all ninth graders in a high school would be a good sample to determine the number of student parking spaces needed at that high school.
III. A survey of all students in one lunch period in a high school would be a good sample to determine the number of hours adults spend on social media websites.
IV. A survey of all Calculus students in a high school would be a good sample to determine the number of students throughout the school who don’t like math.

150 What is the solution when the equation \( wx^2 + w = 0 \) is solved for \( x \), where \( w \) is a positive integer?

151 Mallory wants to buy a new window air conditioning unit. The cost for the unit is $329.99. If she plans to run the unit three months out of the year for an annual operating cost of $108.78, which function models the cost per year over the lifetime of the unit, \( C(n) \), in terms of the number of years, \( n \), that she owns the air conditioner.

152 The graph below represents national and New York State average gas prices.

If New York State's gas prices are modeled by \( G(x) \) and \( C > 0 \), which expression best approximates the national average \( x \) months from August 2014?

153 Last year, the total revenue for Home Style, a national restaurant chain, increased 5.25% over the previous year. If this trend were to continue, which expression could the company's chief financial officer use to approximate their monthly percent increase in revenue? [Let \( m \) represent months.]
154 When \( g(x) = \frac{2}{x+2} \) and \( h(x) = \log(x+1) + 3 \) are graphed on the same set of axes, which coordinates best approximate their point of intersection?

155 There are 400 students in the senior class at Oak Creek High School. All of these students took the SAT. The distribution of their SAT scores is approximately normal. The number of students who scored within 2 standard deviations of the mean is approximately

156 The first term of a geometric sequence is 8 and the fourth term is 216. What is the sum of the first 12 terms of the corresponding series?

157 What is the inverse of \( f(x) = x^3 - 2 \)?

158 If \( p(x) = ab^x \) and \( r(x) = cd^x \), then \( p(x) \cdot r(x) \) equals

159 Stephanie found that the number of white-winged cross bills in an area can be represented by the formula \( C = 550(1.08)^t \), where \( t \) represents the number of years since 2010. Which equation correctly represents the number of white-winged cross bills in terms of the monthly rate of population growth?

160 A manufacturing company has developed a cost model, \( C(x) = 0.15x^3 + 0.01x^2 + 2x + 120 \), where \( x \) is the number of items sold, in thousands. The sales price can be modeled by \( S(x) = 30 - 0.01x \). Therefore, revenue is modeled by \( R(x) = x \cdot S(x) \). The company's profit, \( P(x) = R(x) - C(x) \), could be modeled by

161 The solution set for the equation \( \sqrt{x+14} - \sqrt{2x+5} = 1 \) is

162 What is the inverse of the function \( y = 4x + 5 \)?

163 For positive values of \( x \), which expression is equivalent to \( \sqrt{16x^2 \cdot x^3 + 3\sqrt{8x^5}} \)?

164 A circle centered at the origin has a radius of 10 units. The terminal side of an angle, \( \theta \), intercepts the circle in Quadrant II at point \( C \). The \( y \)-coordinate of point \( C \) is 8. What is the value of \( \cos \theta \)?

165 The solution set for the equation \( b = \sqrt{2b^2 - 64} \) is
166 For the system shown below, what is the value of $z$?

\begin{align*}
y &= -2x + 14 \\
3x - 4z &= 2 \\
3x - y &= 16
\end{align*}

167 What is the inverse of $f(x) = \frac{x}{x+2}$, where $x \neq -2$?

168 Julie averaged 85 on the first three tests of the semester in her mathematics class. If she scores 93 on each of the remaining tests, her average will be 90. Which equation could be used to determine how many tests, $T$, are left in the semester?

169 What is the solution set of the equation

$$\frac{3x + 25}{x + 7} - 5 = \frac{3}{x}?$$

170 For $x \neq 0$, which expressions are equivalent to one divided by the sixth root of $x$?

I. $\frac{6\sqrt[3]{x}}{\sqrt{x}}$  
II. $\frac{1}{\sqrt[6]{x}}$  
III. $\frac{1}{x^{\frac{1}{6}}}$

171 Relative to the graph of $y = 3\sin x$, what is the shift of the graph of $y = 3\sin\left(x + \frac{\pi}{3}\right)$?

172 If $5000$ is put into a savings account that pays 3.5% interest compounded monthly, how much money, to the nearest ten cents, would be in that account after 6 years, assuming no money was added or withdrawn?

173 Consider the probability statements regarding events $A$ and $B$ below.

- $P(A \text{ or } B) = 0.3$
- $P(A \text{ and } B) = 0.2$
- $P(A|B) = 0.8$

What is $P(B)$?

174 The inverse of the function $f(x) = \frac{x + 1}{x - 2}$ is

175 The lifespan of a 60-watt lightbulb produced by a company is normally distributed with a mean of 1450 hours and a standard deviation of 8.5 hours. If a 60-watt lightbulb produced by this company is selected at random, what is the probability that its lifespan will be between 1440 and 1465 hours?

176 The hours of daylight, $y$, in Utica in days, $x$, from January 1, 2013 can be modeled by the equation $y = 3.06\sin(0.017x - 1.40) + 12.23$. How many hours of daylight, to the nearest tenth, does this model predict for February 14, 2013?
177 A candidate for political office commissioned a poll. His staff received responses from 900 likely voters and 55% of them said they would vote for the candidate. The staff then conducted a simulation of 1000 more polls of 900 voters, assuming that 55% of voters would vote for their candidate. The output of the simulation is shown in the diagram below.

Given this output, and assuming a 95% confidence level, the margin of error for the poll is closest to

178 The temperature, in degrees Fahrenheit, in Times Square during a day in August can be predicted by the function \( T(x) = 8 \sin(0.3x - 3) + 74 \), where \( x \) is the number of hours after midnight. According to this model, the predicted temperature, to the nearest degree Fahrenheit, at 7 P.M. is

179 The solutions to the equation \( 5x^2 - 2x + 13 = 9 \) are

180 The expression \( 6x^3(-4x + 5) \) is equivalent to

181 If \( a, b, \) and \( c \) are all positive real numbers, which graph could represent the sketch of the graph of \( p(x) = -a(x + b)\left(x^2 - 2cx + c^2\right) \)?

182 If \( f(x) = \log_3x \) and \( g(x) \) is the image of \( f(x) \) after a translation five units to the left, which equation represents \( g(x) \)?

183 After examining the functions \( f(x) = \ln(x + 2) \) and \( g(x) = e^{x-1} \) over the interval \((2,3]\), Lexi determined that the correct number of solutions to the equation \( f(x) = g(x) \) is

184 Which expression is equivalent to \( \frac{4x^3 + 9x - 5}{2x - 1} \), where \( x \neq \frac{1}{2} \)?

185 In 2010, the population of New York State was approximately 19,378,000 with an annual growth rate of 1.5%. Assuming the growth rate is maintained for a large number of years, which equation can be used to predict the population of New York State \( t \) years after 2010?

186 If \( p(x) = 2\ln(x) - 1 \) and \( m(x) = \ln(x + 6) \), then what is the solution for \( p(x) = m(x) \)?
187 A study of black bears in the Adirondacks reveals that their population can be represented by the function \( P(t) = 3500(1.025)^t \), where \( t \) is the number of years since the study began. Which function is correctly rewritten to reveal the monthly growth rate of the black bear population?

