Algebra II Regents Bimodal Worksheet # 1

Algebra II Regents Bimodal Worksheets

1. The roots of the equation $3x^2 + 2x = -7$ are

2. 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?

3. 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?

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

5. If $p(x) = 2\ln(x) - 1$ and $m(x) = \ln(x + 6)$, then what is the solution for $p(x) = m(x)$?

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

7. What is the inverse of $f(x) = -6(x - 2)$?

8. 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.

9. Given $f^{-1}(x) = -\frac{3}{4}x + 2$, which equation represents $f(x)$?

10. The solutions to $x + 3 - \frac{4}{x - 1} = 5$ are
11 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?

12 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/m² (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/m² be classified?

13 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?

14 The solution of $87e^{0.3x} = 5918$, to the nearest thousandth, is

15 What is the solution to $8(2^{x+3}) = 48$?
16 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?

17 What is the solution set of the equation 
\[ \frac{3x + 25}{x + 7} - 5 = \frac{3}{x} \]?

18 The function \( N(x) = 90(0.86)^x + 69 \) can be used to predict the temperature of a cup of hot chocolate in degrees Fahrenheit after \( x \) minutes. What is the approximate average rate of change of the temperature of the hot chocolate, in degrees per minute, over the interval \([0,6]\)?

19 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?

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

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

22 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?

23 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

24 Which diagram shows an angle rotation of 1 radian on the unit circle?
25 The solutions to the equation $-\frac{1}{2}x^2 = -6x + 20$ are

26 What is the solution set of $x = \sqrt[3]{3x + 40}$?

27 A number, minus twenty times its reciprocal, equals eight. The number is

28 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?

29 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?

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

31 A solution of the equation $2x^2 + 3x + 2 = 0$ is

32 What is the solution set for $x$ in the equation below?

$$\sqrt{x+1} - 1 = x$$

33 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?

34 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?

35 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?

36 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?
37 The solutions to the equation $5x^2 - 2x + 13 = 9$ are

38 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

39 What is the inverse of the function $y = 4x + 5$?

40 When the expression $(x + 2)^3 + 4(x + 2) + 3$ is rewritten as the product of two binomials, the result is

41 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?

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

43 For positive values of $x$, which expression is equivalent to $\sqrt[3]{16x^2} \cdot \sqrt[3]{x^3} + \sqrt[3]{8x^5}$

44 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?

45 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

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

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

47 The completely factored form of $n^4 - 9n^2 + 4n^3 - 36n - 12n^2 + 108$ is

48 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 $\sec \theta$?
49 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?

50 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?

51 Expressed in simplest \(a + bi\) form, \((7 - 3i) + (x - 2i)^2 - (4i + 2x^2)\) is

52 What is the solution set of the equation \(\frac{10}{x^2 - 2x} + \frac{4}{x} = \frac{5}{x - 2}\)?

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

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

55 The graph of the function \(p(x)\) is sketched below.

Which equation could represent \(p(x)\)?

56 The solution to the equation \(4x^2 + 98 = 0\) is

57 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 \(\tan \theta\)?

58 The expression \(\frac{6x^3 + 17x^2 + 10x + 2}{2x + 3}\) equals

59 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.]
60 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?

61 Data for the students enrolled in a local high school are shown in the Venn diagram below.

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?

62 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?

63 Which equation represents a parabola with the focus at $(0,-1)$ and the directrix of $y = 1$?

64 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?

65 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?

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

Which expression defines $f(x)$?

67 The expression $\frac{9x^2 - 2}{3x + 1}$ is equivalent to
68 The graph of \( p(x) \) is shown below.

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

69 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 \((a^2 + b^2)^2 = (a^2 - b^2)^2 + (2ab)^2\)

70 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?

71 A recursive formula for the sequence 18, 9, 4.5, ... is

72 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

73 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. \( \frac{x - 1}{2} - \frac{3}{2} \)

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

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

76 Which graph has the following characteristics?

- three real zeros
- as \( x \to -\infty \), \( f(x) \to -\infty \)
- as \( x \to \infty \), \( f(x) \to \infty \)
77 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 3.78.

78 The population of Jamesburg for the years 2010-2013, respectively, was reported as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>250,000</td>
</tr>
<tr>
<td>2011</td>
<td>250,937</td>
</tr>
<tr>
<td>2012</td>
<td>251,878</td>
</tr>
<tr>
<td>2013</td>
<td>252,822</td>
</tr>
</tbody>
</table>

How can this sequence be recursively modeled?

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

80 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?

81 Which equation represents the equation of the parabola with focus \((-3, 3)\) and directrix \( y = 7 \)?

82 What is the solution set of the following system of equations?

\[
\begin{align*}
\ y &= 3x + 6 \\
\ y &= (x + 4)^2 - 10
\end{align*}
\]

83 If \( \sin^2(32^\circ) + \cos^2(M) = 1 \), then \( M \) equals

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

85 Which expression is equivalent to \((2x - i)^2 - (2x - i)(2x + 3i)\) where \( i \) is the imaginary unit and \( x \) is a real number?

86 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

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

88 The solution set for the equation \( b = \sqrt{2b^2 - 64} \) is
89 If \( p(x) = ab^x \) and \( r(x) = cd^x \), then \( p(x) \cdot r(x) \) equals

90 Which equation represents the set of points equidistant from line \( \ell \) and point \( R \) shown on the graph below?

