Texas STAAR 2021 Algebra I

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STAAR ALGEBRA I REFERENCE MATERIALS

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FACTORING

Perfect square trinomials	$a^2 + 2ab + b^2 = (a + b)^2$ $a^2 - 2ab + b^2 = (a - b)^2$
Difference of squares	$a^2 - b^2 = (a - b)(a + b)$

PROPERTIES OF EXPONENTS

Product of powers	$a^m a^n = a^{(m + n)}$
Quotient of powers	$\frac{a^m}{a^n} = a^{(m - n)}$
Power of a power	$(a^m)^n = a^{mn}$
Rational exponent	$a^{\frac{m}{n}} = \sqrt[n]{a^m}$
Negative exponent	$a^{-n} = \frac{1}{a^n}$

LINEAR EQUATIONS

Standard form	$Ax + By = C$
Slope-intercept form	$y = mx + b$
Point-slope form	$y - y_1 = m(x - x_1)$
Slope of a line	$m = \frac{y_2 - y_1}{x_2 - x_1}$

QUADRATIC EQUATIONS

Standard form	$f(x) = ax^2 + bx + c$
Vertex form	$f(x) = a(x - h)^2 + k$
Quadratic formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Axis of symmetry	$x = \frac{-b}{2a}$

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Algebra I

Administered May 2021

RELEASED

DIRECTIONS

Read each question carefully. For a multiple-choice question, determine the best answer to the question from the four answer choices provided. For a griddable question, determine the best answer to the question. Then fill in the answer on your answer document.

1 Which expression is equivalent to $\sqrt{184}$?

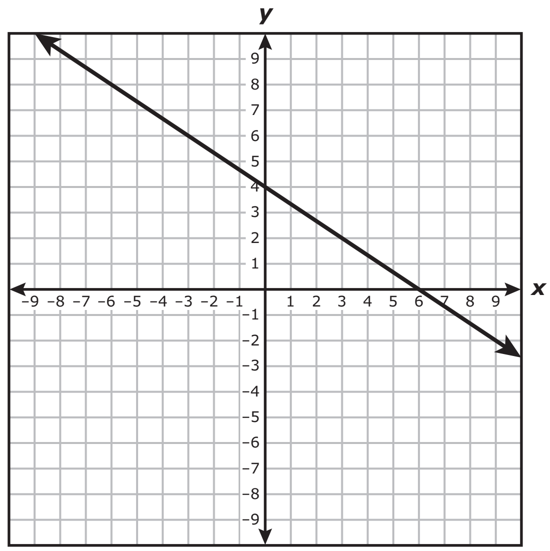
A 92

B $2\sqrt{46}$

C $4\sqrt{23}$

D $4\sqrt{46}$

2 The graph of a linear function is shown on the grid.



Which function is best represented by this graph?

F $g(x) = 6x + 4$

G $g(x) = 4x - \frac{2}{3}$

H $g(x) = -\frac{3}{2}x + 6$

J $g(x) = -\frac{2}{3}x + 4$

3 The values in the table represent a linear relationship between x and y.

x	-8.5	-6.5	-2.5	-1
y	-92	-72	-32	-17

What is the rate of change of y with respect to x?

A 10

B 17

C -10

D -17

---

4 Given $g(x) = x^2 - 6x - 16$, which statement is true?

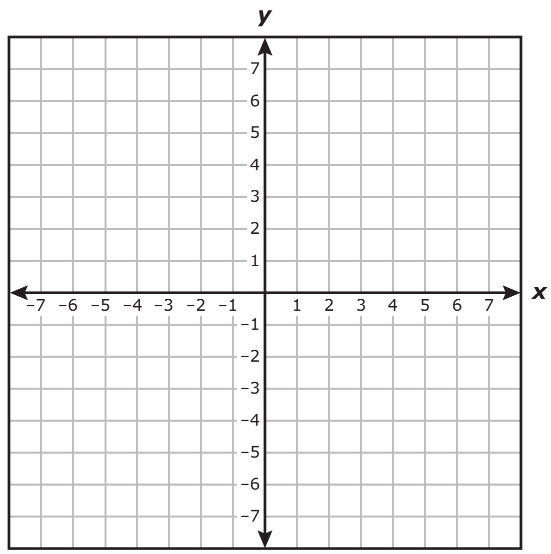
F The zeros are -8 and 2, because the factors of g are $(x + 8)$ and $(x - 2)$.

G The zeros are -8 and -2, because the factors of g are $(x + 8)$ and $(x + 2)$.

H The zeros are -2 and 8, because the factors of g are $(x + 2)$ and $(x - 8)$.

J The zeros are 2 and 8, because the factors of g are $(x - 2)$ and $(x - 8)$.

5 Which ordered pair is in the solution set of $8x + 16y > 32$?



A (0, 2)

B (−3, 5)

C (−1, 1)

D (4, 0)

---

6 What is the equation in slope-intercept form of the line that passes through the points (−26, −11) and (39, 34)?

F $y = -\dfrac{9}{13}x + 7$

G $y = -\dfrac{9}{13}x - 7$

H $y = \dfrac{9}{13}x + 7$

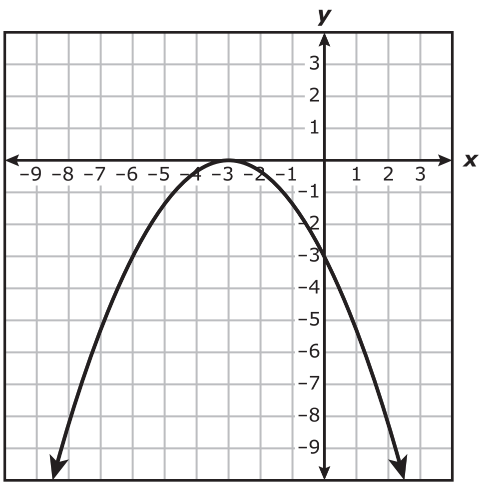
J $y = \dfrac{9}{13}x - 7$

7 Two characteristics of quadratic function p are given.

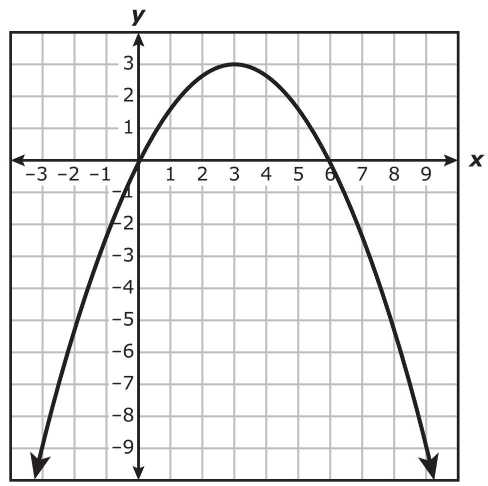
- The axis of symmetry of the graph of p is $x = -3$.
- Function p has exactly one zero.

Based on this information, which graph could represent p?