188 The function \( f(x) = 2^{-0.25x} \cdot \sin \left( \frac{\pi}{2} x \right) \) represents a damped sound wave function. What is the average rate of change for this function on the interval \([-7, 7]\), to the nearest hundredth?
Algebra II Regents Bimodal Worksheets
Answer Section

1 ANS:
\[ x = \frac{-3 \pm \sqrt{3^2 - 4(2)(2)}}{2(2)} = \frac{-3 \pm \sqrt{-7}}{4} = \frac{-3}{4} \pm \frac{i\sqrt{7}}{4} \]

PTS: 2 REF: 061612aii TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

2 ANS:
\[ -1 + 2i \text{ and } -1 - 2i \]
\[ x^2 + 2x + 1 = -5 + 1 \]
\[ (x + 1)^2 = -4 \]
\[ x + 1 = \pm 2i \]
\[ x = -1 \pm 2i \]

PTS: 2 REF: 081703aii TOP: Solving Quadratics
KEY: complex solutions | completing the square

3 ANS:
\[ r(x) = (x - a)(x - b)(x - c)^2 \]

PTS: 2 REF: 061921aii TOP: Graphing Polynomial Functions

4 ANS:
\[ p(5) = 2(5)^3 - 3(5) + 5 = 240 \]

PTS: 2 REF: 011819aii TOP: Remainder Theorem

5 ANS:
\[ (3) \text{ repeats 3 times over } 2\pi. \]

PTS: 2 REF: 011722aii TOP: Graphing Trigonometric Functions
KEY: recognize | bimodalgraph
6. ANS:
   \[
   \left\{ \right. \\
   \frac{10}{x^2 - 2x} + \frac{4}{x} = \frac{5}{x - 2} \\
   \left. \right\} \text{ is extraneous.}
   \]
   
   \[10 + 4(x - 2) = 5x\]
   
   \[10 + 4x - 8 = 5x\]
   
   \[2 = x\]

   **PTS:** 2  **REF:** 081915a1i  **TOP:** Solving Rationals

   **KEY:** rational solutions

7. ANS:
   \[\pm 2i, 2\]
   
   \[m^2 - 2m^2 + 4m - 8 = 0\]
   
   \[m^2(m - 2) + 4(m - 2) = 0\]
   
   \[\left( m^2 + 4 \right)(m - 2) = 0\]

   **PTS:** 2  **REF:** 081821a1i  **TOP:** Solving Polynomial Equations

8. ANS:
   \[18\]
   
   \[120 = 68 + (195 - 68)e^{-0.05t}\]
   
   \[52 = 127e^{-0.05t}\]
   
   \[\ln \frac{52}{127} = \ln e^{-0.05t}\]
   
   \[\ln \frac{52}{127} = -0.05t\]
   
   \[\ln \frac{52}{127} = -0.05t\]
   
   \[\frac{52}{127} = t\]
   
   \[18 \approx t\]

   **PTS:** 2  **REF:** 081918a1i  **TOP:** Exponential Decay

9. ANS:
   \[a_1 = 25,000, a_n = a_{n-1} + 1000\]

   **PTS:** 2  **REF:** 011824a1i  **TOP:** Sequences

10. ANS:
   \[32^\circ\]

   **PTS:** 2  **REF:** 011704a1i  **TOP:** Simplifying Trigonometric Expressions
11 ANS:
\[7\]
\[1240(1.06)^x = 890(1.11)^x\]
\[x \approx 7\]

PTS: 2  REF: 061814aii  TOP: Other Systems

12 ANS:
\[12\%\]
\[0.48 \cdot 0.25 = 0.12\]

PTS: 1  REF: 061811aii  TOP: Probability of Compound Events

13 ANS:
\[2\%\]

PTS: 2  REF: 081919aii  TOP: Normal Distributions

14 ANS:
\[-3\]

PTS: 2  REF: 011815aii  TOP: Unit Circle

15 ANS:
\[y = 3^x\]

PTS: 2  REF: 011708aii  TOP: Inverse of Functions

16 ANS:
\[
\frac{157}{229} = \frac{157}{25 + 47 + 157}
\]

PTS: 2  REF: 081607aii  TOP: Conditional Probability

17 ANS:
\[2, -2, i, \text{ and } -i\]

PTS: 2  REF: 081708aii  TOP: Solving Polynomial Equations
18 ANS:
496 ± 230
496 ± 2(115)

PTS: 2    REF: 011718aii    TOP: Normal Distributions
KEY: interval

19 ANS:
0.271

\[ y = 278(0.5)^{\frac{18}{13}} \approx 0.271 \]

PTS: 2    REF: 011920aii    TOP: Modeling Exponential Functions

20 ANS:
{(1,1),(6,16)}

\[ y = g(x) = (x - 2)^2 \]
\[ (x - 2)^2 = 3x - 2 \quad y = 3(6) - 2 = 16 \]
\[ x^2 - 4x + 4 = 3x - 2 \quad y = 3(1) - 2 = 1 \]
\[ x^2 - 7x + 6 = 0 \]
\[ (x - 6)(x - 1) = 0 \]
\[ x = 6, 1 \]

PTS: 2    REF: 011705aii    TOP: Quadratic-Linear Systems

21 ANS:

\[ \frac{\ln \left( \frac{c}{a} \right)}{b} \]
\[ e^{bt} = \frac{c}{a} \]

\[ \ln e^{bt} = \ln \frac{c}{a} \]
\[ bt \ln e = \ln \frac{c}{a} \]
\[ t = \frac{\ln \frac{c}{a}}{b} \]

PTS: 2    REF: 011813aii    TOP: Exponential Growth
22 ANS:
\[(x + 2)^2 = -8(y - 7)
\]
\[
\frac{5 + 9}{2} = 7, \text{ vertex: } (-2, 7); \ p = 7 - 9 = -2, \ y = \frac{1}{4(-2)} (x + 2)^2 + 7
\]
\[
y - 7 = \frac{-1}{8} (x + 2)^2
\]
\[-8(y - 7) = (x + 2)^2
\]

PTS: 2 REF: 061821aii TOP: Graphing Quadratic Functions

23 ANS:
\[-0.087
\]
\[100 \left(\frac{1}{2}\right)^{d/8} = 100e^{kd}
\]
\[
\left(\frac{1}{2}\right)^{\frac{1}{8}} = e^k
\]
\[k \approx -0.087
\]

PTS: 2 REF: 061818aii TOP: Modeling Exponential Functions

24 ANS:
\[29,400 \left(\frac{1}{1.068}\right)^{365t}
\]
1 year = 365 days

PTS: 2 REF: 061823aii TOP: Modeling Exponential Functions

25 ANS:
\[10.25
\]
The maximum of \(p\) is 5. The minimum of \(f\) is \[-\frac{21}{4} (x = -\frac{6}{2(4)} = -\frac{3}{4}
\]
\[f\left(\frac{3}{4}\right) = 4 \left(\frac{3}{4}\right)^2 + 6 \left(\frac{3}{4}\right) - 3 = 4 \left(\frac{9}{16}\right) - 18/4 - 12/4 = -\frac{21}{4}. \ 20/4 - \left(\frac{21}{4}\right) = \frac{41}{4} = 10.25
\]