![Graph](image)

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

92 What is the solution set of the equation \( \frac{2}{3x + 1} = \frac{1}{x} - \frac{6x}{3x + 1} \)?

93 Which expression is equivalent to \( \frac{2x^4 + 8x^3 - 25x^2 - 6x + 14}{x + 6} \)?

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

95 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

96 For the system shown below, what is the value of \( z \)?

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

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

98 The function \( p(t) = 110e^{0.0392t} \) 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

99 What is the inverse of the function \( y = \log_ax \)?
100 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

101 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?

102 If a solution of \( 2(2x - 1) = 5x^2 \) is expressed in simplest \( a + bi \) form, the value of \( b \) is

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

104 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?

105 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.

106 Which equation is represented by the graph shown below?
107 What is the inverse of \( f(x) = x^3 - 2 \)?

108 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. \( (x - 2)(x^2 - 9) = 0 \)

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

110 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

112 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

113 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?

114 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

115 The roots of the equation \( x^2 + 2x + 5 = 0 \) are

116 What is the solution, if any, of the equation \( \frac{2}{x+3} - \frac{3}{4-x} = \frac{2x-2}{x^2-x-12} \)?

117 What are the solution(s) to the system of equations shown below?

\[
\begin{align*}
x^2 + y^2 &= 5 \\
y &= 2x
\end{align*}
\]
118 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>0-10</th>
<th>11-50</th>
<th>Over 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-18</td>
<td>4</td>
<td>37</td>
<td>68</td>
</tr>
<tr>
<td>19-22</td>
<td>6</td>
<td>25</td>
<td>87</td>
</tr>
<tr>
<td>23-60</td>
<td>25</td>
<td>47</td>
<td>157</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?

119 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

120 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?

121 The expression $6 - (3x - 2i)^2$ is equivalent to

122 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.

123 The solution to the equation $18x^2 - 24x + 87 = 0$ is

124 If $f(x) = \log_3 x$ and $g(x)$ is the image of $f(x)$ after a translation five units to the left, which equation represents $g(x)$?
125 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?

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

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

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

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

130 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?

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

132 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?

133 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?

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

What are the values of \( a \), \( b \), and \( c \)?
135 A sketch of \( r(x) \) is shown below.

An equation for \( r(x) \) could be

136 The completely factored form of
\[
2d^4 + 6d^3 - 18d^2 - 54d
\]
is

137 The expression \( 6xi^3(-4xi + 5) \) is equivalent to

138 Consider the following patterns:
 I. 16, -12, 9, -6.75, ...
 II. 1, 4, 9, 16, ...
 III. 6, 18, 30, 42, ...
 IV. \( \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \ldots \)
Which pattern is geometric?

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

140 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?

141 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

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

143 To the nearest tenth, the value of \( x \) that satisfies
\[
2^x = -2x + 11
\]is
144 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?

145 Consider the data in the table below.

<table>
<thead>
<tr>
<th></th>
<th>Right Handed</th>
<th>Left Handed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>87</td>
<td>13</td>
</tr>
<tr>
<td>Female</td>
<td>89</td>
<td>11</td>
</tr>
</tbody>
</table>

What is the probability that a randomly selected person is male given the person is left handed?

146 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

147 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?

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

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

150 Susan won $2,000 and invested it into an account with an annual interest rate of 3.2%. If her investment were compounded monthly, which expression best represents the value of her investment after $t$ years?

151 If $x - 1$ is a factor of $x^3 - kx^2 + 2x$, what is the value of $k$?
152 Which diagram represents an angle, \( \alpha \), measuring \( \frac{13\pi}{20} \) radians drawn in standard position, and its reference angle, \( \theta \)?

153 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?

154 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?

155 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?

156 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?

157 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

158 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 \( P(B) \)?

159 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?

160 Written in simplest form, the fraction \( \frac{x^3 - 9x}{9 - x^2} \), where \( x \neq \pm 3 \), is equivalent to
161 If \( (a^3 + 27) = (a + 3)(a^2 + ma + 9) \), then \( m \) equals

162 Which equation has \( 1 - i \) as a solution?

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

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

165 Which statement(s) are true for all real numbers?
   I \( (x - y)^2 = x^2 + y^2 \)
   II \( (x + y)^3 = x^3 + 3xy + y^3 \)

166 If \( \cos \theta = -\frac{3}{4} \) and \( \theta \) is in Quadrant III, then \( \sin \theta \) is equivalent to

167 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

168 Factored completely, \( m^5 + m^3 - 6m \) is equivalent to

169 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

170 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 \( \cos \theta \)?

171 The function \( N(t) = 100e^{-0.023t} \) 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?

172 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, \( k \)?

173 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?
174 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

\[ B(t) = 750(1.16)^t \]

175 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?

\[ y = \text{Half}$20,000 \times (1 + 0.009)^{t/12} + \text{Half}$20,000 \times e^{0.008t} \]

176 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?

\[ P(t) = 5 \times 2^{t/4} \]

177 Which value, to the nearest tenth, is the smallest solution of \( f(x) = g(x) \) if \( f(x) = 3 \sin \left( \frac{1}{2} x \right) - 1 \) and \( g(x) = x^3 - 2x + 1 \)?

\[ x = 0.3 \]

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

\[ (2 - yi)^2 = 2^2 - 2(2)(yi) + (yi)^2 = 4 - 4yi - y^2i^2 = 4 - 4yi + y^2 \]

179 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?

\[ y = g(x) = \text{Defined by graph} \]

180 What is the solution set of the equation \( \frac{2}{x} - \frac{3x}{x + 3} = \frac{x}{x + 3} \)?

\[ x = -2 \]

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

\[ g(x) = 2x - 16 \]

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

\[ \frac{10x^3 - 3x^2 - 7x + 3}{2x - 1} = 5x^2 + 2x - 3 + \frac{2}{2x - 1} \]
183 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?

184 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

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

186 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?