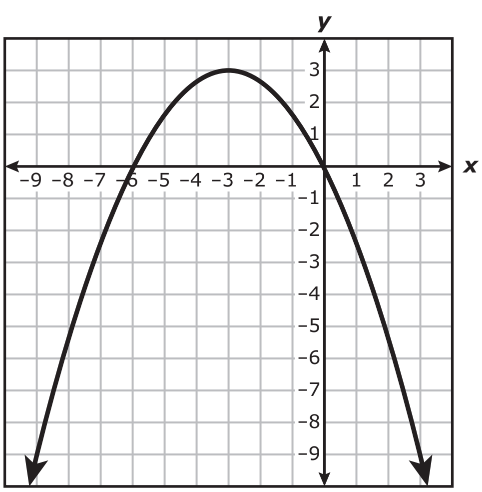
A



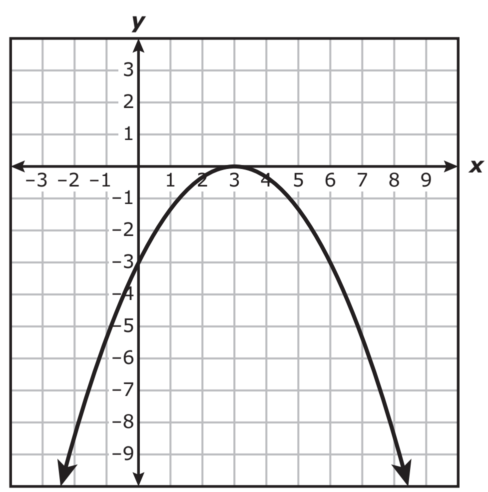
C



B



D



8 Which expression is equivalent to $(x^9yz^4)^5$?

F $x^{14}y^6z^9$

G $x^{14}y^5z^9$

H $x^{45}yz^{20}$

J $x^{45}y^5z^{20}$

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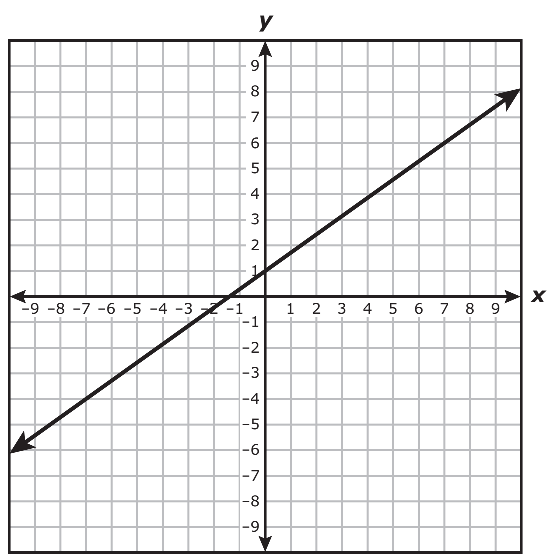
9 The graph of linear function g passes through the points $(-7, -4)$ and $(7, 6)$, as shown.



What are the slope and y-intercept of the graph of g?

A The slope is $\frac{5}{7}$, and the y-intercept is -1.

B The slope is $\frac{5}{7}$, and the y-intercept is 1.

C The slope is $\frac{7}{5}$, and the y-intercept is -1.

D The slope is $\frac{7}{5}$, and the y-intercept is 1.

10 What is the solution to $4(y - 3) + 19 = 8(2y + 3) + 7$?

F $-\frac{1}{2}$

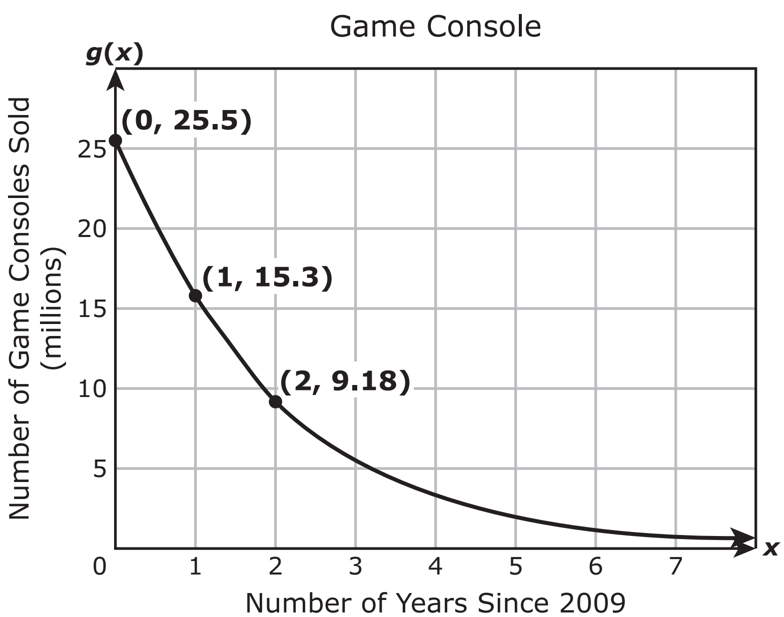
G $\frac{1}{2}$

H -2

J 2

---

11 The graph shows the number of game consoles sold in millions since 2009.



Based on this information, which function best models the number of game consoles sold in millions x years since 2009?

A $g(x) = 0.6(25.5)^x$

B $g(x) = 25.5(0.6)^x$

C $g(x) = 6.12(25.5)^x$

D $g(x) = 25.5(6.12)^x$

12 A ball is placed in a machine that throws the ball up in the air. The table represents some points on the graph of a function that models the ball's distance from the ground with respect to the time since the ball has been thrown.

Ball

Time Since Thrown from Machine (seconds)	0	0.25	0.50	0.75	1.00	1.25	1.50	1.75
Distance from Ground (meters)	0	2.76	4.90	6.43	7.35	7.66	7.35	6.43

What is the range for this situation?

F All real numbers less than or equal to 7.66

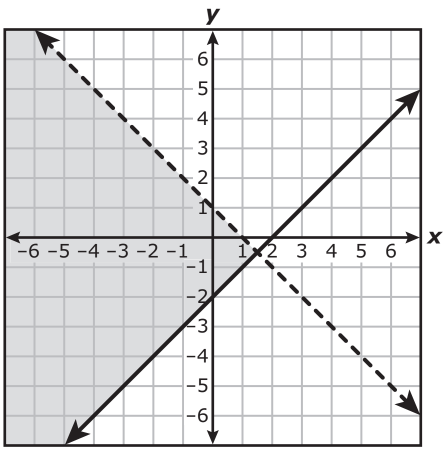
G All real numbers less than or equal to 1.25

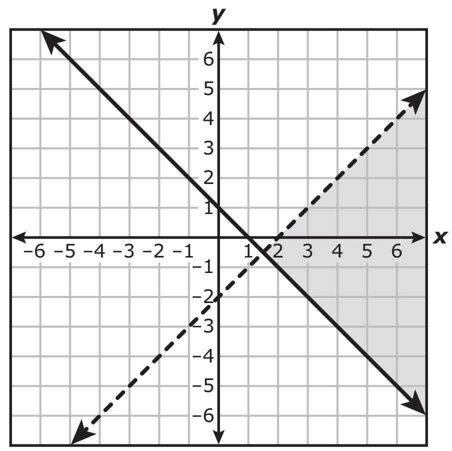
H All real numbers greater than or equal to 0 and less than or equal to 7.66

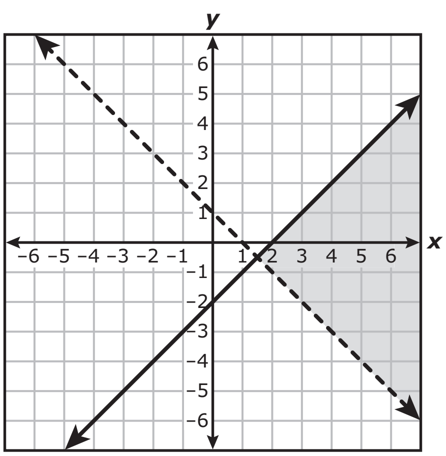
J All real numbers greater than or equal to 0 and less than or equal to 1.25

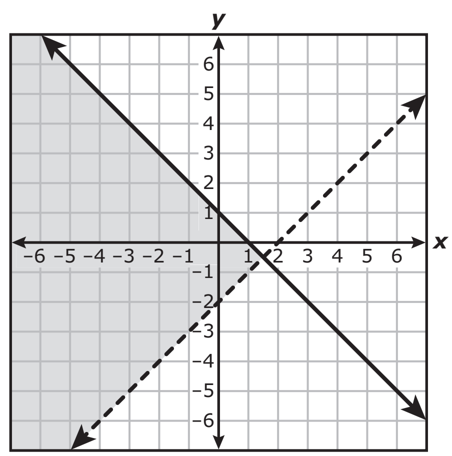
13 Which graph best represents the solution set to this system of inequalities?

$$x + y < 1$$
$$x - y \leq 2$$

A


C


B


D


GO ON

14 Given $p(x) = -4(x - 15)^2 + 2$, what is the value of $p(7)$?

Record your answer and fill in the bubbles on your answer document.

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15 A customer paid a total of \$6.00 for 68 copies at a print shop. Some of the copies were black-and-white copies, and the rest were color copies.

- Each black-and-white copy cost \$0.08.
- Each color copy cost \$0.15.

Which system of equations can be used to find b, the number of black-and-white copies, and c, the number of color copies that the customer paid for at the print shop?