PTS: 2 REF: 011922aii TOP: Comparing Functions

26 ANS:
\[$17,433,922.00
\]
\[S_{20} = \frac{.01 - .01(3)^{20}}{1 - 3} = 17,433,922
\]

PTS: 2 REF: 011822aii TOP: Series
27 ANS: 8

PTS: 2 REF: 011716aii TOP: Other Systems

28 ANS: 2.29 and 3.63

PTS: 2 REF: 011814aii TOP: Other Systems

29 ANS: 
\[a_n = 2 \cdot 3^n\]

PTS: 2 REF: 011814aii TOP: Other Systems

30 ANS: II, only
The 2010 population is 110 million.

PTS: 2 REF: 061718aii TOP: Modeling Exponential Functions

31 ANS: 
\[9k^2 - 12ki - 4\]
\[(3k - 2i)^2 = 9k^2 - 12ki + 4i^2 = 9k^2 - 12ki - 4\]

PTS: 2 REF: 081618aii TOP: Operations with Complex Numbers

32 ANS: 
\[P = 714(0.9716)^y\]
\[\frac{1}{0.75^{10}} \approx 9.716\]

PTS: 2 REF: 061713aii TOP: Modeling Exponential Functions

33 ANS: 
\[(n + 3)(n - 3)(n + 6)(n - 2)\]
\[n^2 \left( n^2 - 9 \right) + 4n \left( n^2 - 9 \right) - 12 \left( n^2 - 9 \right)\]
\[\left( n^2 + 4n - 12 \right) \left( n^2 - 9 \right)\]
\[(n + 6)(n - 2)(n + 3)(n - 3)\]

PTS: 2 REF: 061911aii TOP: Factoring Polynomials
KEY: factoring by grouping
34 ANS: 
very loud
\[ d = 10 \log \frac{6.3 \times 10^{-3}}{1.0 \times 10^{-12}} \approx 98 \]

PTS: 2
REF: 011715aii
TOP: Evaluating Logarithmic Expressions

35 ANS: 
\[ 400(1.001121184)^{52t} \]
\[ \frac{1}{52} \]
\[ 1.06 \]

PTS: 2
REF: 061924aii
TOP: Modeling Exponential Functions

36 ANS: 
\[ p(x) = (x^2 - 9)(x - 2) \]

PTS: 2
REF: 061701aii
TOP: Graphing Polynomial Functions

37 ANS: 
\[ g(x) = 2x - 16 \]
\[ y = \frac{1}{2}x + 8 \quad x = \frac{1}{2}y + 8 \]
\[ 2x = y + 16 \]
\[ y = 2x - 16 \]

PTS: 2
REF: 081806aii
TOP: Inverse of Functions
KEY: linear

38 ANS: 
\[ y = \frac{1}{2} \cos 2x \]

PTS: 2
REF: 061708aii
TOP: Modeling Trigonometric Functions

39 ANS: 
\[ a_0 = 75,000 \]
\[ a_n = 0.92(a_{n-1}) \]

PTS: 2
REF: 081810aii
TOP: Sequences

40 ANS: 
\[ d = 5 \sin \left( \frac{\pi}{6} t \right) + 9 \]
\[ a = \frac{14 - 4}{2} = 5, \quad d = \frac{14 + 4}{2} = 9 \]

PTS: 2
REF: 061810aii
TOP: Modeling Trigonometric Functions
41 ANS:

\[ x^3 \]
\[ \frac{\frac{2}{3} \cdot x^\frac{5}{2}}{\frac{1}{6}} \cdot \frac{x^{15}}{x^6} = \frac{\frac{4}{6}}{x^\frac{1}{6}} = x^\frac{18}{6} = x^3 \]

PTS: 2  REF: 081812aii  TOP: Operations with Radicals
KEY: with variables, index > 2

42 ANS:

\[ 3x - 1 - \frac{1}{3x + 1} \]
\[ 3x + 1 \]
\[ 9x^2 + 0x - 2 \]
\[ 9x^2 + 3x \]
\[ -3x - 2 \]
\[ -3x - 1 \]
\[ -1 \]

PTS: 2  REF: 081910aii  TOP: Rational Expressions
KEY: division

43 ANS:

\[ y \]
\[ x \]

PTS: 2  REF: 081616aii  TOP: Unit Circle  KEY: bimodalgraph

44 ANS:

\[ S_n = \frac{85000 - 85000(1.06)^7}{1 - 1.06} \approx 713476.20 \]

PTS: 2  REF: 061905aii  TOP: Series
45 ANS: \{0, \pm 3, 4\}

\[x^4 - 4x^3 - 9x^2 + 36x = 0\]
\[x^3(x - 4) - 9x(x - 4) = 0\]
\[(x^3 - 9x)(x - 4) = 0\]
\[x(x^2 - 9)(x - 4) = 0\]
\[x(x + 3)(x - 3)(x - 4) = 0\]
\[x = 0, \pm 3, 4\]

PTS: 2 REF: 061606aii TOP: Solving Polynomial Equations

46 ANS:

\[
\frac{5x^2 + x - 3}{2x - 1} = \frac{5x^2 + x - 3}{10x^3 - 3x^2 - 7x + 3}
\]
\[
10x^3 - 5x^2
\]
\[
2x^2 - 7x
\]
\[
\frac{2x^2 - x}{-6x + 3}
\]
\[-6x + 3\]

PTS: 2 REF: 011809aii TOP: Rational Expressions

KEY: division

47 ANS:

\[9110 = 5000e^{30r}\]
\[
\ln \frac{911}{500} = \ln e^{30r}
\]
\[
\frac{\ln 911}{30} = r
\]
\[r \approx 0.02\]

PTS: 2 REF: 011810aii TOP: Exponential Growth
48 ANS: 0.2743

PTS: 2 REF: 061817aii TOP: Normal Distributions
KEY: probability

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

\[
2x - 8 + 3x + 9 = 2x - 2
\]

\[
3x = -3
\]

\[
x = -1
\]

PTS: 2 REF: 011717aii TOP: Solving Rationals
KEY: rational solutions

50 ANS:
\[
x^2 - 2x + 2 = 0
\]

If 1 - \(i\) is one solution, the other is 1 + \(i\).

\((x - (1 - i))(x - (1 + i)) = 0\)

\[
x^2 - x - ix - x + ix + (1 - i^2) = 0
\]

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

PTS: 2 REF: 081601aii TOP: Complex Conjugate Root Theorem

51 ANS:
\[
m_1 = 2000
\]

\[
m_n = (0.84)m_{n-1}
\]

PTS: 2 REF: 081909aii TOP: Sequences KEY: recursive

52 ANS:
0
Since \(x + 4\) is a factor of \(p(x)\), there is no remainder.

PTS: 2 REF: 081621aii TOP: Remainder Theorem
53 ANS: \[
\begin{array}{c}
\left\{ \frac{1}{2} \right\} \\
\end{array}
\]
\[
\frac{2}{3x + 1} = \frac{1}{x} - \frac{6x}{3x + 1} \quad \frac{1}{3} \text{ is extraneous.}
\]
\[
\frac{6x + 2}{3x + 1} = \frac{1}{x}
\]
\[
6x^2 + 2x = 3x + 1
\]
\[
6x^2 - x - 1 = 0
\]
\[(2x - 1)(3x + 1) = 0
\]
\[x = \frac{1}{2}, -\frac{1}{3}\]

PTS: 2 REF: 011915a1i TOP: Solving Rationals

54 ANS: \[
\frac{1}{3} \pm \frac{2i\sqrt{5}}{3}
\]
\[x = \frac{-2 \pm \sqrt{2^2 - 4(3)(-7)}}{2(3)} = \frac{-2 \pm \sqrt{64}}{6} = \frac{-2 \pm 4}{6} = \frac{1}{3} \pm \frac{2i\sqrt{5}}{3}
\]

PTS: 2 REF: 081809a1i TOP: Solving Quadratics KEY: complex solutions | quadratic formula

55 ANS: \[
\begin{array}{c}
\left\{ -1, \frac{3}{2} \right\} \\
\end{array}
\]
\[
\frac{2}{x} = \frac{4x}{x + 3}
\]
\[
2x + 6 = 4x^2
\]
\[
4x^2 - 2x - 6 = 0
\]
\[2\left(2x^2 - x - 3\right) = 0
\]
\[(2x - 3)(x + 1) = 0
\]
\[x = \frac{3}{2}, -1
\]