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

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

189 Chet has $1200 invested in a bank account modeled by the function $P(n) = 1200(1.002)^n$, where $P(n)$ is the value of his account, in dollars, after $n$ months. Chet's debt is modeled by the function $Q(n) = 100n$, where $Q(n)$ is the value of debt, in dollars, after $n$ months. After $n$ months, which function represents Chet's net worth, $R(n)$?

190 Which equation represents a parabola with a focus of $(-2, 5)$ and a directrix of $y = 9$?
191 Given $c(m) = m^3 - 2m^2 + 4m - 8$, the solution of $c(m) = 0$ is

192 A recursive formula for the sequence 40, 30, 22.5, . . . is

193 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?

194 The sequence $a_1 = 6, a_n = 3a_{n-1}$ can also be written as

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

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

197 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?

198 Consider $f(x) = 4x^2 + 6x - 3$, and $p(x)$ defined by the graph below.

The difference between the values of the maximum of $p$ and minimum of $f$ is
Algebra II Regents Bimodal Worksheets

Answer Section

1. ANS:
\[
\frac{1}{3} \pm \frac{2i\sqrt{5}}{3}
\]
\[
x = \frac{-2 \pm \sqrt{2^2 - 4(3)(7)}}{2(3)} = \frac{-2 \pm \sqrt{-80}}{6} = \frac{-2 \pm i\sqrt{16 \cdot 5}}{6} = \frac{1}{3} \pm \frac{2i\sqrt{5}}{3}
\]
PTS: 2 REF: 081809aii TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

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

3. ANS:
496 ± 230
496 ± 2(115)

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

4. ANS:
\{0, ±3, 4\}
\[
x^4 - 4x^3 - 9x^2 + 36x = 0
\]
\[
x^3(x - 4) - 9x(x - 4) = 0
\]
\[
(x^3 - 9x)(x - 4) = 0
\]
\[
x(x^2 - 9)(x - 4) = 0
\]
\[
x(x + 3)(x - 3)(x - 4) = 0
\]
\[
x = 0, ±3, 4
\]
PTS: 2 REF: 061606aii TOP: Solving Polynomial Equations

5. ANS:
5.62

PTS: 2 REF: 081819aii TOP: Other Systems
6 ANS:

![Graphing Polynomial Functions](image)

7 ANS:

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

8 ANS:

0.03

\[ ME = \left( z \sqrt{\frac{p(1-p)}{n}} \right) = \left( 1.96 \sqrt{\frac{(0.55)(0.45)}{900}} \right) \approx 0.03 \text{ or } \frac{1}{\sqrt{900}} \approx 0.03 \]

9 ANS:

\[ f(x) = \frac{4}{3} x + \frac{8}{3} \]
\[ x = -\frac{3}{4} y + 2 \]
\[ -4x = 3y - 8 \]
\[ -4x + 8 = 3y \]
\[ -\frac{4}{3} x + \frac{8}{3} = y \]

ID: A
10 ANS:
\[ \frac{3 \pm \sqrt{17}}{2} \]
\[ x - \frac{4}{x - 1} = 2 \]
\[ x = \frac{3 \pm \sqrt{(-3)^2 - 4(1)(-2)}}{2(1)} = \frac{3 \pm \sqrt{17}}{2} \]
\[ x(x - 1) - 4 = 2(x - 1) \]
\[ x^2 - x - 4 = 2x - 2 \]
\[ x^2 - 3x - 2 = 0 \]

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

11 ANS:
(0.134, 0.374) 
0.254 ± 2(0.060) \rightarrow (0.134, 0.374)

PTS: 2 REF: 061913aii TOP: Analysis of Data

12 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

13 ANS:
\[ C = 550(1.00643)^{12t} \]
\[ 1.00643^{12} \approx 1.08 \]

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

14 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
15 ANS:
\[ x = \frac{\ln 6}{\ln 2} - 3 \]
\[ 8(2^{x + 3}) = 48 \]
\[ 2^{x + 3} = 6 \]
\[ (x + 3)\ln 2 = \ln 6 \]
\[ x + 3 = \frac{\ln 6}{\ln 2} \]
\[ x = \frac{\ln 6}{\ln 2} - 3 \]

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

16 ANS:
\[ 7 \]
\[ 1240(1.06)^x = 890(1.11)^x \]
\[ x \approx 7 \]

PTS: 2  REF: 061814aii  TOP: Other Systems

17 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

18 ANS:
\[ -8.93 \]
\[ \frac{N(6) - N(0)}{6 - 0} \approx -8.93 \]

PTS: 2  REF: 012012aii  TOP: Rate of Change
19  ANS:  
0.0668

PTS: 2  REF: 081711aii  TOP: Normal Distributions  
KEY: percent

20  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: 081807aii  TOP: Solving Radicals  
KEY: extraneous solutions

21  ANS:  
\[x^2 + 1 + \frac{4}{x + 2}\]  
\[x^2 + 0x + 1\]  
\[x^2 + 2x^2 + x + 6\]  
\[x^3 + 2x^2\]  
\[0x^2 + x\]  
\[0x^2 + 0x\]  
\[x + 6\]  
\[x + 2\]  
\[4\]

PTS: 2  REF: 081611aii  TOP: Rational Expressions  
KEY: division

22  ANS:  
exponential function

PTS: 2  REF: 081903aii  TOP: Families of Functions
23 \text{ ANS:}  
\[ c(x) = 0.2x^2 - 100x + 300 \]  
\[ p(x) = r(x) - c(x) \]  
\[ -0.5x^2 + 250x - 300 = -0.3x^2 + 150x - c(x) \]  
\[ c(x) = 0.2x^2 - 100x + 300 \]  
\text{PTS: 2} \quad \text{REF: 061813aii} \quad \text{TOP: Operations with Functions}  