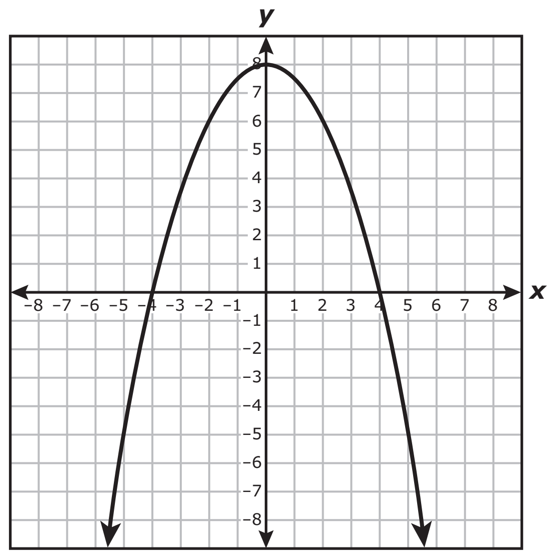
A $b + c = 6.00$
$0.08b + 0.15c = 68$

B $b + c = 68$
$0.15b + 0.08c = 6.00$

C $b + c = 6.00$
$0.15b + 0.08c = 68$

D $b + c = 68$
$0.08b + 0.15c = 6.00$

16 The graph of a quadratic function is shown on the grid.



Which function is best represented by this graph?

F $f(x) = -\frac{1}{2}x^2 + 16$

G $f(x) = -x^2 + 16$

H $f(x) = -\frac{1}{2}x^2 + 8$

J $f(x) = -x^2 + 8$

17 The table of values shows a linear relationship between x and y.

x	y
-7	9
-2	1
3	-7
8	-15

What is the slope of the line represented by the table of values?

A $-\frac{8}{5}$

B $-\frac{5}{8}$

C $\frac{8}{5}$

D $\frac{5}{8}$

---

18 Which expression is a factored form of $2x^2 - 25x + 63$?

F $(x + 9)(2x + 7)$

G $(x - 9)(2x - 7)$

H $(x + 7)(2x + 9)$

J $(x - 7)(2x - 9)$

19 What is the equation in standard form of the line that passes through the point $(6, -1)$ and is parallel to the line represented by $8x + 3y = 15$?

A $8x + 3y = -45$

B $8x - 3y = -51$

C $8x + 3y = 45$

D $8x - 3y = 51$

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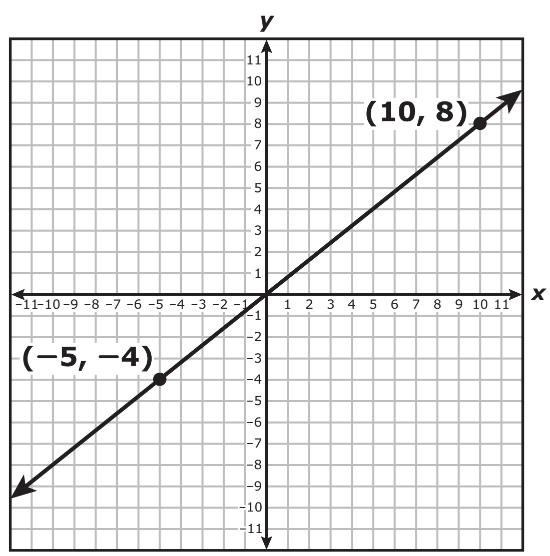
20 The graph of linear function h is shown on the grid.



Given $f(x) = x$ and $h(x) = af(x)$, what is the value of a?

Record your answer and fill in the bubbles on your answer document.

21 A conservation agency tracks the sea turtle population by counting the number of nesting sites where the turtles lay their eggs. The table shows the numbers of nesting sites for several years since 2001. The data can be modeled by an exponential function.

Sea Turtles

Number of Years Since 2001, x	Number of Nesting Sites, $n(x)$
1	46,125
2	37,994
3	40,513
4	29,368
5	34,082
6	31,746
7	27,691

Which function best models the data?

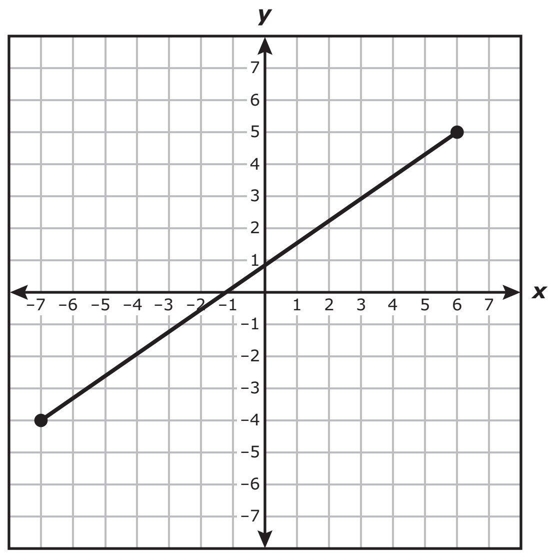
A $n(x) = 25{,}956.80(1.08)^x$

B $n(x) = 46{,}797.94(0.93)^x$

C $n(x) = 1.08(25{,}956.80)^x$

D $n(x) = 0.93(46{,}797.94)^x$

22 A part of linear function g is graphed on the grid.



Which inequalities best describe the domain and range of the part shown?

F Domain: $-4 < x < 5$
Range: $-7 < g(x) < 6$

G Domain: $-7 < x < 6$
Range: $-4 < g(x) < 5$

H Domain: $-4 \leq x \leq 5$
Range: $-7 \leq g(x) \leq 6$

J Domain: $-7 \leq x \leq 6$
Range: $-4 \leq g(x) \leq 5$

23 Which value of x is a solution to this equation?

$$3x^2 - 30x - 72 = 0$$

A $x = -12$

B $x = -4$

C $x = -2$

D $x = -6$

24 The tables of ordered pairs represent some points on the graphs of lines *f* and *g*.

Line *f*

x	y
2	7
4	10.5
7	15.75
11	22.75

Line *g*

x	y
−3	4
−2	0
1	−12
4	−24

Which system of equations represents lines *f* and *g*?

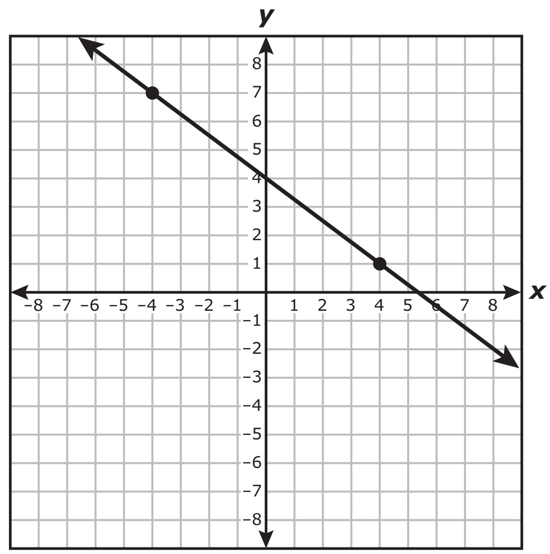
F $y = 1.75x + 3.5$
$y = -4x - 8$

G $y = 1.75x + 3.5$
$y = -4x - 2$

H $y = 3.5x + 1.75$
$y = -4x - 8$

J $y = 3.5x + 1.75$
$y = -4x - 2$

25 The graph of a linear function is shown on the grid.



What is the rate of change of *y* with respect to *x* for this function?

A $\frac{7}{9}$

B $-\frac{7}{9}$

C $\frac{3}{4}$

D $-\frac{3}{4}$

---

26 Which expression is equivalent to $\frac{36x^4y^5}{(3xy)^2}$ for all values of *x* and *y* where the expression is defined?

