1. If $f(x) = 2(3^x) + 1$, what is the value of $f(2)$?
   1) 13  3) 37
   2) 19  4) 54

2. A high school sponsored a badminton tournament. After each round, one-half of the players were eliminated. If there were 64 players at the start of the tournament, which equation models the number of players left after 3 rounds?
   1) $y = 64(1 - .5)^3$  3) $y = 64(1 - .3)^{0.5}$
   2) $y = 64(1 + .5)^3$  4) $y = 64(1 + .3)^{0.5}$

3. Given $7x + 2 \geq 58$, which number is not in the solution set?
   1) 6  3) 10
   2) 8  4) 12

4. Which table could represent a function?
   1) 3)
   2) 4)

5. Which value of $x$ makes $\frac{x - 3}{4} + \frac{2}{3} = \frac{17}{12}$ true?
   1) 8  3) 0
   2) 6  4) 4

6. Which expression is equivalent to $18x^2 - 50$?
   1) $2(3x + 5)^2$  3) $2(3x - 5)(3x + 5)$
   2) $2(3x - 5)^2$  4) $2(3x - 25)(3x + 25)$
7 The functions \( f(x) = x^2 - 6x + 9 \) and \( g(x) = f(x) + k \) are graphed below. 

Which value of \( k \) would result in the graph of \( g(x) \)?

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

8 The shaded boxes in the figures below represent a sequence.

If figure 1 represents the first term and this pattern continues, how many shaded blocks will be in figure 35?

1) 55  
2) 148  
3) 420  
4) 805

9 The zeros of the function \( f(x) = x^3 - 9x^2 \) are

1) 9, only  
2) 0 and 9  
3) 0 and 3, only  
4) \(-3, 0, \) and 3
10 A middle school conducted a survey of students to determine if they spent more of their time playing games or watching videos on their tablets. The results are shown in the table below.

<table>
<thead>
<tr>
<th></th>
<th>Playing Games</th>
<th>Watching Videos</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>138</td>
<td>46</td>
<td>184</td>
</tr>
<tr>
<td>Girls</td>
<td>54</td>
<td>142</td>
<td>196</td>
</tr>
<tr>
<td>Total</td>
<td>192</td>
<td>188</td>
<td>380</td>
</tr>
</tbody>
</table>

Of the students who spent more time playing games on their tablets, approximately what percent were boys?
1) 41  
2) 56  
3) 72  
4) 75

11 Which statement best describes the solutions of a two-variable equation?
1) The ordered pairs must lie on the graphed equation.  
3) The ordered pairs must have $x = 0$ for one coordinate.  
2) The ordered pairs must lie near the graphed equation.  
4) The ordered pairs must have $y = 0$ for one coordinate.

12 The expression $x^2 - 10x + 24$ is equivalent to
1) $(x + 12)(x - 2)$  
3) $(x + 6)(x + 4)$  
2) $(x - 12)(x + 2)$  
4) $(x - 6)(x - 4)$

13 Which statement is true about the functions $f(x)$ and $g(x)$, given below?

$$f(x) = -x^2 - 4x - 4$$

1) The minimum value of $g(x)$ is greater than the maximum value of $f(x)$.  
3) $f(x)$ and $g(x)$ have the same roots.  
2) $f(x)$ and $g(x)$ have the same $y$-intercept.  
4) $f(x) = g(x)$ when $x = -4$. 

14 The equation \( V(t) = 12,000(0.75)^t \) represents the value of a motorcycle \( t \) years after it was purchased. Which statement is true?
1) The motorcycle cost $9000 when purchased.
2) The motorcycle cost $12,000 when purchased.
3) The motorcycle's value is decreasing at a rate of 75% each year.
4) The motorcycle's value is decreasing at a rate of 0.25% each year.

15 The solutions to \((x + 4)^2 - 2 = 7\) are
1) \(-4 \pm \sqrt{5}\)
2) \(4 \pm \sqrt{5}\)
3) \(-1\) and \(-7\)
4) \(1\) and \(7\)

16 Which expression is not equivalent to \(-4x^3 + x^2 - 6x + 8\)?
1) \(x^2(-4x + 1) - 2(3x - 4)\)
2) \(x(-4x^2 - x + 6) + 8\)
3) \(-4x^3 + (x - 2)(x - 4)\)
4) \(-4(x^3 - 2) + x(x - 6)\)

17 Which situation could be modeled as a linear equation?
1) The value of a car decreases by 10% every year.
2) The number of fish in a lake doubles every 5 years.
3) Two liters of water evaporate from a pool every day.
4) The amount of caffeine in a person's body decreases by \(\frac{1}{3}\) every 2 hours.