24 \text{ ANS:}  
\text{PTS: 2} \quad \text{REF: 081616aii} \quad \text{TOP: Unit Circle} \quad \text{KEY: bimodalgraph}  

25 \text{ ANS:}  
6 \pm 2i  
\[ -2 \left( \frac{1}{2} x^2 = -6x + 20 \right) \]  
\[ x^2 - 12x = -40 \]  
\[ x^2 - 12x + 36 = -40 + 36 \]  
\[ (x - 6)^2 = -4 \]  
\[ x - 6 = \pm 2i \]  
\[ x = 6 \pm 2i \]  
\text{PTS: 2} \quad \text{REF: fall1504aii} \quad \text{TOP: Solving Quadratics} \quad \text{KEY: complex solutions | completing the square}  

26 \text{ ANS:}  
\{8\}  
\[ x^2 = 3x + 40. \ x = -5 \text{ is an extraneous solution.} \]  
\[ x^2 - 3x - 40 = 0 \]  
\[ (x - 8)(x + 5) = 0 \]  
\[ x = 8, -5 \]  
\text{PTS: 2} \quad \text{REF: 012010aii} \quad \text{TOP: Solving Radicals} \quad \text{KEY: extraneous solutions}
27 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: 061916aii TOP: Modeling Rationals

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

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

29 ANS:
2450
\[ \log_{0.8} \left( \frac{V}{17000} \right) = t \]
\[ \frac{17,000(0.8)^3 - 17,000(0.8)}{3 - 1} \approx -2450 \]
\[ 0.8^t = \frac{V}{17000} \]
\[ V = 17000(0.8)^t \]

PTS: 2 REF: 081709aii TOP: Rate of Change

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

PTS: 2 REF: 081709aii TOP: Determining Trigonometric Functions

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

PTS: 2 REF: 061612aii TOP: Solving Quadratics

KEY: complex solutions | quadratic formula
32 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

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

PTS: 2 REF: 011712aii TOP: Other Systems

34 ANS: 
\[V = 120 \sin(120\pi t)\] 
\[\text{period} = \frac{2\pi}{B}\] 
\[\frac{1}{60} = \frac{2\pi}{B}\] 
\[B = 120\pi\] 

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

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

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

36 ANS: 
\[10.4\] 

PTS: 2 REF: 011804aii TOP: Determining Trigonometric Functions KEY: radians
37 ANS:
\[ x = \frac{2 \pm \sqrt{(-2)^2 - 4(5)(4)}}{2(5)} = \frac{2 \pm \sqrt{-76}}{10} = \frac{2 \pm i\sqrt{19}}{10} = \frac{1}{5} \pm \frac{i\sqrt{19}}{5} \]

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

38 ANS:

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

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

39 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

40 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

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

PTS: 2  REF: 061706aii  TOP: Graphing Trigonometric Functions
42 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

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

PTS: 2    REF: 061820aii    TOP: Operations with Radicals
KEY: with variables, index > 2

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

PTS: 2    REF: 081724aii    TOP: Sequences

45 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

46 ANS:
I, II, and III

PTS: 2    REF: 061716aii    TOP: Radicals and Rational Exponents
KEY: variables
47 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

48 ANS:
\[-3\]

PTS: 2 REF: 011815aii TOP: Unit Circle

49 ANS:
8

PTS: 2 REF: 011716aii TOP: Other Systems

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

PTS: 2 REF: 011822aii TOP: Series

51 ANS:
\[(3 - x^2) - (4x + 7)i\]
\[7 - 3i + x^2 - 4xi + 4i^2 - 4i - 2x^2 = 7 - 7i - x^2 - 4xi - 4 = 3 - x^2 - 4xi - 7i = (3 - x^2) - (4x + 7)i\]

PTS: 2 REF: 012022aii TOP: Operations with Complex Numbers
52 ANS:
\[
x(x - 2) \left( \frac{10}{x^2 - 2x} + \frac{4}{x} = \frac{5}{x - 2} \right) \text{ 2 is extraneous.}
\]
\[
10 + 4(x - 2) = 5x \\
10 + 4x - 8 = 5x \\
2 = x
\]

PTS: 2  REF: 081915aii  TOP: Solving Rationals

KEY: rational solutions

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

PTS: 2  REF: 081702aii  TOP: Operations with Complex Numbers

54 ANS:
\[
2x^2 - 3x + 7 - \frac{11}{2x + 3} \\
2x + 3 \left( 4x^3 + 0x^2 + 5x + 10 \right) \\
\]
\[
4x^3 + 6x^2 \\
-6x^2 + 5x \\
-6x^2 - 9x \\
14x + 10 \\
14x + 21 \\
-11
\]

PTS: 2  REF: 061614aii  TOP: Rational Expressions

KEY: division

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

PTS: 2  REF: 061701aii  TOP: Graphing Polynomial Functions
56 ANS:
\[ \pm \frac{7i \sqrt{2}}{2} \]
\[ 4x^2 = -98 \]
x^2 = \frac{-98}{4}
x^2 = \frac{49}{2}

\[ x = \pm \sqrt{\frac{49}{2}} = \pm \frac{7i \sqrt{2}}{2} = \pm \frac{7i \sqrt{2}}{2} \]