F $12x^3y^4$

G $27x^2y^3$

H $4x^2y^3$

J $6x^3y^4$

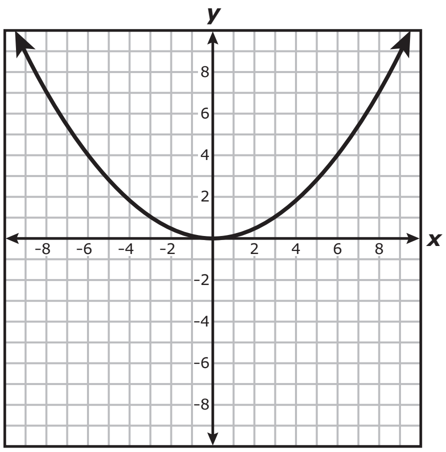
GO ON

27 What is the value of the y-intercept of the graph of $g(x) = 73\left(\frac{4}{5}\right)^x$?

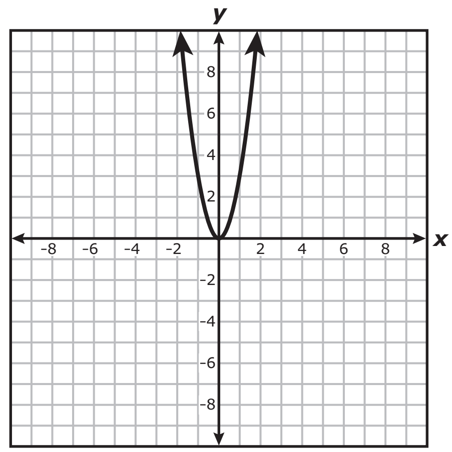
Record your answer and fill in the bubbles on your answer document.

28 The graph of $f(x) = x^2$ is reflected over the x-axis and is stretched horizontally to create the graph of function g. Which graph could represent g?

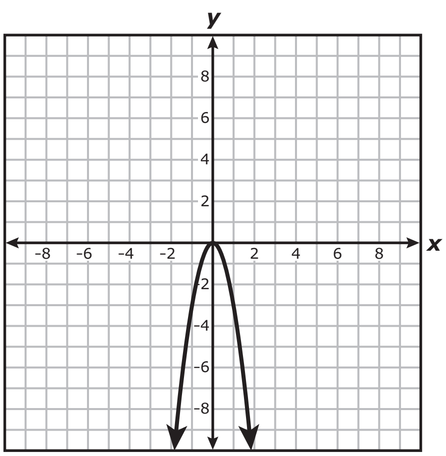
F



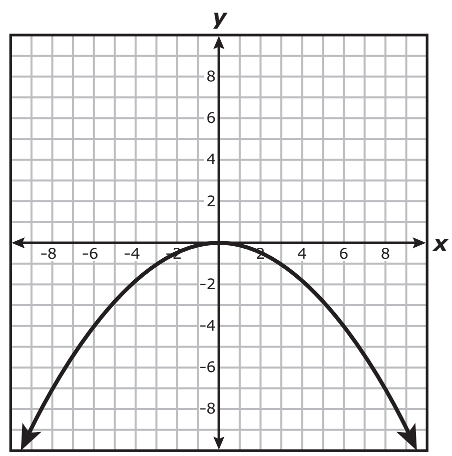
H



G



J



29 Which expression is equivalent to $\left(\frac{3}{2}p + 1\right)\left(\frac{1}{2}p + 3\right)$?

A $2p^2 + 3$

B $4p^2 + 3$

C $\frac{3}{4}p^2 + 5p + 3$

D $\frac{3}{4}p^2 + 10p + 3$

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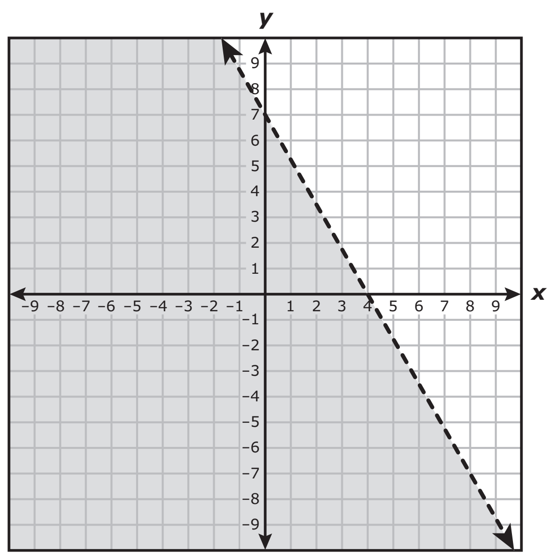
30 Which inequality is best represented by the graph?



F $4x + 7y \leq 49$

G $4x + 7y < 49$

H $7x + 4y \leq 28$

J $7x + 4y < 28$

31 Which situation best shows causation?

A The length of a rectangle affects the width of the rectangle.

B The amount of time a cell phone is used affects the charge of its battery.

C The number of ice-cream bars sold affects the number of milkshakes sold.

D The number of soccerballs a team owns affects the number of games the team wins during the soccer season.

32 Which expression is equivalent to $16w^2 + 24w + 9$?

F $(4w + 3)^2$

G $(4w - 3)^2$

H $(8w + 3)^2$

J $(8w - 3)^2$

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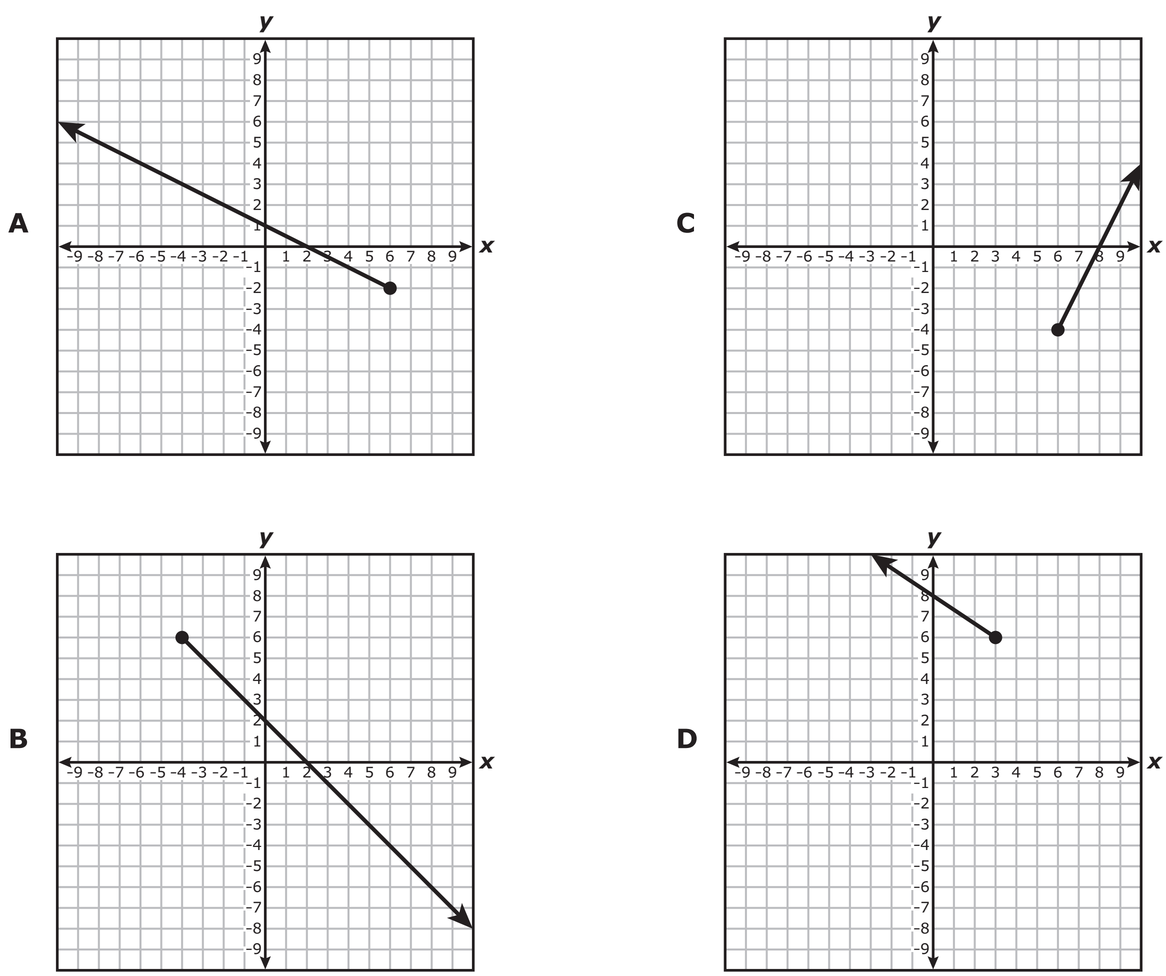
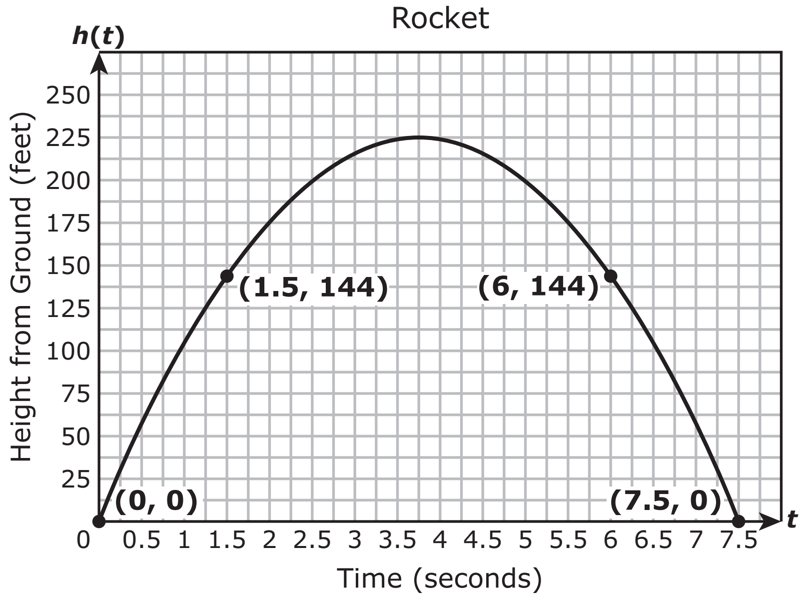
33 Which graph best represents a function with a domain of all real numbers less than or equal to 6?