PTS: 2 REF: 061809a1i TOP: Solving Rationals

56 ANS: left \(a\) units, down \(b\) units

PTS: 2 REF: 061706a1i TOP: Graphing Trigonometric Functions
57 ANS:
\[ f(t) = 10,000(1.00075)^{12t} + 10,000e^{0.008t} \]
\[ 1 + \frac{0.09}{12} = 1.00075 \]

PTS: 2 REF: 011918a Top: Modeling Exponential Functions

58 ANS:
\[ \{5, 7\} \]
\[ x^2 - 4x - 5 = 4x^2 - 40x + 100 \]
\[ 3x^2 - 36x + 105 = 0 \]
\[ x^2 - 12x + 35 = 0 \]
\[ (x - 7)(x - 5) = 0 \]
\[ x = 5, 7 \]

PTS: 2 REF: 081807a Top: Solving Radicals
KEY: extraneous solutions

59 ANS:
\[ 3x^2 + 4x - 1 + \frac{5}{2x + 3} \]
\[ = \frac{3x^2 + 4x - 1}{2x + 3} + \frac{5}{2x + 3} \]
\[ = \frac{3x^2 + 4x - 1 + 5}{2x + 3} \]
\[ = \frac{8x^2 + 10x}{2x + 3} \]
\[ = \frac{8x^2 + 10x - 2x + 2 - 2x - 3}{2x + 3} \]
\[ = \frac{-2x + 2}{2x + 3} \]
\[ = \frac{-2x - 3}{5} \]

PTS: 2 REF: fall1503a Top: Rational Expressions
KEY: division

60 ANS:
10 or -2
\[ x - \frac{20}{x} = 8 \]
\[ x^2 - 8x - 20 = 0 \]
\[ (x - 10)(x + 2) = 0 \]
\[ x = 10, -2 \]

PTS: 2 REF: 061916a Top: Modeling Rationals
61 ANS:

\[ \frac{2}{3} \pm \frac{1}{6}i\sqrt{158} \]

\[ x = \frac{8 \pm \sqrt{(-8)^2 - 4(6)(29)}}{2(6)} = \frac{8 \pm \sqrt{-632}}{12} = \frac{8 \pm i\sqrt{4 \cdot 158}}{12} = \frac{2}{3} \pm \frac{1}{6}i\sqrt{158} \]

PTS: 2  REF: 011711aii  TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

62 ANS:

14.066

\[ \ln e^{0.3x} = \ln \frac{5918}{87} \]

\[ x = \frac{\ln \frac{5918}{87}}{0.3} \]

PTS: 2  REF: 081801aii  TOP: Exponential Equations
KEY: without common base

63 ANS:

\[(k + 2)(k - 2)(k + 6)(k + 2)\]

\[k^4 - 4k^2 + 8k^3 - 32k + 12k^2 - 48\]

\[k^2(k^2 - 4) + 8k(k^2 - 4) + 12(k^2 - 4)\]

\[(k^2 - 4)(k^2 + 8k + 12)\]

\[(k + 2)(k - 2)(k + 6)(k + 2)\]

PTS: 2  REF: fall1505aii  TOP: Factoring Polynomials
KEY: factoring by grouping

64 ANS:

\[ j_1 = 250,000 \]

\[ j_n = 1.00375j_{n-1} \]

PTS: 2  REF: 061623aii  TOP: Sequences

65 ANS:

\[(x + 5)(x + 3)\]

\[u = x + 2 \quad u^2 + 4u + 3\]

\[(u + 3)(u + 1)\]

\[(x + 2 + 3)(x + 2 + 1)\]

\[(x + 5)(x + 3)\]

PTS: 2  REF: 081901aii  TOP: Factoring Polynomials
KEY: higher power
66 ANS:

\[ P = \frac{2\pi}{\frac{\pi}{45}} = 90 \]

PTS: 2 REF: 081822aii TOP: Graphing Trigonometric Functions
KEY: period

67 ANS:

PTS: 2 REF: 081707aii TOP: Reference Angles
KEY: bimodalgraph

68 ANS:

\[ 2d(d + 3)^2(d - 3) \]
\[ 2d(d^3 + 3d^2 - 9d - 27) \]
\[ 2d(d^2(d + 3) - 9(d + 3)) \]
\[ 2d(d^2 - 9)(d + 3) \]
\[ 2d(d + 3)(d - 3)(d + 3) \]
\[ 2d(d + 3)^2(d - 3) \]

PTS: 2 REF: 081615aii TOP: Factoring Polynomials
KEY: factoring by grouping

69 ANS:

PTS: 2 REF: 061816aii TOP: Graphing Polynomial Functions
KEY: bimodalgraph
70  ANS:  
\[
\frac{N(10) - N(1)}{10 - 1} \approx -2.03, \quad \frac{N(20) - N(10)}{20 - 10} \approx -1.63, \quad \frac{N(25) - N(15)}{25 - 15} \approx -1.46, \quad \frac{N(30) - N(1)}{30 - 1} \approx -1.64
\]

PTS: 2    REF: 061807aii   TOP: Rate of Change

71  ANS:  
\[-9x^2 + 12xi + 10\]

\[
6 - (3x - 2i)(3x - 2i) = 6 - \left(9x^2 - 12xi + 4i^2\right) = 6 - 9x^2 + 12xi + 4 = -9x^2 + 12xi + 10
\]

PTS: 2    REF: 061915aii   TOP: Operations with Complex Numbers

72  ANS:  
\[
\frac{2x^2 - 3x + 7 - \frac{11}{2x + 3}}{2x + 3}
\]

\[
\frac{4x^3 + 6x^2}{2x + 3}
\]

\[
-6x^2 + 5x
\]

\[
-6x^2 - 9x
\]

\[
14x + 10
\]

\[
14x + 21
\]

\[
-11
\]

PTS: 2    REF: 061614aii   TOP: Rational Expressions
KEY: division

73  ANS:  
\[-3\]

PTS: 2    REF: 081904aii   TOP: Factoring Polynomials
KEY: higher power

74  ANS:  
\[
(0.134, 0.374)
\]

\[
0.254 \pm 2(0.060) \rightarrow (0.134, 0.374)
\]

PTS: 2    REF: 061913aii   TOP: Analysis of Data
\[
\log_{0.8}\left(\frac{V}{17000}\right) = t \quad \frac{17,000(0.8)^3 - 17,000(0.8)}{3 - 1} \approx -2450
\]

\[
0.8^t = \frac{V}{17000}
\]

\[V = 17000(0.8)^t\]

\[
\frac{124}{x + 16y}
\]

\[
f^{-1}(x) = 2 - \frac{x}{6}
\]

\[
x = -6(y - 2)
\]

\[
-\frac{x}{6} = y - 2
\]

\[
-\frac{x}{6} + 2 = y
\]

\[
\frac{4 - 8xi}{(2x - i)^2 - (2x - i)(2x + 3i)}
\]

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

\[
(2x - i)(-4i)
\]

\[
-8xi + 4i^2
\]

\[
-8xi - 4
\]

\[
\text{proportion} \approx 0.16; \text{margin of error} \approx 0.02
\]

\[
ME = \left( z\sqrt{\frac{p(1-p)}{n}} \right) = \left( 1.96 \sqrt{\frac{0.16(0.84)}{1334}} \right) \approx 0.02
\]
80 ANS:
10

\[ H(t) \text{ is at a minimum at } 70(-1) + 80 = 10 \]

PTS: 2 REF: 061613aii TOP: Graphing Trigonometric Functions
KEY: maximum/minimum

81 ANS:

\[ \frac{x}{2} \]