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

57 ANS:
\[ \frac{24}{7} \]

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

PTS: 2  REF: 081811aii  TOP: Determining Trigonometric Functions

58 ANS:
\[ \frac{3x^2 + 4x - 1 + \frac{5}{2x + 3}}{2x + 3} \]
\[ \frac{3x^2 + 4x - 1}{6x^2 + 9x} \]
\[ \frac{8x^2 + 10x}{8x^2 + 12x} \]
\[ -2x + 2 \]
\[ -2x - 3 \]
\[ \frac{5}{5} \]

PTS: 2  REF: fall1503aii  TOP: Rational Expressions
KEY: division

59 ANS:
\[ (1.00427)^m \]
\[ \frac{1}{1.0525^{\frac{1}{12}}} \approx 1.00427 \]

PTS: 2  REF: 061621aii  TOP: Modeling Exponential Functions
60 ANS:
149
\[ d = 32 \cdot (0.8)^{b-1} \quad S_n = \frac{32 - 32 \cdot (0.8)^{12}}{1 - 0.8} \approx 149 \]

PTS: 2  
REF: 081721aii  
TOP: Series

61 ANS:
\[
\begin{align*}
\frac{85}{295} & \\
\frac{85}{210 + 85} & \\
\end{align*}
\]

PTS: 2  
REF: 081818aii  
TOP: Venn Diagrams

62 ANS:
\[ A = 100 \cdot (0.990656)^t \]
\[
\left( \frac{1}{2} \right)^{\frac{1}{73.83}} \approx 0.990656
\]

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

63 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. \( y = \frac{-1}{4p} (x-h)^2 + k \)
\[ y = \frac{-1}{4} (x-0)^2 + 0 \]
\[ y = \frac{-1}{4} x^2 \]

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

64 ANS:
\[ \frac{124}{x + 16y} \]

PTS: 2  
REF: 061824aii  
TOP: Modeling Rationals

65 ANS:
\[
29,400 \cdot \left( 1.068 \right)^{365r}
\]
1 year = 365 days

PTS: 2  
REF: 061823aii  
TOP: Modeling Exponential Functions
66 ANS: \[ \frac{x}{5(x^2)} \]

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

67 ANS:
\[
3x - 1 - \frac{1}{3x + 1} \left( \frac{3x - 1}{3x + 1} \right) \left( 9x^2 + 0x - 2 \right) \\
9x^2 + 3x \\
- 3x - 2 \\
-3x - 1 \\
- 1
\]

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

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

PTS: 2  REF: 081621aii  TOP: Remainder Theorem

69 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

70 ANS:
0.2743

PTS: 2  REF: 061817aii  TOP: Normal Distributions  KEY: probability
71 ANS:
\[ g_1 = 18 \]
\[ g_n = \frac{1}{2} g_{n-1} \]

(2) is not recursive

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

72 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

73 ANS:
I, II, and III
\[ \frac{x^2 - 4x}{2x} = \frac{x(x - 4)}{2x} = \frac{x - 4}{2} = \frac{x}{2} - \frac{4}{2} = \frac{x - 1 - 3}{2} = \frac{x - 4}{2} \]

PTS: 2 REF: 011921aii TOP: Rational Expressions

KEY: factoring

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

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

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

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

![Graph Image]

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

77 ANS:

$4.01$

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

78 ANS:

\[ j_1 = 250,000 \]

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

PTS: 2  REF: 061623aii  TOP: Sequences

79 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

80 ANS:

\[ -0.26 \]

\[ \frac{f(7) - f(-7)}{7 - (-7)} = \frac{2^{-0.25(7)} \sin \left( \frac{\pi}{2} (7) \right) - 2^{-0.25(-7)} \sin \left( \frac{\pi}{2} (-7) \right)}{14} \approx -0.26 \]

PTS: 2  REF: 061721aii  TOP: Rate of Change
81 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: 011914a  TOP: Graphing Quadratic Functions

82 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: 061903a  TOP: Quadratic-Linear Systems

83 ANS:
32°

PTS: 2  REF: 011704a  TOP: Simplifying Trigonometric Expressions

84 ANS:
4

PTS: 2  REF: 011924a  TOP: Other Systems

85 ANS:
\[ -4 - 8xi \]
\[(2x - i)^2 - (2x - i)(2x + 3i)\]
\[(2x - i)[(2x - i) - (2x + 3i)]\]
\[ (2x - i)(-4i) \]
\[-8xi + 4i^2 \]
\[-8xi - 4 \]

PTS: 2  REF: 011911a  TOP: Operations with Complex Numbers
86 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: 081617a1i  TOP: Solving Rationals
KEY: rational solutions

87 ANS:
\[ \pm i \]
\[
w x^2 + w = 0
\]
\[
w (x^2 + 1) = 0
\]
\[
x^2 = -1
\]
\[
x = \pm i
\]

PTS: 2  REF: 061912a1i  TOP: Solving Quadratics
KEY: complex solutions | taking square roots

88 ANS:
\{8\}
\[
b^2 = 2b^2 - 64 \quad \text{−8 is extraneous.}
\]
\[
-b^2 = -64
\]
\[
b = \pm 8
\]

PTS: 2  REF: 061919a1i  TOP: Solving Radicals
KEY: extraneous solutions

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

PTS: 2  REF: 011710a1i  TOP: Operations with Functions

90 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: 081619a1i  TOP: Graphing Quadratic Functions
91 ANS:

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

PTS: 2    REF: 011819a1i    TOP: Remainder Theorem

92 ANS:

\[
\begin{align*}
&\frac{2}{3x+1} = \frac{1}{x} - \frac{6x}{3x+1} - \frac{1}{3} \\
&\frac{6x + 2}{3x+1} = \frac{1}{x} \\
&6x^2 + 2x = 3x + 1 \\
&6x^2 - x - 1 = 0 \\
&(2x - 1)(3x + 1) = 0 \\
x &= \frac{1}{2}, -\frac{1}{3}
\end{align*}
\]