GO ON

34 Quadratic function h can be used to model the height in feet of a rocket from the ground t seconds after it was launched. The graph of the function is shown.



What is the maximum value of the graph of the function?

Record your answer and fill in the bubbles on your answer document.

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35 Which expression is equivalent to $(15a^0b^2c^{34})(3a^{16}b^{-29}c^0)$ for all values of a, b, and c where the expression is defined?

A $\dfrac{18}{b^{58}}$

B $\dfrac{45}{b^{58}}$

C $\dfrac{18a^{16}c^{34}}{b^{27}}$

D $\dfrac{45a^{16}c^{34}}{b^{27}}$

GO ON

36 A contractor's total earnings from a job include a fixed amount plus an amount based on the number of hours worked. The values in the table represent the linear relationship between the number of hours worked and the contractor's total earnings in dollars.

Contractor

Number of Hours Worked	Total Earnings
0	\$20.00
5	\$63.75
15	\$151.25
25	\$238.75
35	\$326.25
40	\$370.00

What is the rate of change of the contractor's total earnings in dollars with respect to the number of hours worked?

F \$8.75 per hour worked

G \$9.25 per hour worked

H \$10.00 per hour worked

J \$20.00 per hour worked

---

37 What is the solution set for $2x^2 + 15 = -11x$?

A $\{-5, -1.5\}$

B $\{2.5, 3\}$

C $\{1.5, 5\}$

D $\{-3, -2.5\}$

38 The table represents some points on the graph of an exponential function.

x	$f(x)$
2	36
3	54
4	81
5	121.5
6	182.25

Which function represents this relationship?

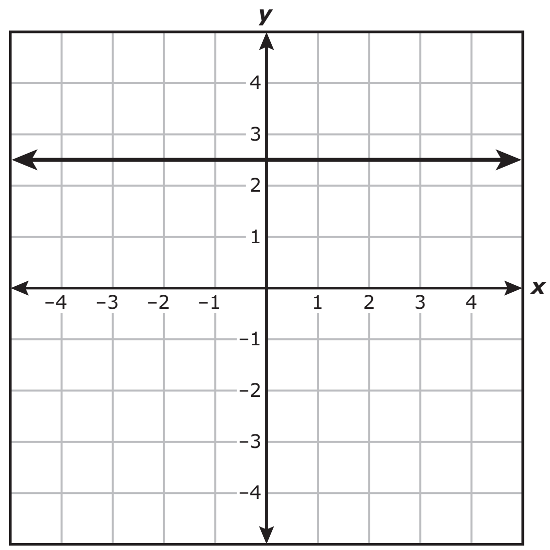
F $f(x) = 16\left(\frac{3}{2}\right)^x$

G $f(x) = 16\left(\frac{2}{3}\right)^x$

H $f(x) = 36\left(\frac{3}{2}\right)^x$

J $f(x) = 36\left(\frac{2}{3}\right)^x$

39 Which statement best represents the equation of the line shown on the grid and its relationship to the x-axis?



A The equation of the line is $x = 2.5$, and the line is parallel to the x-axis.

B The equation of the line is $x = 2.5$, and the line is perpendicular to the x-axis.

C The equation of the line is $y = 2.5$, and the line is parallel to the x-axis.

D The equation of the line is $y = 2.5$, and the line is perpendicular to the x-axis.

---

40 Which expression is equivalent to $9n^2 - 25$?

F $(3n - 5)^2$

G $(3n + 5)(3n - 5)$

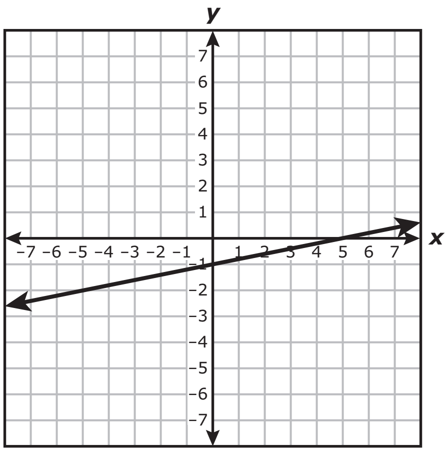
H $9(n - 4)^2$

J $9(n + 4)(n - 4)$

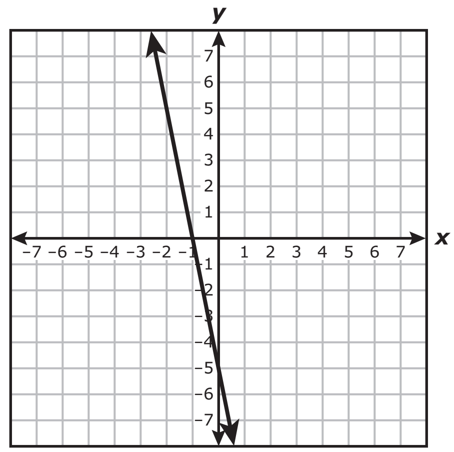
GO ON

41 Linear function t has an x-intercept of -1 and a y-intercept of 5. Which graph best represents t?

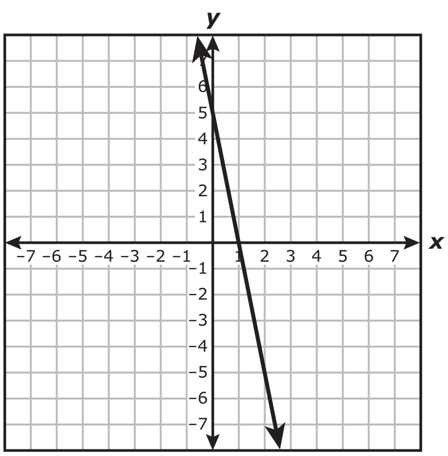
A



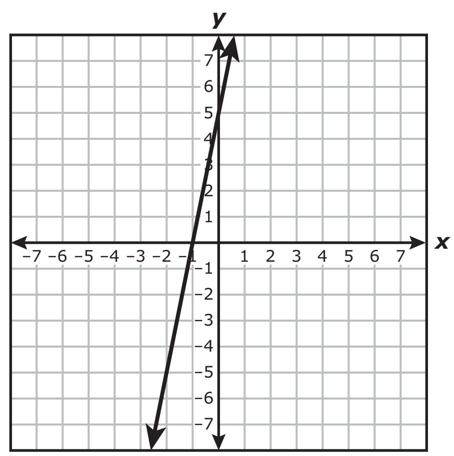
C



B



D

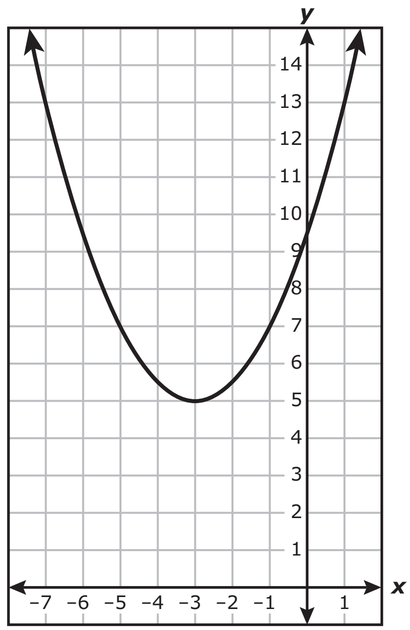


42 The value of y is directly proportional to the value of x. When $x = 3.5$, the value of y is 14.

What is the value of y when $x = 28$?