PTS: 2 REF: 061906aii TOP: Families of Functions

82 ANS:

\[ \frac{3}{2} \pm \frac{\sqrt{17}}{2} \]

\[ x \frac{4}{x - 1} = 2 \quad x = \frac{3 \pm \sqrt{(-3)^2 - 4(1)(-2)}}{2(1)} = \frac{3 \pm \sqrt{17}}{2} \]

\[ x(x - 1) - 4 = 2(x - 1) \]
\[ x^2 - x - 4 = 2x - 2 \]
\[ x^2 - 3x - 2 = 0 \]

PTS: 2 REF: 011812aii TOP: Solving Rationals
KEY: rational solutions

83 ANS:

2 or \(-4\)

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

PTS: 2 REF: 081701aii TOP: Undefined Rationals

84 ANS:

\[ m(m^2 + 3)(m^2 - 2) \]
\[ m^5 + m^3 - 6m = m(m^4 + m^2 - 6) = m(m^2 + 3)(m^2 - 2) \]

PTS: 2 REF: 011703aii TOP: Factoring Polynomials
KEY: higher power
85 ANS:
I, II, and III
\[
\frac{x^2 - 4x}{2x} = \frac{x(x - 4)}{2x} = \frac{x - 4}{2} = \frac{x}{2} - 2 = \frac{x - 1 - 3}{2} = \frac{x - 4}{2}
\]

PTS: 2  REF: 011921aii  TOP: Rational Expressions
KEY: factoring

86 ANS:

The graph shows three real zeros, and has end behavior matching the given end behavior.

PTS: 2  REF: 061604aii  TOP: Graphing Polynomial Functions
KEY: bimodalgraph

87 ANS:
2.6

PTS: 2  REF: 081603aii  TOP: Other Systems

88 ANS:
4

PTS: 2  REF: 011924aii  TOP: Other Systems
\[ \pm \frac{7i \sqrt{2}}{2} \]
\[ 4x^2 = -98 \]
\[ x^2 = \frac{-98}{4} \]
\[ x^2 = \frac{49}{2} \]
\[ x = \pm \sqrt{\frac{49}{2}} = \pm \frac{7i \sqrt{2}}{\sqrt{2}} = \pm \frac{7i \sqrt{2}}{2} \]

PTS: 2  REF: 061707aii  TOP: Solving Quadratics
KEY: complex solutions | taking square roots

90 ANS:
\[ \frac{3}{5} \]

A reference triangle can be sketched using the coordinates \((-4,3)\) in the second quadrant to find the value of \(\sin \theta\).

PTS: 2  REF: spr1503aii  TOP: Determining Trigonometric Functions
KEY: extension to reals

91 ANS:
\[ 300e^{-0.87} \]
\[ \frac{A}{P} = e^{rt} \]
\[ 0.42 = e^{rt} \]
\[ \ln 0.42 = \ln e^{rt} \]
\[ -0.87 \approx rt \]

PTS: 2  REF: 011723aii  TOP: Modeling Exponential Functions

92 ANS:
\[ \frac{85}{295} \]
\[ \frac{85}{210 + 85} \]

PTS: 2  REF: 081818aii  TOP: Venn Diagrams
93 ANS: 
\[ \{7\} \]
\[ \sqrt{56-x} = x \]

-8 is extraneous.

\[ 56-x = x^2 \]
\[ 0 = x^2 + x - 56 \]
\[ 0 = (x + 8)(x - 7) \]
\[ x = 7 \]

PTS: 2 REF: 061605aii TOP: Solving Radicals KEY: extraneous solutions

94 ANS: 
\[ g_1 = 18 \]
\[ g_n = \frac{1}{2} g_{n-1} \]

(2) is not recursive

PTS: 2 REF: 081608aii TOP: Sequences KEY: recursive

95 ANS: 
\[ 2x^3 - 4x^2 - x + \frac{14}{x+6} \]
\[ = \frac{2x^3 - 4x^2 - x + \frac{14}{x+6}}{x+6} \]
\[ = \frac{2x^4 + 8x^3 - 25x^2 - 6x + 14}{x+6} \]
\[ = \frac{2x^4 + 12x^3}{x+6} \]
\[ = \frac{-4x^3 - 25x^2}{x+6} \]
\[ = \frac{-4x^3 - 24x^2}{x+6} \]
\[ = -x^2 - 6x \]
\[ = -x^2 - 6x \]

PTS: 2 REF: 081805aii TOP: Rational Expressions KEY: division

96 ANS: 
\[ \frac{-c-d}{d+2c} \]
\[ \frac{c^2 - d^2}{d^2 + cd - 2c^2} = \frac{(c+d)(c-d)}{(d+2c)(d-c)} = \frac{-c}{d+2c} = \frac{-c-d}{d+2c} \]

PTS: 2 REF: 011818aii TOP: Rational Expressions KEY: factoring
97 ANS:
II, only
The events are independent because \( P(A \text{ and } B) = P(A) \cdot P(B) \).

\[
0.125 = 0.5 \cdot 0.25
\]
If \( P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) = 0.25 + 0.5 - 0.125 = 0.625 \), then the events are not mutually exclusive because \( P(A \text{ or } B) = P(A) + P(B) \)

\[
0.625 \neq 0.5 + 0.25
\]

PTS: 2 REF: 061714aii TOP: Theoretical Probability

98 ANS:
\[ x^2 = -4y \]
The vertex of the parabola is \((0,0)\). The distance, \(p\), between the vertex and the focus or the vertex and the directrix is 1. \[ y = \frac{-1}{4p} (x - h)^2 + k \]

\[
y = \frac{-1}{4(1)} (x - 0)^2 + 0
\]

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

PTS: 2 REF: 081706aii TOP: Graphing Quadratic Functions

99 ANS:
\[
x = \ln 6 \ln 2 - 3
\]

\[
8(2^{x+3}) = 48
\]

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

\[
(x + 3) \ln 2 = \ln 6
\]

\[
x + 3 = \frac{\ln 6}{\ln 2}
\]

\[
x = \frac{\ln 6}{\ln 2} - 3
\]

PTS: 2 REF: 061702aii TOP: Exponential Equations
KEY: without common base

100 ANS:
I and III
\[
(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3 \neq x^3 + 3xy + y^3
\]

PTS: 2 REF: 081620aii TOP: Polynomial Identities
A parabola with a focus of $(0,4)$ and a directrix of $y = 2$ is sketched as follows: By inspection, it is determined that the vertex of the parabola is $(0,3)$. It is also evident that the distance, $p$, between the vertex and the focus is 1. It is possible to use the formula $(x - h)^2 = 4p(y - k)$ to derive the equation of the parabola as follows: $(x - 0)^2 = 4(1)(y - 3)$

$$x^2 = 4y - 12$$

$$x^2 + 12 = 4y$$

$$\frac{x^2}{4} + 3 = y$$

or A point $(x,y)$ on the parabola must be the same distance from the focus as it is from the directrix. For any such point $(x,y)$, the distance to the focus is $\sqrt{(x - 0)^2 + (y - 4)^2}$ and the distance to the directrix is $y - 2$. Setting this equal leads to: $x^2 + y^2 - 8y + 16 = y^2 - 4y + 4$

$$x^2 + 16 = 4y + 4$$

$$\frac{x^2}{4} + 3 = y$$

If $\cos \theta = \frac{7}{25}$, $\sin \theta = \pm \frac{24}{25}$, and $\tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{-24}{7} = \frac{-24}{7}$