PTS: 2    REF: 011915a1i    TOP: Solving Rationals

93 ANS:

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

PTS: 2    REF: 081805a1i    TOP: Rational Expressions

KEY: division

94 ANS:

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

PTS: 2    REF: 011917a1i    TOP: Inverse of Functions

KEY: other
95 ANS:

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

PTS: 2  REF: 061922aii  TOP: Determining Trigonometric Functions
KEY: radians

96 ANS:

\[
\begin{align*}
3x - (-2x + 14) &= 16 \\
3(6) - 4z &= 2 \\
5x &= 30 \\
-4z &= -16 \\
x &= 6 \\
z &= 4
\end{align*}
\]

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

97 ANS:

\[
\sqrt{56-x} = x 
\]

\[ -8 \text{ is extraneous.} \]

\[
\begin{align*}
56 - x &= x^2 \\
0 &= x^2 + x - 56 \\
0 &= (x + 8)(x - 7) \\
x &= 7
\end{align*}
\]

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

98 ANS:

II, only
The 2010 population is 110 million.

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

99 ANS:

\[ y = 3^x \]

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

100 ANS:

\[ 10 \]

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

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

101 ANS:

\[ G(x) - C \]

PTS: 2  REF: 081817aii  TOP: Transformations with Functions
\[ 5x^2 - 4x + 2 = 0 \]
\[ 4 \pm \frac{\sqrt{(-4)^2 - 4(5)(2)}}{2(5)} = \frac{4 \pm \sqrt{-24}}{10} = \frac{4 \pm 2i\sqrt{6}}{10} = \frac{2 \pm i\sqrt{6}}{5} \]

PTS: 2  REF: 012020aii  TOP: Solving Quadratics
KEY: complex solutions | quadratic formula

ANS:
\[(k + 2)(k - 2)(k + 6)(k + 2)\]
\[k^4 - 4k^2 + 8k - 32k + 12k^2 - 48\]
\[k^2(k^2 - 4) + 8k(k^2 - 4) + 12(k^2 - 4)\]
\[(k^2 - 4)(k^2 + 8k + 12)\]
\[(k + 2)(k - 2)(k + 6)(k + 2)\]

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

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

PTS: 2  REF: 061722aii  TOP: Modeling Rationals

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

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

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

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

PTS: 2  REF: 061815aii  TOP: Inverse of Functions
KEY: other
108 ANS:
I and II, only
\[ x^3 + 2x^2 - 9x - 18 = 0 \]
\[ x^3 - 9x + 2x^2 - 18 = 0 \]
\[ x^3 - 9x + 2x^2 - 18 = 0 \]
\[ x^2(x + 2) - 9(x + 2) = 0 \]
\[ x(x^2 - 9) + 2(x^2 - 9) = 0 \]
\[ x(x^2 - 9) + 2(x^2 - 9) = 0 \]
\[ (x + 2)(x^2 - 9) = 0 \]

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

109 ANS:
\[-2 \]
\[ f(x) = (x + 1)(x - 1)(x - 2) = (x^2 - 1)(x - 2) = x^3 - 2x^2 - x + 2 \]

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

110 ANS:
0.8

PTS: 2 REF: 081824aii TOP: Conditional Probability

111 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

112 ANS:
48
\[ \bar{x} + 2\sigma \text{ represents approximately } 48\% \text{ of the data.} \]

PTS: 2 REF: 061609aii TOP: Normal Distributions

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

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

KEY: percent

KEY: probability
114 ANS:  
(2,5)  
The vertex is (2,2) and \( p = 3 \).  \( 3 + 2 = 5 \)  
PTS: 2  REF: 081823a1i  TOP: Graphing Quadratic Functions

115 ANS:  
\(-1 + 2i\) and \(-1 - 2i\)  
\( x^2 + 2x + 1 = -5 + 1 \)  
\( (x + 1)^2 = -4 \)  
\( x + 1 = \pm 2i \)  
\( x = -1 \pm 2i \)  
PTS: 2  REF: 081703a1i  TOP: Solving Quadratics  
KEY: complex solutions | completing the square

116 ANS:  
\( \frac{2(x - 4)}{(x + 3)(x - 4)} + \frac{3(x + 3)}{(x - 4)(x + 3)} = \frac{2x - 2}{x^2 - x - 12} \)  
\( \quad 2x - 8 + 3x + 9 = 2x - 2 \)  
\( \quad 3x = -3 \)  
\( \quad x = -1 \)  
PTS: 2  REF: 011717a1i  TOP: Solving Rationals  
KEY: rational solutions

117 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: 081916a1i  TOP: Quadratic-Linear Systems

118 ANS:  
\( \frac{157}{229} \)  
\( \frac{157}{25 + 47 + 157} \)  
PTS: 2  REF: 081607a1i  TOP: Conditional Probability
119 ANS: proportion $\approx .16$; margin of error $\approx .02$

$$\frac{212}{1334} \approx .16 \quad ME = \left(z \sqrt{\frac{p(1-p)}{n}}\right) = \left(1.96 \sqrt{\frac{(0.16)(0.84)}{1334}}\right) \approx 0.02 \quad \text{or} \quad \frac{1}{\sqrt{1334}} \approx .027$$

PTS: 2 REF: 081716aii TOP: Analysis of Data

120 ANS: 34

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

$$b = \frac{8}{11}$$

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

121 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

122 ANS: $B$ 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

123 ANS:

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

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

124 ANS:

$$g(x) = \log_3(x + 5)$$

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

125 ANS:

$$a_0 = 75,000$$

$$a_n = 0.92(a_{n-1})$$

PTS: 2 REF: 081810aii TOP: Sequences
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.