Record your answer and fill in the bubbles on your answer document.

43 A quadratic function is graphed on the grid.



Which answer choice best represents the domain and range of the function?

A Domain: $x \geq -3$
Range: $y \geq 5$

B Domain: All real numbers
Range: $y \geq 5$

C Domain: $x \geq -3$
Range: All real numbers

D Domain: $y \geq 5$
Range: $x \geq -3$

44 The table represents some points on the graph of linear function f.

x	-3	2	5	11
$f(x)$	-130	0	78	234

Which function represents f ?

F $f(x) = 26(x - 2)$

G $f(x) = -26(2x - 1)$

H $f(x) = 13(x - 2)$

J $f(x) = -2(26x - 1)$

---

45 Which expression is equivalent to $x^2 + 10x + 24$?

A $(x + 1)(x + 24)$

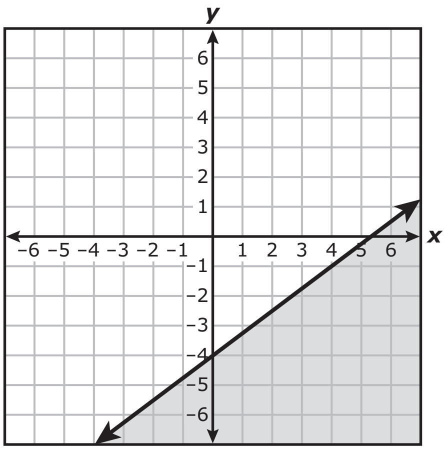
B $(x + 2)(x + 12)$

C $(x + 3)(x + 8)$

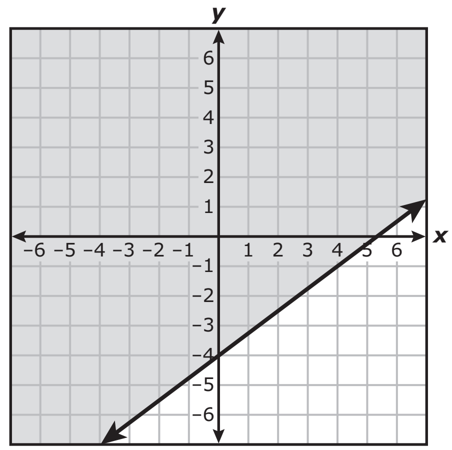
D $(x + 4)(x + 6)$

46 Which graph best represents the solution set of $y \leq \frac{3}{4}x - 4$?

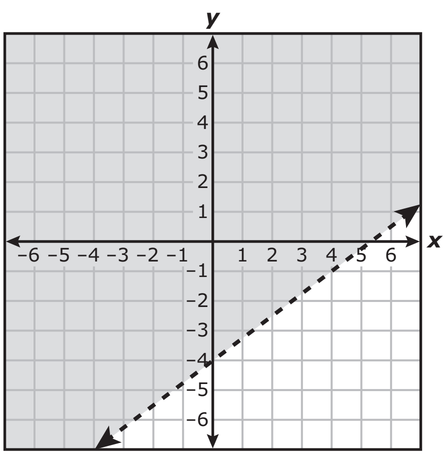
F



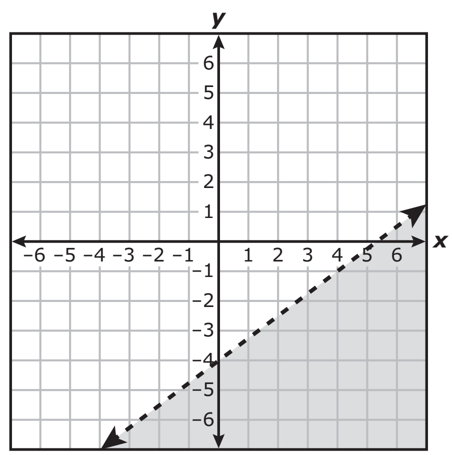
H



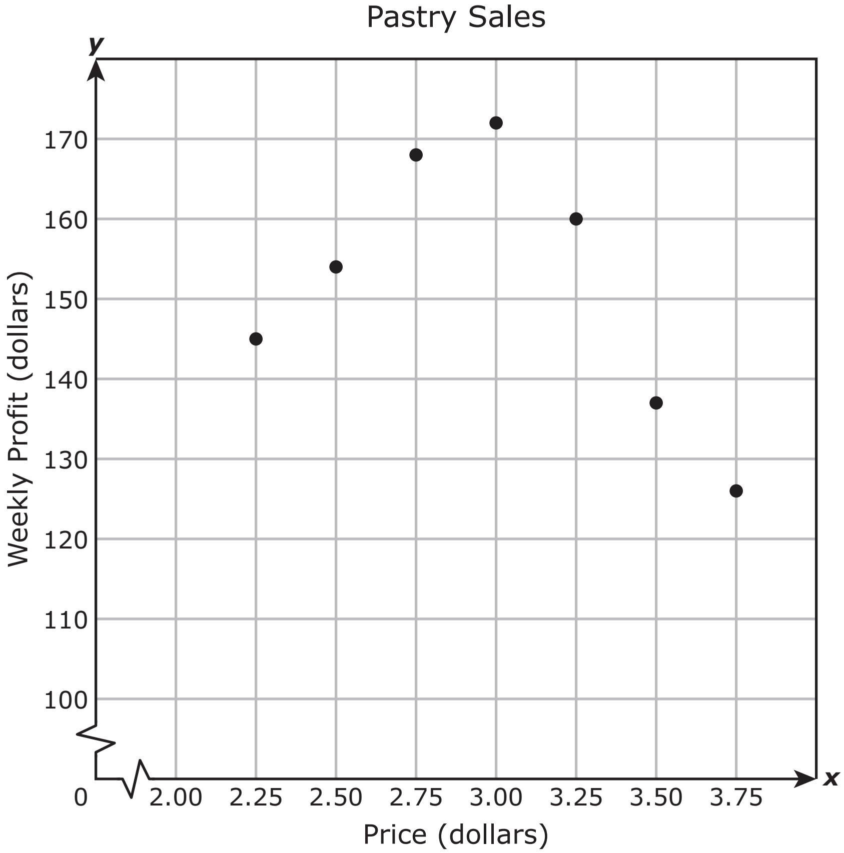
G



J



47 The scatterplot and table show the weekly profit in dollars earned from the sale of pastries at seven different prices. The data can be modeled by a quadratic function.



x	y
2.25	145
2.50	154
2.75	168
3.00	172
3.25	160
3.50	137
3.75	126

Which function best models the data?