18 The range of the function \( f(x) = |x + 3| - 5 \) is
1) \([-5, \infty)\)
2) \((-\infty, -5]\)
3) \([3, \infty)\)
4) \((3, \infty)\)

19 A laboratory technician used the function \( t(m) = 2(3)^{2m+1} \) to model her research. Consider the following expressions:

I. \(6(3)^{2m}\)  II. \(6(6)^{2m}\)  III. \(6(9)^m\)

The function \( t(m) \) is equivalent to
1) I, only
2) II, only
3) I and III
4) II and III

20 Which system of equations has the same solutions as the system below?
\[
\begin{align*}
3x - y &= 7 \\
2x + 3y &= 12
\end{align*}
\]
1) \(6x - 2y = 14\)
2) \(-6x + 9y = 36\)
3) \(-9x - 3y = -21\)
4) \(3x - y = 7\)
4) \(x + y = 2\)
21. A population of paramecia, \( P \), can be modeled using the exponential function \( P(t) = 3(2)^t \), where \( t \) is the number of days since the population was first observed. Which domain is most appropriate to use to determine the population over the course of the first two weeks?

1) \( t \geq 0 \)  
2) \( t \leq 2 \)  
3) \( 0 \leq t \leq 2 \)  
4) \( 0 \leq t \leq 14 \)

22. Given the following data set:

\[
65, 70, 70, 70, 80, 80, 80, 85, 90, 90, 95, 95, 95, 100
\]

Which representations are correct for this data set?

1) I and II  
2) I and III, only  
3) II and III, only  
4) I, II, and III

23. A recursively defined sequence is shown below.

\[
a_1 = 5 \quad a_{n+1} = 2a_n - 7
\]

The value of \( a_4 \) is

1) \(-9\)  
2) \(-1\)  
3) \(8\)  
4) \(15\)
24 Which polynomial has a leading coefficient of 4 and a degree of 3?

1) \(3x^4 - 2x^2 + 4x - 7\)  
2) \(4 + x - 4x^2 + 5x^3\)  
3) \(4x^4 - 3x^3 + 2x^2\)  
4) \(2x + x^2 + 4x^3\)

25 Graph \(f(x) = -\sqrt{x} + 1\) on the set of axes below.

26 Maria orders T-shirts for her volleyball camp. Adult-sized T-shirts cost $6.25 each and youth-sized T-shirts cost $4.50 each. Maria has $550 to purchase both adult-sized and youth-sized T-shirts. If she purchases 45 youth-sized T-shirts, determine algebraically the maximum number of adult-sized T-shirts she can purchase.

27 A news report suggested that an adult should drink a minimum of 4 pints of water per day. Based on this report, determine the minimum amount of water an adult should drink, in fluid ounces, per week.

28 Express \((3x - 4)(x + 7) - \frac{1}{4}x^2\) as a trinomial in standard form.

29 John was given the equation \(4(2a + 3) = -3(a - 1) + 31 - 11a\) to solve. Some of the steps and their reasons have already been completed. State a property of numbers for each missing reason.

\[
\begin{align*}
4(2a + 3) &= -3(a - 1) + 31 - 11a & \text{Given} \\
8a + 12 &= -3a + 3 + 31 - 11a \\
8a + 12 &= 34 - 14a & \text{Combining like terms} \\
22a + 12 &= 34 \\
\end{align*}
\]

30 State whether the product of \(\sqrt{3}\) and \(\sqrt{9}\) is rational or irrational. Explain your answer.

31 Use the method of completing the square to determine the exact values of \(x\) for the equation \(x^2 - 8x + 6 = 0\).
32 A formula for determining the finite sum, $S$, of an arithmetic sequence of numbers is $S = \frac{n}{2} (a + b)$, where $n$ is the number of terms, $a$ is the first term, and $b$ is the last term. Express $b$ in terms of $a$, $S$, and $n$.

33 Michael threw a ball into the air from the top of a building. The height of the ball, in feet, is modeled by the equation $h = -16t^2 + 64t + 60$, where $t$ is the elapsed time, in seconds. Graph this equation on the set of axes below.

Determine the average rate of change, in feet per second, from when Michael released the ball to when the ball reached its maximum height.
34. Graph the system of inequalities:

\[-x + 2y - 4 < 0\]
\[3x + 4y + 4 \geq 0\]

Stephen says the point (0,0) is a solution to this system. Determine if he is correct, and explain your reasoning.

35. The following table represents a sample of sale prices, in thousands of dollars, and number of new homes available at that price in 2017.