There was an effect observed that could be due to the random assignment of plants to the groups.
104 ANS:  
I and II, only  
\[ x^3 + 2x^2 - 9x - 18 = 0 \quad x^3 - 9x + 2x^2 - 18 = 0 \quad x^3 - 9x + 2x^2 - 18 = 0 \]
\[ x^2(x + 2) - 9(x + 2) = 0 \quad x(x^2 - 9) + 2(x^2 - 9) = 0 \quad x(x^2 - 9) + 2(x^2 - 9) = 0 \]
\[ (x + 2)(x^2 - 9) = 0 \]

PTS: 2  REF: 011903aii  TOP: Solving Polynomial Equations

105 ANS:  
6 ± 2i  
\[-2 \left( \frac{1}{2} x^2 = -6x + 20 \right) \]
\[ x^2 - 12x = -40 \]
\[ x^2 - 12x + 36 = -40 + 36 \]
\[ (x - 6)^2 = -4 \]
\[ x - 6 = \pm 2i \]
\[ x = 6 \pm 2i \]

PTS: 2  REF: fall1504aii  TOP: Solving Quadratics  
KEY: complex solutions | completing the square

106 ANS:  
\[-3x^2 + 18xi \]
\[(x + 3i)^2 - (2x - 3i)^2 = x^2 + 6xi + 9i^2 - \left( 4x^2 - 12xi + 9i^2 \right) = -3x^2 + 18xi \]

PTS: 2  REF: 061805aii  TOP: Operations with Complex Numbers

107 ANS:  
(2,5)  
The vertex is (2,2) and \( p = 3 \). 3 + 2 = 5

PTS: 2  REF: 081823aii  TOP: Graphing Quadratic Functions

108 ANS:  
(1,2) and (−1,−2)  
\[ x^2 + (2x)^2 = 5 \quad y = 2x = \pm 2 \]
\[ x^2 + 4x^2 = 5 \]
\[ 5x^2 = 5 \]
\[ x = \pm 1 \]

PTS: 2  REF: 081916aii  TOP: Quadratic-Linear Systems
\[ \frac{\sqrt{7}}{4} \]
\[ -\sqrt{1 - \left(\frac{3}{4}\right)^2} = -\sqrt{\frac{16 - 9}{16}} = -\sqrt{\frac{7}{16}} = -\frac{\sqrt{7}}{4} \]

PTS: 2  
REF: 081905aii  
TOP: Determining Trigonometric Functions

110 ANS:

\[ 10 \]
\[ 440 \times 2.3\% \approx 10 \]

PTS: 2  
REF: 011807aii  
TOP: Normal Distributions  
KEY: predict

111 ANS:

\[ 34 \]
\[ 121(b)^2 = 64 \left(\frac{8}{11}\right)^2 \approx 34 \]
\[ b = \frac{8}{11} \]

PTS: 2  
REF: 011904aii  
TOP: Sequences  
KEY: explicit

112 ANS:

\[ x^2 + 1 + \frac{4}{x + 2} \]
\[ x + 2 \left( x^3 + 2x^2 + x + 6 \right) \]
\[ x^3 + 2x^2 \]
\[ 0x^2 + x \]
\[ 0x^2 + 0x \]
\[ x + 6 \]
\[ x + 2 \]
\[ 4 \]

PTS: 2  
REF: 081611aii  
TOP: Rational Expressions  
KEY: division
113 ANS:
\[ 3 \]
\[ 1^3 - k(1)^2 + 2(1) = 0 \]
\[ k = 3 \]

PTS: 2 REF: 061812aii TOP: Factoring Polynomials
KEY: higher power

114 ANS:
0.8

PTS: 2 REF: 081824aii TOP: Conditional Probability

115 ANS:
$4.01$

PTS: 2 REF: 011817aii TOP: Graphing Polynomial Functions

116 ANS:

\[ B \text{ and } D \]

The maximum volume of \( p(x) = -(x + 2)(x - 10)(x - 14) \) is about 56, at \( x = 12.1 \)

PTS: 2 REF: 081712aii TOP: Graphing Polynomial Functions

117 ANS:

\[ 48 \]

\[ x + 2\sigma \] represents approximately 48% of the data.

PTS: 2 REF: 061609aii TOP: Normal Distributions
KEY: percent
118 ANS:  
\{(0,6),(-5,-9)\}  
\[ (x + 4)^2 - 10 = 3x + 6 \quad y = 3(-5) + 6 = -9 \]  
\[ x^2 + 8x + 16 - 10 = 3x + 6 \quad y = 3(0) + 6 = 6 \]  
\[ x^2 + 5x = 0 \]  
\[ x(x + 5) = 0 \]  
\[ x = -5,0 \]  
PTS: 2 REF: 061903aii TOP: Quadratic-Linear Systems

119 ANS:  
8.52  
PTS: 2 REF: 061914aii TOP: Other Systems

120 ANS:  
\[ \frac{365}{300(1.30)^{14}} \]  
PTS: 2 REF: 081622aii TOP: Modeling Exponential Functions

121 ANS:  
\[ \frac{FW}{W-F} \]  
\[ \frac{1}{J} = \frac{1}{F} - \frac{1}{W} \]  
\[ \frac{1}{J} = \frac{W-F}{FW} \]  
\[ J = \frac{FW}{W-F} \]  
PTS: 2 REF: 081617aii TOP: Solving Rationals KEY: rational solutions

122 ANS:  
c(x) = 0.2x^2 - 100x + 300  
p(x) = r(x) - c(x)  
\[-0.5x^2 + 250x - 300 = -0.3x^2 + 150x - c(x) \]  
c(x) = 0.2x^2 - 100x + 300  
PTS: 2 REF: 061813aii TOP: Operations with Functions

123 ANS:  
\[ -19 - 17i \]  
\[ -3 + 5i - \left( 4 + 24i - 2i - 12i^2 \right) = -3 + 5i - (16 + 22i) = -19 - 17i \]  
PTS: 2 REF: 081815aii TOP: Operations with Complex Numbers
124 ANS:
\[ A = 100(0.990656)^t \]
\[ \left( \frac{1}{2} \right)^{173.83} \approx 0.990656 \]

PTS: 2  REF: 081710aii  TOP: Modeling Exponential Functions

125 ANS:
\[ a_0 = 1000 \]
\[ a_n = a_{n-1}(1.018) + 750 \]

PTS: 2  REF: 081724aii  TOP: Sequences

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

The vertex is \((-3,5)\) and \(p = 2\).
\[ y = -\frac{1}{4(2)}(x+3)^2 + 5 \]

PTS: 2  REF: 011914aii  TOP: Graphing Quadratic Functions

127 ANS:
\[ f^{-1}(x) = \log_a x \]

PTS: 2  REF: 011917aii  TOP: Inverse of Functions

KEY: other

128 ANS:
\[ y = 5 \]

In vertex form, the parabola is \[ y = -\frac{1}{4(2)}(x+4)^2 + 3 \]. The vertex is \((-4,3)\) and \(p = 2\).
\[ 3 + 2 = 5 \]

PTS: 2  REF: 011816aii  TOP: Graphing Quadratic Functions

129 ANS:
\[ \frac{\sqrt{23}}{5} \]

\[ \cos \theta = \pm \sqrt{1 - \left( \frac{-\sqrt{2}}{5} \right)^2} = \pm \sqrt{\frac{25 - 2}{25}} = \pm \frac{\sqrt{23}}{5} \]

PTS: 2  REF: 061712aii  TOP: Determining Trigonometric Functions
130 ANS:
\[ a = 2, b = 6, c = 3 \]
The cosine function has been translated +3. Since the maximum is 5 and the minimum is 1, the amplitude is 2.
\[ \frac{\pi}{3} = \frac{2\pi}{b} \]
\[ b = 6 \]