A $y = 0.001x^2 - 0.426x + 35.672$

B $y = -60.4x^2 + 348.1x - 334.2$

C $y = 0.001x^2 + 35.672$

D $y = -60.4x^2 - 334.2$

---

48 Which expression is equivalent to $35m^2 - 63$?

F $7(5m^2 - 9)$

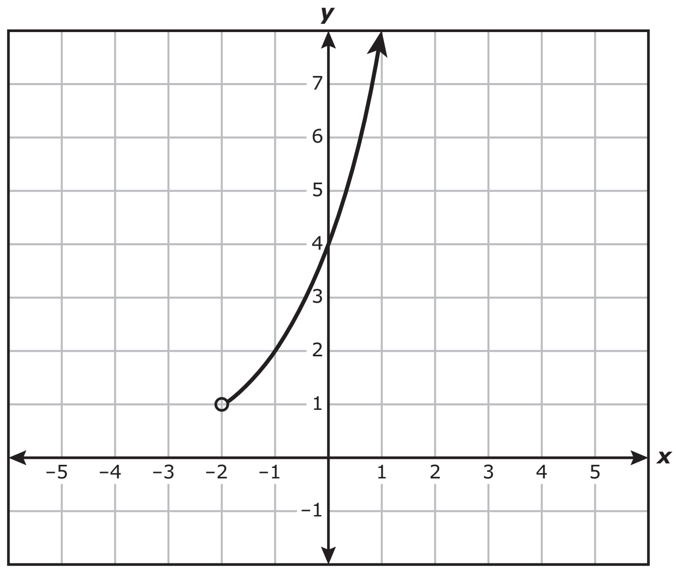
G $-7(5m^2 + 9)$

H $7m(5m - 9)$

J $-7m(5m + 9)$

GO ON

49 A part of exponential function f is graphed on the grid.



Which inequality best represents the domain of the part shown?

A $x > 1$

B $y > 1$

C $x > -2$

D $y > -2$

---

50 What is the value of y in the solution to this system of equations?

$$\begin{aligned} 6y + x &= -59 \\ x &= -2y + 9 \end{aligned}$$

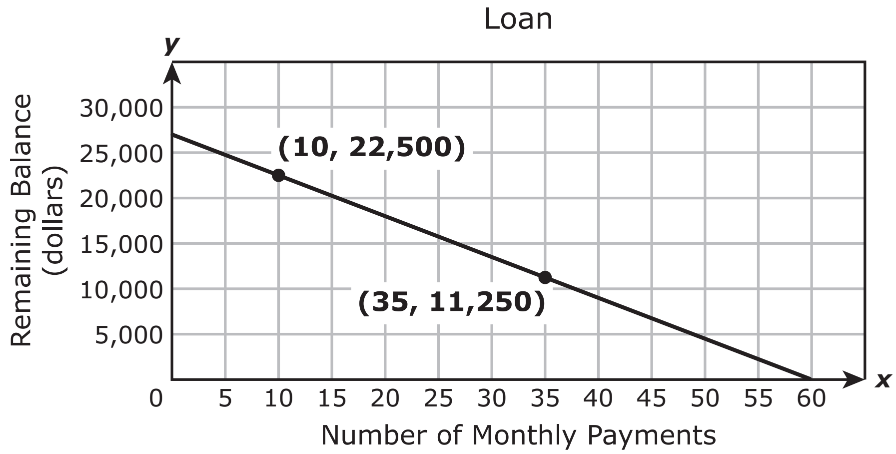
F 8.5

G –17

H 43

J –12.5

51 The graph models the linear relationship between the number of monthly payments made on a loan and the remaining balance in dollars left to pay on the loan.



Which statement describes the x-intercept of the graph?

A The x-intercept is 60, which represents the initial balance in dollars of the loan.

B The x-intercept is 27,000, which represents the initial balance in dollars of the loan.

C The x-intercept is 60, which represents the number of monthly payments needed to repay the loan.

D The x-intercept is 27,000, which represents the number of monthly payments needed to repay the loan.

---

52 The graph of $f(x) = x^2$ was translated 4.5 units to the left to create the graph of function g. Which function represents g?

F $g(x) = (x - 4.5)^2$

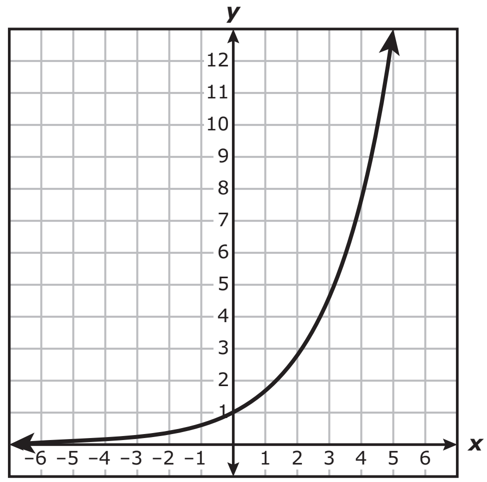
G $g(x) = (x + 4.5)^2$

H $g(x) = x^2 - 4.5$

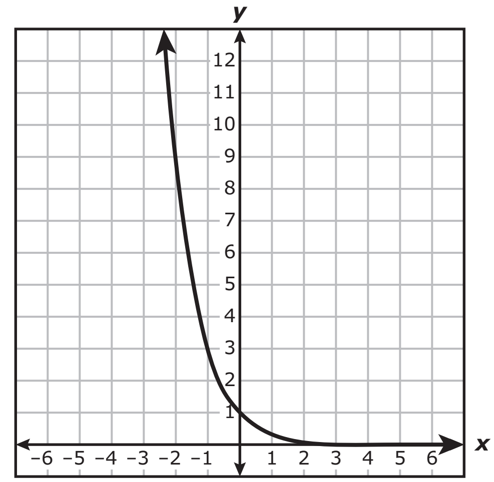
J $g(x) = x^2 + 4.5$

53 Which graph best represents $y = 5\left(\frac{1}{3}\right)^x$?

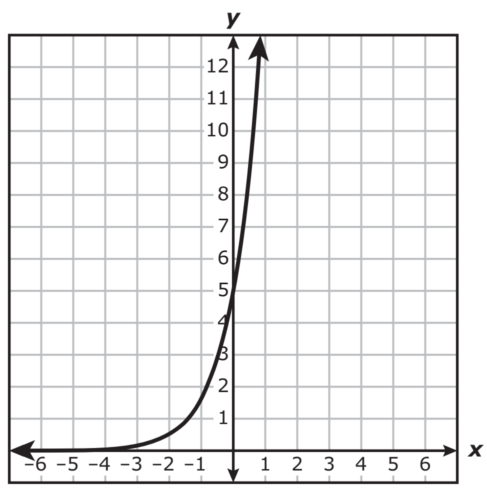
A



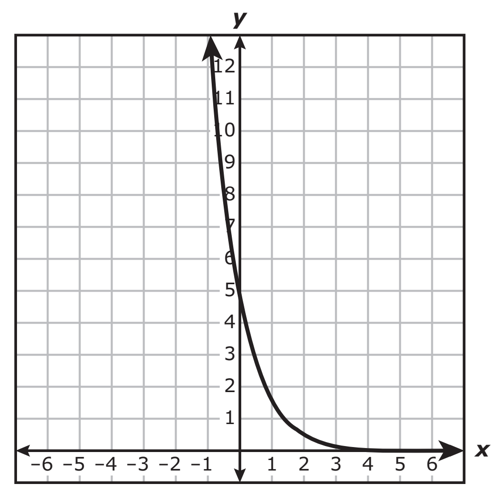
C



B



D



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54 What is the solution to this equation?

$$-4(2m - 7) = 3(52 - 4m)$$

F 32

G 46

H –6.4

J –40.75

BE SURE YOU HAVE RECORDED ALL OF YOUR ANSWERS ON THE ANSWER DOCUMENT.