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

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

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

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

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

\[ xy + 2x = y \]

\[ xy - y = -2x \]

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

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

\[ P_0 = 19,378,000 \]

\[ P_t = 1.015P_{t-1} \]

\[ P_0 = 19,378,000 \]

\[ P_t = 1.015P_{t-1} \]
131 ANS:

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

PTS: 2  REF: 081812aii  TOP: Operations with Radicals

KEY: with variables, index > 2

132 ANS:

\[ 300e^{-0.87} = e^{rt} \]

\[ 0.42 = e^{rt} \]

\[ \ln 0.42 = \ln e^{rt} \]

\[ -0.87 \approx rt \]

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

133 ANS:

\[ 400(1.001121184)^{52t} \]

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

134 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

135 ANS:

\[ r(x) = (x-a)(x+b)(x+c)^2 \]

PTS: 2  REF: 061921aii  TOP: Graphing Polynomial Functions
136 ANS:
\[2d(d + 3)^2(d - 3)\]
\[2d(d^3 + 3d^2 - 9d - 27)\]
\[2d(d^2 + 3) - 9(d + 3))\]
\[2d(d^2 - 9)(d + 3)\]
\[2d(d + 3)(d - 3)(d + 3)\]
\[2d(d + 3)^2(d - 3)\]

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

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

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

138 ANS:
\[1\]
\[-\frac{12}{16} = \frac{9}{-12} = -\frac{6.75}{9}\]

PTS: 2 REF: 012017aii TOP: Sequences KEY: difference or ratio

139 ANS:
2.29 and 3.63

PTS: 2 REF: 011814aii TOP: Other Systems

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

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

141 ANS:
380
400 \cdot .954 \approx 380

PTS: 2 REF: 061918aii TOP: Normal Distributions
KEY: predict
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: $x^2 + y^2 - 8y + 16 = y^2 - 4y + 4$

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

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

143 ANS: 2.6
145 ANS:
\[
\frac{13}{24} + \frac{13}{13 + 11} = \frac{13}{24}
\]

PTS: 2  REF: 012011aii  TOP: Conditional Probability

146 ANS:
\[
2\%
\]

PTS: 2  REF: 081919aii  TOP: Normal Distributions

KEY: percent

147 ANS:
\[
S_7 = \frac{85000 - 85000(1.06)^7}{1 - 1.06} \approx 713476.20
\]

PTS: 2  REF: 061905aii  TOP: Series

148 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

149 ANS:
\[
\frac{2x^2 + x + 5}{2x - 1} \div \frac{4x^3 + 9x}{4x^3 - 2x^2 - x - 10x - 5}
\]

PTS: 2  REF: 081713aii  TOP: Rational Expressions

KEY: division
150 ANS: 
\[ 2000(1.003)^{12t} \]
\[ 2000 \left(1 + \frac{0.032}{12}\right)^{12t} \approx 2000(1.003)^{12t} \]

PTS: 2 REF: 012004aii TOP: Modeling Exponential Functions

151 ANS: 
\[ 3 \]
\[ 1^3 - k(1)^2 + 2(1) = 0 \]
\[ k = 3 \]

PTS: 2 REF: 061812aii TOP: Remainder Theorem

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

PTS: 2 REF: 081918aii TOP: Exponential Decay

153 ANS: 
\[ 631 \]
\[ 84.1\% \times 750 \approx 631 \]

PTS: 2 REF: 011923aii TOP: Normal Distributions

KEY: predict
\[ a_1 = 25,000, \ a_n = a_{n-1} + 1000 \]

PTS: 2  REF: 011824aii  TOP: Sequences

\[
\frac{255 + 93T}{T+3} = 90
\]

PTS: 2  REF: 061602aii  TOP: Modeling Rationals

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

\[
P(A) = 0.25
\]

\[
P(B) \cdot P(A|B) = P(A \text{ and } B)
\]

\[
P(B) \cdot 0.8 = 0.2
\]

\[
P(B) = 0.25
\]

PTS: 2  REF: 061714aii  TOP: Theoretical Probability

\[
2\%
\]

\[
9110 = 5000e^{30r}
\]

\[
\ln \frac{911}{500} = \ln e^{30r}
\]

\[
\ln \frac{911}{500} = 30r
\]

\[
\ln \frac{911}{500} = r
\]

\[
r \approx 0.02
\]

PTS: 2  REF: 061714aii  TOP: Theoretical Probability

\[
-x
\]

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

PTS: 2  REF: 012023aii  TOP: Rational Expressions

KEY: factoring
161 ANS: 

\[-3\]

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

162 ANS:

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

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

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

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

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

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

163 ANS:

\[\{2\}\]

\[\sqrt{x + 14} = \sqrt{2x + 5} + 1\]

\[\sqrt{22 + 14} - \sqrt{2(22) + 5} = 1\]

\[x + 14 = 2x + 5 + 2\sqrt{2x + 5} + 1\]

\[-x + 8 = 2\sqrt{2x + 5}\]

\[x^2 - 16x + 64 = 8x + 20\]

\[x^2 - 24x + 44 = 0\]

\[(x - 22)(x - 2) = 0\]

\[x = 2, 22\]

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

164 ANS:

\[-\frac{c - d}{d + 2c}\]

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

PTS: 2 REF: 011818aii TOP: Rational Expressions
KEY: factoring

165 ANS:

neither I nor II

\[(x - y)^2 = x^2 - 2xy + y^2\]

\[(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3\]