PTS: 2  REF: 011913aii  TOP: Modeling Trigonometric Functions

131 ANS:
\[ 149 \]
\[ d = 32(0.8)^{b-1} \quad S_n = \frac{32 - 32(0.8)^{12}}{1 - 0.8} \approx 149 \]

PTS: 2  REF: 081721aii  TOP: Series

132 ANS:
\[ \{-1,0\} \]
\[ \sqrt{x + 1} = x + 1 \]
\[ x + 1 = x^2 + 2x + 1 \]
\[ 0 = x^2 + x \]
\[ 0 = x(x + 1) \]
\[ x = -1, 0 \]

PTS: 2  REF: 011802aii  TOP: Solving Radicals
KEY: extraneous solutions

133 ANS:
\[ -y^2 - 4yi + 4 \]
\[ (2-\sqrt{2})(2-\sqrt{2}) = 4 - 4yi + y^2 i^2 = -y^2 - 4yi + 4 \]

PTS: 2  REF: 061603aii  TOP: Operations with Complex Numbers

134 ANS:
\[ y = 2000(1.0032737)^{12r} \]
\[ \frac{1}{1.04^{12}} \approx 1.0032737 \]

PTS: 2  REF: 011906aii  TOP: Modeling Exponential Functions

135 ANS:
neither I nor II
\[ (x-y)^2 = x^2 - 2xy + y^2 \quad (x+y)^3 = x^3 + 3x^2y + 3xy^2 + y^3 \]

PTS: 2  REF: 061902aii  TOP: Polynomial Identities
136 ANS:

\[ f(x) = \frac{4}{3}x + \frac{8}{3} \]

\[ x = \frac{3}{4}y + 2 \]

\[ -4x = 3y - 8 \]

\[ -4x + 8 = 3y \]

\[ \frac{4}{3}x + \frac{8}{3} = y \]

PTS: 2  REF: 061616aii  TOP: Inverse of Functions

KEY: linear

137 ANS:

\[ y = -\frac{1}{8}(x - 2)^2 - 1 \]

The vertex is \((2, -1)\) and \(p = 2\).  \( y = -\frac{1}{4(2)}(x - 2)^2 - 1 \)

PTS: 2  REF: 081619aii  TOP: Graphing Quadratic Functions

138 ANS:

\[ 56 \]

\[ P(28) = 52(28) = 56 \]

PTS: 2  REF: 011702aii  TOP: Modeling Exponential Functions

139 ANS:

\[ 631 \]

\[ 84.1 \% \times 750 \approx 631 \]

PTS: 2  REF: 011923aii  TOP: Normal Distributions

KEY: predict

140 ANS:

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

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

PTS: 2  REF: 061803aii  TOP: Rational Expressions

KEY: factoring
141 ANS: 0.0668

PTS: 2       REF: 081711aii       TOP: Normal Distributions

KEY: percent

142 ANS: exponential function

PTS: 2       REF: 081903aii       TOP: Families of Functions

143 ANS:
\( f(x) = (x + 1)(x - 1)(x - 2) = (x^2 - 1)(x - 2) = x^3 - 2x^2 - x + 2 \)

PTS: 2       REF: 081921aii       TOP: Graphing Polynomial Functions

144 ANS:
\( V = 120 \sin(120 \pi t) \)

period = \( \frac{2\pi}{B} \)

\[ \frac{1}{60} = \frac{2\pi}{B} \]

\( B = 120\pi \)

PTS: 2       REF: 061624aii       TOP: Modeling Trigonometric Functions

145 ANS:
\( B(t) = 750(1.012)^{12t} \)

\( B(t) = 750 \left( 1.16^{\frac{1}{12}} \right)^{12t} \approx 750(1.012)^{12t} \)

\( B(t) = 750 \left( 1 + \frac{0.16}{12} \right)^{12t} \) is wrong, because the growth is an annual rate that is not compounded monthly.

PTS: 2       REF: spr1504aii       TOP: Modeling Exponential Functions
146 ANS:
\[ (3, 0) \]
\[
\log_2(x - 1) - 1 = 0 \\
\log_2(x - 1) = 1 \\
x - 1 = 2^1 \\
x = 3
\]

PTS: 2  REF: 061819aii  TOP: Graphing Logarithmic Functions

147 ANS:
\[ f(n) = -8.75 + 0.75n \]

PTS: 2  REF: 061720aii  TOP: Sequences  KEY: explicit

148 ANS:
\[ y = \frac{1}{8} (x - 1)^2 \]

The vertex is (1,0) and \( p = 2 \).

PTS: 2  REF: 061717aii  TOP: Graphing Quadratic Functions

149 ANS:
I. only
II. Ninth graders drive to school less often; III. Students know little about adults; IV. Calculus students love math!

PTS: 2  REF: 081602aii  TOP: Analysis of Data  KEY: bias

150 ANS:
\[ \pm i \]
\[ wx^2 + w = 0 \]
\[ wx^2 = -w \]
\[ x^2 = -1 \]
\[ x = \pm i \]

PTS: 2  REF: 061912aii  TOP: Solving Quadratics  KEY: complex solutions | taking square roots

151 ANS:
\[ C(n) = \frac{329.99 + 108.78n}{n} \]

PTS: 2  REF: 061722aii  TOP: Modeling Rationals

152 ANS:
\[ G(x) - C \]

PTS: 2  REF: 081817aii  TOP: Transformations with Functions
153 ANS:
\[(1.00427)^{\frac{1}{12}} \approx 1.00427\]

PTS: 2  REF: 061621aii  TOP: Modeling Exponential Functions

154 ANS:
\((-0.9, 1.9)\)

PTS: 2  REF: 011712aii  TOP: Other Systems

155 ANS:
\[380 \approx 380\]

PTS: 2  REF: 061918aii  TOP: Normal Distributions

KEY: predict

156 ANS:
\[2,125,760\]
\[8r^3 = 216 \quad S_{12} = \frac{8 - 8(3)^{12}}{1 - 3} = 2125760\]
\[r^3 = 27\]
\[r = 3\]

PTS: 2  REF: 081902aii  TOP: Series

157 ANS:
\[f^{-1}(x) = \sqrt[3]{x + 2}\]
\[y = x^3 - 2\]
\[x = y^3 - 2\]
\[x + 2 = y^3\]
\[\sqrt[3]{x + 2} = y\]

PTS: 2  REF: 061815aii  TOP: Inverse of Functions

KEY: other

158 ANS:
\[ac(bd)^x\]

PTS: 2  REF: 011710aii  TOP: Operations with Functions
159 ANS:
\[ C = 550(1.00643)^{12} \]
\[ 1.00643^{12} \approx 1.08 \]

PTS: 2 REF: 081808aii TOP: Modeling Exponential Functions

160 ANS:
\[-0.15x^3 - 0.02x^2 + 28x - 120 \]
\[ x(30 - 0.01x) - (0.15x^3 + 0.01x^2 + 2x + 120) = 30x - 0.01x^2 - 0.15x^3 - 0.01x^2 - 2x - 120 \]
\[ = -0.15x^3 - 0.02x^2 + 28x - 120 \]

PTS: 2 REF: 061709aii TOP: Operations with Functions

161 ANS:
\[ \{2\} \]
\[ \sqrt{x + 14} = \sqrt{2x + 5} + 1 \]
\[ \sqrt{22 + 14} - \sqrt{2(22) + 5} = 1 \]
\[ x + 14 = 2x + 5 + 2\sqrt{2x + 5} + 1 \]
\[ 6 - 7 \neq 1 \]
\[ -x + 8 = 2\sqrt{2x + 5} \]
\[ x^2 - 16x + 64 = 8x + 20 \]
\[ x^2 - 24x + 44 = 0 \]
\[ (x - 22)(x - 2) = 0 \]
\[ x = 2, 22 \]