<table>
<thead>
<tr>
<th>Sale Price, ( p ) (in thousands of dollars)</th>
<th>160</th>
<th>180</th>
<th>200</th>
<th>220</th>
<th>240</th>
<th>260</th>
<th>280</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of New Homes Available, ( f(p) )</td>
<td>126</td>
<td>103</td>
<td>82</td>
<td>75</td>
<td>82</td>
<td>40</td>
<td>20</td>
</tr>
</tbody>
</table>

State the linear regression function, \( f(p) \), that estimates the number of new homes available at a specific sale price, \( p \). Round all values to the nearest hundredth. State the correlation coefficient of the data to the nearest hundredth. Explain what this means in the context of the problem.

36. The length of a rectangular sign is 6 inches more than half its width. The area of this sign is 432 square inches. Write an equation in one variable that could be used to find the number of inches in the dimensions of this sign. Solve this equation algebraically to determine the dimensions of this sign, in inches.
Two families went to Rollercoaster World. The Brown family paid $170 for 3 children and 2 adults. The Peckham family paid $360 for 4 children and 6 adults. If \( x \) is the price of a child's ticket in dollars and \( y \) is the price of an adult's ticket in dollars, write a system of equations that models this situation. Graph your system of equations on the set of axes below.

State the coordinates of the point of intersection. Explain what each coordinate of the point of intersection means in the context of the problem.
0120AI Common Core State Standards
Answer Section

1 ANS: 2
\[ f(2) = 2(3^2) + 1 = 19 \]

PTS: 2 REF: 012001ai NAT: F.IF.A.2 TOP: Functional Notation

2 ANS: 1
PTS: 2 REF: 012002ai NAT: F.BF.A.1
TOP: Modeling Exponential Functions KEY: AI

3 ANS: 1
\[ 7x + 2 \geq 58 \]
\[ 7x \geq 56 \]
\[ x \geq 8 \]

PTS: 2 REF: 012003ai NAT: A.REI.B.3 TOP: Interpreting Solutions

4 ANS: 2
PTS: 2 REF: 012004ai NAT: F.IF.A.1
TOP: Defining Functions KEY: ordered pairs

5 ANS: 2
\[ \frac{x-3}{4} + \frac{8}{12} = \frac{17}{12} \]
\[ \frac{x-3}{4} = \frac{9}{12} \]
\[ \frac{x-3}{4} = \frac{3}{4} \]
\[ x - 3 = 3 \]
\[ x = 6 \]

PTS: 2 REF: 012005ai NAT: A.REI.B.3 TOP: Solving Linear Equations
KEY: fractional expressions

6 ANS: 3
\[ 18x^2 - 50 = 2(9x^2 - 25) = 2(3x - 5)(3x + 5) \]


7 ANS: 4
PTS: 2 REF: 012007ai NAT: F.BF.B.3
TOP: Graphing Polynomial Functions

8 ANS: 2
\[ a_n = 4n + 8 \]
\[ a_{35} = 4(35) + 8 = 148 \]

PTS: 2 REF: 012008ai NAT: F.IF.A.3 TOP: Sequences
KEY: explicit
9 ANS: 2
\[ f(x) = x^3 - 9x^2 = x^2(x - 9) = 0 \]
\[ x = 0,9 \]

PTS: 2 REF: 012009ai NAT: A.APR.B.3 TOP: Zeros of Polynomials

10 ANS: 3
\[ \frac{138}{192} \approx 72\% \]

PTS: 2 REF: 012010ai NAT: S.ID.B.5 TOP: Frequency Tables KEY: two-way


13 ANS: 2
The y-intercept of both \( f(x) \) and \( g(x) \) is \(-4\).

PTS: 2 REF: 012013ai NAT: F.IF.C.9 TOP: Comparing Functions

14 ANS: 2 PTS: 2 REF: 012014ai NAT: F.LE.B.5 TOP: Modeling Exponential Functions

15 ANS: 3
\[ (x + 4)^2 = 9 \]
\[ x + 4 = \pm 3 \]
\[ x = -1, -7 \]

PTS: 2 REF: 012015ai NAT: A.REI.B.4 TOP: Solving Quadratics KEY: taking square roots

16 ANS: 2
\[ x(-4x^2 - x + 6) + 8 = -4x^3 - x^2 + 6x + 8 \]

PTS: 2 REF: 012016ai NAT: A.APR.A.1 TOP: Operations with Polynomials KEY: multiplication

17 ANS: 3 PTS: 2 REF: 012017ai NAT: F.LE.A.1 TOP: Families of Functions

18 ANS: 1 PTS: 2 REF: 012018ai NAT: F.IF.A.2 TOP: Domain and Range KEY: real domain, absolute value

19 ANS: 3
\[ t(m) = 2(3)^{2m+1} = 2(3)^{2m}(3)^1 = 6(3)^{2m} = 6(3^2)^m = 6(9)^m \]

PTS: 2 REF: 012019ai NAT: A.SSE.B.3 TOP: Modeling Exponential Functions
20 ANS: 2
\[6(3x - y = 7)\]
\[2(2x + 3y = 12)\]