PTS: 2 REF: 061902aii TOP: Polynomial Identities
166 ANS: 
\[-\frac{\sqrt{7}}{4} - \sqrt{1 - \left(\frac{3}{4}\right)^2} = -\sqrt{\frac{16 - 9}{16}} = -\sqrt{\frac{7}{16}} = -\frac{\sqrt{7}}{4}\]

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

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

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

168 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

169 ANS:
\[2\]

PTS: 2 REF: 081920aii TOP: Other Systems

170 ANS:
\[-\frac{3}{5}\]

PTS: 2 REF: 061617aii TOP: Determining Trigonometric Functions
KEY: extension to reals
\[ \frac{N(10) - N(1)}{10 - 1} \approx -2.03, \quad \frac{N(20) - N(10)}{20 - 10} \approx -1.63, \quad \frac{N(25) - N(15)}{25 - 15} \approx -1.46, \quad \frac{N(30) - N(1)}{30 - 1} \approx -1.64 \]

**PTS:** 2  \quad **REF:** 061807aii  \quad **TOP:** Rate of Change

172  \quad **ANS:**  
\[-0.087\]

\[ 100 \left( \frac{1}{2} \right)^\frac{d}{s} = 100e^{kd} \]

\[ \left( \frac{1}{2} \right)^\frac{1}{s} = e^k \]

\[ k \approx -0.087 \]

**PTS:** 2  \quad **REF:** 061818aii  \quad **TOP:** Modeling Exponential Functions

173  \quad **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  \quad **REF:** 081902aii  \quad **TOP:** Series

174  \quad **ANS:**  
\[ B(t) = 750(1.012)^{12t} \]

\[ B(t) = 750 \left( 1.16^{\frac{12}{12}} \right)^{12t} \approx 750(1.012)^{12t} \quad B(t) = 750 \left( 1 + \frac{0.16}{12} \right)^{12t} \]

is wrong, because the growth is an annual rate that is not compounded monthly.

**PTS:** 2  \quad **REF:** spr1504aii  \quad **TOP:** Modeling Exponential Functions

175  \quad **ANS:**  
\[ f(t) = 10,000(1.00075)^{12t} + 10,000e^{0.008t} \]

\[ 1 + \frac{0.009}{12} = 1.00075 \]

**PTS:** 2  \quad **REF:** 011918aii  \quad **TOP:** Modeling Exponential Functions
176 ANS:
56
\[ P(28) = \frac{98}{28^2} \approx 56 \]

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

177 ANS:
\( -2.1 \)

PTS: 2 REF: 012021aii TOP: Other Systems

178 ANS:
\[-y^2 - 4yi + 4 \]
\[(2 - yi)(2 - yi) = 4 - 4yi + y^2 i^2 = -y^2 - 4yi + 4 \]

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

179 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
180 ANS:
\[
\left\{-1, \frac{3}{2}\right\}
\]
\[
\frac{2}{x} = \frac{4x}{x + 3}
\]
\[
2x + 6 = 4x^2
\]
\[
4x^2 - 2x - 6 = 0
\]
\[
2\left(2x^2 - x - 3\right) = 0
\]
\[
(2x - 3)(x + 1) = 0
\]
\[
x = \frac{3}{2}, -1
\]

PTS: 2  REF: 061809a1i  TOP: Solving Rationals

181 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: 081806a1i  TOP: Inverse of Functions

182 ANS:
\[
5x^2 + x - 3
\]
\[
\frac{5x^2 + x - 3}{2x - 1} \left(10x^3 - 3x^2 - 7x + 3\right)
\]
\[
10x^3 - 5x^2
\]
\[
2x^2 - 7x
\]
\[
2x^2 - x
\]
\[
-6x + 3
\]
\[
-6x + 3
\]

PTS: 2  REF: 011809a1i  TOP: Rational Expressions

KEY: linear

KEY: division
183 ANS:
\[ m_1 = 2000 \]
\[ m_n = (0.84)m_{n-1} \]

PTS: 2  REF: 081909a1i  TOP: Sequences  KEY: recursive

184 ANS:
8.52

PTS: 2  REF: 061914a1i  TOP: Other Systems

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

PTS: 2  REF: 011722a1i  TOP: Graphing Trigonometric Functions  KEY: recognize | bimodalgraph

186 ANS:
0.8415

PTS: 2  REF: 081604a1i  TOP: Normal Distributions  KEY: probability

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

PTS: 2  REF: 011813a1i  TOP: Exponential Growth
ANS:
\[ f(n) = -8.75 + 0.75n \]

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

ANS:
\[ R(n) = 1200(1.002)^n - 100n \]

PTS: 2  REF: 012002aii  TOP: Operations with Functions

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

ANS:
\[ \pm 2i, 2 \]
\[ m^3 - 2m^2 + 4m - 8 = 0 \]
\[ m^2(m - 2) + 4(m - 2) = 0 \]
\[ (m^2 + 4)(m - 2) = 0 \]

PTS: 2  REF: 081821aii  TOP: Solving Polynomial Equations

ANS:
\[ g_1 = 40 \]
\[ g_n = \frac{3}{4}g_{n-1} \]
(1) and (3) are not recursive

PTS: 2  REF: 012013aii  TOP: Sequences  KEY: recursive

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

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

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

PTS: 2  REF: 081618aii  TOP: Sequences  KEY: recursive
195 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

196 ANS:
2 or -4
\[x^2 + 2x - 8 = 0\]
\[(x + 4)(x - 2) = 0\]
\[x = -4, 2\]

PTS: 2 REF: 081701aii TOP: Undefined Rationals

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

PTS: 2 REF: 081917aii TOP: Exponential Growth

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

PTS: 2 REF: 011922aii TOP: Comparing Functions