PTS: 2 REF: 081704aii TOP: Solving Radicals
KEY: advanced

162 ANS:
\[ y = \frac{1}{4}x - \frac{5}{4} \]
\[ x = 4y + 5 \]
\[ x - 5 = 4y \]
\[ \frac{1}{4}x - \frac{5}{4} = y \]

PTS: 2 REF: 061909aii TOP: Inverse of Functions
KEY: linear

163 ANS:
\[ 6^{\frac{3}{5}} \]
\[ 4x \cdot x^{\frac{2}{3}} + 2x^{\frac{5}{3}} = 4x^{\frac{5}{3}} + 2x^{\frac{5}{3}} + 6x^{\frac{5}{3}} = 6^{\frac{3}{5}}x^{\frac{5}{3}} \]

PTS: 2 REF: 061820aii TOP: Operations with Radicals
KEY: with variables, index > 2
164 ANS: 
\[ \frac{3}{5} \]

\[ \cos \theta = -\frac{6}{10} = -\frac{3}{5} \]

PTS: 2 REF: 061617aii TOP: Determining Trigonometric Functions
KEY: extension to reals

165 ANS: 
\[ \{8\} \]

\[ b^2 = 2b^2 - 64 \]

\[ -b^2 = -64 \]

\[ b = \pm 8 \]

-8 is extraneous.

PTS: 2 REF: 061919aii TOP: Solving Radicals
KEY: extraneous solutions

166 ANS: 
4

\[ 3x - (-2x + 14) = 16 \quad 3(6) - 4z = 2 \]

\[ 5x = 30 \quad -4z = -16 \]

\[ x = 6 \quad z = 4 \]

PTS: 2 REF: 011803aii TOP: Solving Linear Systems
KEY: three variables

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

\[ x = \frac{y}{y+2} \]

\[ xy + 2x = y \]

\[ xy - y = -2x \]

\[ y(x - 1) = -2x \]

\[ y = \frac{-2x}{x-1} \]

PTS: 2 REF: 081924aii TOP: Inverse of Functions
KEY: other
168 ANS: \[
\frac{255 + 93T}{T+3} = 90
\]

PTS: 2  REF: 061602aii  TOP: Modeling Rationals

169 ANS:
\[
\left\{ -\frac{7}{2}, -3 \right\}
\]
\[
x(x + 7) \left[ \frac{3x + 25}{x + 7} - 5 = \frac{3}{x} \right]
\]
\[
x(3x + 25) - 5x(x + 7) = 3(x + 7)
\]
\[
3x^2 + 25x - 5x^2 - 35x = 3x + 21
\]
\[
2x^2 + 13x + 21 = 0
\]
\[
(2x + 7)(x + 3) = 0
\]
\[
x = -\frac{7}{2}, -3
\]

PTS: 2  REF: fall1501aii  TOP: Solving Rationals

KEY: rational solutions

170 ANS:
I, II, and III

PTS: 2  REF: 061716aii  TOP: Radicals and Rational Exponents

KEY: variables

171 ANS:
\[
\frac{\pi}{3}
\]

PTS: 2  REF: 011701aii  TOP: Graphing Trigonometric Functions

172 ANS:
$6166.50$
\[
5000 \left( 1 + \frac{.035}{12} \right)^{12 \cdot 6} \approx 6166.50
\]

PTS: 2  REF: 081917aii  TOP: Exponential Growth

173 ANS:
0.25
\[
P(B) \cdot P(A|B) = P(A \text{ and } B)
\]
\[
P(B) \cdot 0.8 = 0.2
\]
\[
P(B) = 0.25
\]

PTS: 2  REF: 081913aii  TOP: Conditional Probability
174 ANS: 
\[ f^{-1}(x) = \frac{2x + 1}{x - 1} \]
\[ x = \frac{y + 1}{y - 2} \]
\[ xy - 2x = y + 1 \]
\[ xy - y = 2x + 1 \]
\[ y(x - 1) = 2x + 1 \]
\[ y = \frac{2x + 1}{x - 1} \]

PTS: 2  REF: 081714aii  TOP: Inverse of Functions
KEY: other

175 ANS: 
0.8415

PTS: 2  REF: 081604aii  TOP: Normal Distributions
KEY: probability

176 ANS: 
10.4

PTS: 2  REF: 011804aii  TOP: Determining Trigonometric Functions
KEY: radians

177 ANS: 
0.03
\[ ME = z \sqrt{\frac{p(1-p)}{n}} = 1.96 \sqrt{\frac{(0.55)(0.45)}{900}} \approx 0.03 \]

PTS: 2  REF: 081612aii  TOP: Analysis of Data

178 ANS: 
77
\[ T(19) = 8 \sin(0.3(19) - 3) + 74 \approx 77 \]

PTS: 2  REF: 061922aii  TOP: Determining Trigonometric Functions
KEY: radians
179 ANS:
\[ \frac{1}{5} \pm \frac{\sqrt{19}i}{5} \]
\[ x = \frac{2 \pm \sqrt{(-2)^2 - 4(5)(4)}}{2(5)} = \frac{2 \pm \sqrt{-76}}{10} = \frac{2 \pm i\sqrt{4 \cdot 19}}{10} = \frac{1}{5} \pm \frac{i\sqrt{19}}{5} \]

PTS: 2  REF: 011905aii  TOP: Solving Quadratics  
KEY: complex solutions | quadratic formula

180 ANS:
\[ -24x^3 - 30xi \]
\[ 6xi(-4xi + 5) = -24x^2i^4 + 30xi^3 = -24x^2(1) + 30x(-1) = -24x^2 - 30xi \]

PTS: 2  REF: 061704aii  TOP: Operations with Complex Numbers

181 ANS:

The zeros of the polynomial are at \(-b\), and \(c\). The sketch of a polynomial of degree 3 with a negative leading coefficient should have end behavior showing as \(x\) goes to negative infinity, \(f(x)\) goes to positive infinity. The multiplicities of the roots are correctly represented in the graph.

PTS: 2  REF: spr1501aii  TOP: Graphing Polynomial Functions  
KEY: bimodalgraph

182 ANS:
\[ g(x) = \log_3(x + 5) \]

PTS: 2  REF: 011902aii  TOP: Graphing Logarithmic Functions

183 ANS:

PTS: 2  REF: 081920aii  TOP: Other Systems
184 ANS:
\[ \frac{2x^2 + x + 5}{2x - 1} = \frac{2x^2 + x + 5}{4x^3 + 0x^2 + 9x - 5} \]
\[ 4x^3 - 2x^2 \]
\[ 2x^2 + 9x \]
\[ 2x^2 - x \]
\[ 10x - 5 \]
\[ 10x - 5 \]

PTS: 2 REF: 081713aii TOP: Rational Expressions
KEY: division

185 ANS:
\[ P_0 = 19,378,000 \]
\[ P_i = 1.015P_{i-1} \]

PTS: 2 REF: 081624aii TOP: Sequences

186 ANS:
5.62

PTS: 2 REF: 081819aii TOP: Other Systems

187 ANS:
\[ P(t) = 3500(1.00206)^{12t} \]
\[ \frac{1}{1.025^{12}} \approx 1.00206 \]

PTS: 2 REF: 081924aii TOP: Modeling Exponential Functions

188 ANS:
\[ f(7) - f(-7) = \frac{2^{-0.25(7)} \cdot \sin \left( \frac{\pi}{2} (7) \right) - 2^{-0.25(-7)} \cdot \sin \left( \frac{\pi}{2} (-7) \right)}{7 - (-7)} \approx -0.26 \]

PTS: 2 REF: 061721aii TOP: Rate of Change