PTS: 2  REF: 012020ai  NAT: A.REI.C.6  TOP: Solving Linear Systems

21 ANS: 4

PTS: 2  REF: 012021ai  NAT: F.IF.B.5
TOP: Domain and Range

22 ANS: 4

PTS: 2  REF: 012022ai  NAT: S.ID.A.1
TOP: Dot Plots

23 ANS: 1
\[a_2 = 2(5) - 7 = 3\]
\[a_3 = 2(3) - 7 = -1\]
\[a_4 = 2(-1) - 7 = -9\]

PTS: 2  REF: 012023ai  NAT: F.IF.A.3  TOP: Sequences
KEY: recursive

24 ANS: 4
\[4x^3 + x^2 + 2x\]

PTS: 2  REF: 012024ai  NAT: A.SSE.A.1  TOP: Modeling Expressions

25 ANS:

\[f(x)\]

PTS: 2  REF: 012025ai  NAT: F.IF.C.7  TOP: Graphing Root Functions

26 ANS:
\[6.25a + 4.5(45) \leq 550\]
55 shirts
\[6.25a + 202.5 \leq 550\]
\[6.25a \leq 347.50\]
\[a \leq 55.6\]

PTS: 2  REF: 012026ai  NAT: A.CED.A.1  TOP: Modeling Linear Inequalities
27 ANS:
\[
\frac{4 \text{ pints}}{\text{day}} \times \frac{2 \text{ cups}}{1 \text{ pint}} \times \frac{8 \text{ ounces}}{1 \text{ cup}} \times \frac{7 \text{ days}}{\text{week}} = 448 \text{ ounces/week}
\]

PTS: 2  REF: 012027ai  NAT: N.Q.A.1  TOP: Conversions
KEY: dimensional analysis

28 ANS:
\[
3x^2 + 21x - 4x - 28 - \frac{1}{4} x^2 = 2.75x^2 + 17x - 28
\]

PTS: 2  REF: 012028ai  NAT: A.APR.A.1  TOP: Operations with Polynomials
KEY: multiplication

29 ANS:
Distributive and Addition Property of Equality

PTS: 2  REF: 012029ai  NAT: A.REI.A.1  TOP: Identifying Properties

30 ANS:
The product is irrational because \( \sqrt{27} \) can not be written as the ratio of two integers.

PTS: 2  REF: 012030ai  NAT: N.RN.B.3  TOP: Operations with Radicals
KEY: classify

31 ANS:
\[
x^2 - 8x = -6
\]
\[
x^2 - 8x + 16 = -6 + 16
\]
\[
(x - 4)^2 = 10
\]
\[
x - 4 = \pm \sqrt{10}
\]
\[
x = 4 \pm \sqrt{10}
\]

PTS: 2  REF: 012031ai  NAT: A.REI.B.4  TOP: Solving Quadratics
KEY: completing the square

32 ANS:
\[
2S = n(a + b)
\]
\[
\frac{2S}{n} = a + b
\]
\[
\frac{2S}{n} - a = b
\]

PTS: 2  REF: 012032ai  NAT: A.CED.A.4  TOP: Transforming Formulas
33 ANS:

\[
\frac{h(2) - h(0)}{2 - 0} = 32
\]

PTS: 4  REF: 012033ai  NAT: F.IF.B.4  TOP: Graphing Quadratic Functions
KEY: context

34 ANS:

Correct, as \(0 + 2(0) - 4 < 0\)
\[3(0) + 4(0) + 4 \geq 0\]

PTS: 4  REF: 012034ai  NAT: A.REI.D.12  TOP: Graphing Systems of Linear Inequalities
KEY: graph

35 ANS:

\[f(p) = -0.79p + 249.86\]  \(r = -0.95\) There is a strong negative correlation as the higher the sales price, the fewer number of new homes available.

PTS: 4  REF: 012035ai  NAT: S.ID.B.6  TOP: Regression
KEY: linear with correlation coefficient
36  ANS:

\[
\frac{1}{2} w + 6 = 432
\]

\[
\frac{1}{2} w^2 + 6w = 432 \quad l = \frac{1}{2} (24) + 6 = 18
\]

\[
w^2 + 12w - 864 = 0
\]

\[
(w - 24)(w + 36) = 0
\]

\[
w = 24
\]

PTS: 4
REF: 012036ai
NAT: A.CED.A.1
TOP: Geometric Applications of Quadratics

37  ANS:

\[
3x + 2y = 170
\]

\[
(30, 40) \text{ The price of a child’s ticket is $30 and the price of an adult’s}
\]

\[
4x + 6y = 360
\]

\[
ticket is $40.
\]

PTS: 6
REF: 012037ai
NAT: A.REI.C.6
TOP: Graphing Linear Systems