STOP

Item Number	Reporting Category	Readiness or Supporting	Content Student Expectation	Correct Answer
1	1	Supporting	A.11(A)	B
2	3	Readiness	A.2(C)	J
3	2	Readiness	A.3(B)	A
4	4	Supporting	A.7(B)	H
5	2	Readiness	A.3(D)	B
6	3	Supporting	A.2(B)	H
7	4	Readiness	A.7(A)	A
8	1	Readiness	A.11(B)	J
9	2	Readiness	A.3(C)	B
10	3	Readiness	A.5(A)	H
11	5	Readiness	A.9(C)	B
12	4	Readiness	A.6(A)	H
13	2	Supporting	A.3(H)	A
14	1	Supporting	A.12(B)	-254
15	3	Readiness	A.2(I)	D
16	4	Supporting	A.6(C)	H
17	2	Supporting	A.3(A)	A
18	1	Readiness	A.10(E)	G
19	3	Supporting	A.2(E)	C
20	2	Supporting	A.3(E)	0.8
21	5	Supporting	A.9(E)	B
22	3	Readiness	A.2(A)	J
23	4	Readiness	A.8(A)	C
24	3	Readiness	A.2(I)	F
25	2	Readiness	A.3(B)	D
26	1	Readiness	A.11(B)	H
27	5	Readiness	A.9(D)	73
28	4	Readiness	A.7(C)	J
29	1	Supporting	A.10(B)	C
30	3	Supporting	A.2(H)	J
31	2	Supporting	A.4(B)	B
32	1	Readiness	A.10(E)	F
33	3	Readiness	A.2(A)	A
34	4	Readiness	A.7(A)	225
35	1	Readiness	A.11(B)	D
36	2	Readiness	A.3(B)	F
37	4	Readiness	A.8(A)	D
38	5	Readiness	A.9(C)	F
39	3	Supporting	A.2(G)	C
40	1	Supporting	A.10(F)	G
41	2	Readiness	A.3(C)	D
42	3	Supporting	A.2(D)	112
43	4	Readiness	A.6(A)	B
44	3	Readiness	A.2(C)	F
45	1	Readiness	A.10(E)	D
46	2	Readiness	A.3(D)	F
47	4	Supporting	A.8(B)	B
48	1	Supporting	A.10(D)	F
49	5	Supporting	A.9(A)	C
50	3	Readiness	A.5(C)	G
51	2	Readiness	A.3(C)	C
52	4	Readiness	A.7(C)	G
53	5	Readiness	A.9(D)	D
54	3	Readiness	A.5(A)	F

Item#	Rationale	
1	Option B is correct	To determine the equivalent expression, the student could have rewritten $\sqrt{184}$ as $\sqrt{4} \cdot \sqrt{46}$ and then calculated the square root (a value that, when multiplied by itself, is equal to the number under the $\sqrt{}$) of 4 to get $2 \cdot \sqrt{46}$, or $2\sqrt{46}$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely divided 184 by 2 instead of finding the square root. The student needs to focus on understanding how to simplify square roots.
	Option C is incorrect	The student likely simplified $\sqrt{184}$ as $\sqrt{8} \cdot \sqrt{23}$ and divided 8 by 2 instead of finding the square root because 8 is a composite number (a number that is a multiple of two numbers other than itself and 1). The student needs to focus on understanding how to simplify square roots.
	Option D is incorrect	The student likely did not take the square root of 4, resulting in $4\sqrt{46}$. The student needs to focus on understanding how to simplify square roots.

Item#	Rationale	
2	Option J is correct	To determine which function is best represented by the graph, the student could have found the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) and the y-intercept (value where a line crosses the y-axis vertical) to substitute into the slope-intercept form of a line ($y = mx + b$). The slope can be found by calculating the change in y-values over the change in x-values $\left(m = \frac{0-4}{6-0} = \frac{-4}{6} = -\frac{4}{6} = -\frac{2}{3}\right)$. The equation can be completed by substituting 4 from the y-intercept, $(0, 4)$, for b and $-\frac{2}{3}$ for m, resulting in $y = -\frac{2}{3}x + 4$. Since y is represented by $g(x)$, the function is $g(x) = -\frac{2}{3}x + 4$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely identified the value for m as where the line appears to cross the x-axis, $(6, 0)$. The student needs to focus on understanding how to write a linear function in slope-intercept form given a graph.
	Option G is incorrect	The student likely reversed the values of m and b in the slope-intercept form of the line. The student needs to focus on understanding how to write a linear function in slope-intercept form given a graph.
	Option H is incorrect	The student likely calculated the slope as $m = \frac{x_2 - x_1}{y_2 - y_1}$, resulting in $m = \frac{6-0}{0-4} = \frac{6}{-4} = -\frac{6}{4} = -\frac{3}{2}$. The student likely identified the value for b as where the line appears to cross the x-axis, $(6, 0)$. The student needs to focus on understanding how to write a linear function in slope-intercept form given a graph.

Item#	Rationale	
3	Option A is correct	To determine the rate of change (constant increase or decrease) of *y* with respect to *x*, the student could have chosen two points from the table and calculated the amount of change. The student could have used the first and last sets of values from the table in the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, resulting in $m = \frac{-17 - (-92)}{-1 - (-8.5)} = \frac{75}{7.5} = 10$. Therefore, the rate of change is 10. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely divided the last set of values in the table $\left(\frac{-17}{-1}\right)$ to determine the rate of change. The student needs to focus on understanding how to find the rate of change from a table.
	Option C is incorrect	The student likely made sign errors when calculating the rate of change, solving $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-17 - (-92)}{1 - 8.5} = \frac{75}{-7.5} = -\frac{75}{7.5} = -10$. The student needs to focus on understanding how to perform arithmetic with rational numbers.
	Option D is incorrect	The student likely divided the last set of values in the table $\left(\frac{-17}{-1}\right)$ to determine the rate of change and made a sign error, identifying the quotient (answer) as a negative number. The student needs to focus on understanding how to find the rate of change from a table and how to perform arithmetic with rational numbers.

Item#	Rationale	
4	Option H is correct	To determine which statement is true, the student could have first found the factors (numbers or expressions that can be multiplied to get another number or expression) of $x^2 - 6x - 16$. The student could have first multiplied x^2 by -16, resulting in $-16x^2$. The student could have then identified two terms that have a product of $-16x^2$ and a sum of $-6x$, which are $2x$ and $-8x$. The student could have then written out an expression representing the first and last terms of the given expression, $2x$, and $-8x$, resulting in $x^2 + 2x - 8x - 16$. The student could have then grouped the first two terms and last two terms of the expression and factored out the greatest (largest) common factor from each group of terms, resulting in $x(x + 2) - 8(x + 2)$. The student could have then factored out $(x + 2)$ from the expression, resulting in $(x + 2)(x - 8)$. Lastly, the student could have then solved for the zeros (input value, x, that produces an output value, y, of 0) by setting each factor (expression within the parentheses) equal to 0 and solving for x, resulting in $x + 2 = 0 \rightarrow x = -2$ and $x - 8 = 0 \rightarrow x = 8$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely identified the two terms that had a product of $-16x^2$ but had a sum of $6x$ ($-2x$ and $8x$), writing out the expression $x^2 - 2x + 8x - 16$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $x(x - 2) + 8(x - 2)$. The student likely then factored out $(x - 2)$ from the expression, resulting in $(x - 2)(x + 8)$. Lastly, the student likely then solved for the zeros, resulting in $x - 2 = 0 \rightarrow x = 2$ and $x + 8 = 0 \rightarrow x = -8$. The student needs to focus on understanding how to find the factors and zeros of a function in the form $g(x) = ax^2 - bx - c$.
	Option G is incorrect	The student likely identified the two terms that had a product of $16x^2$ and had a sum of $10x$ ($2x$ and $8x$), writing out the expression $x^2 + 2x + 8x + 16$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $x(x + 2) + 8(x + 2)$. The student likely then factored out $(x + 2)$ from the expression, resulting in $(x + 2)(x + 8)$. Lastly, the student likely then solved for the zeros, resulting in $x + 2 = 0 \rightarrow x = -2$ and $x + 8 = 0 \rightarrow x = -8$. The student needs to focus on understanding how to find the factors and zeros of a function in the form $g(x) = ax^2 - bx - c$.

Item#	Rationale	
	Option J is incorrect	The student likely identified the two terms that had a product of $16x^2$ and had a sum of $-10x$ ($-2x$ and $-8x$), writing out the expression $x^2 - 2x - 8x + 16$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $x(x-2) - 8(x-2)$. The student likely then factored out $(x-2)$ from the expression, resulting in $(x-2)(x-8)$. Lastly, the student likely then solved for the zeros, resulting in $x - 2 = 0 \rightarrow x = 2$ and $x - 8 = 0 \rightarrow x = 8$. The student needs to focus on understanding how to find the factors and zeros of a function in the form $g(x) = ax^2 - bx - c$.

Item#	Rationale	
5	Option B is correct	To determine which ordered pair is in the solution set of $8x + 16y > 32$, the student could have substituted the given *x*- and *y*-values of the ordered pair into the inequality to see if it generates a true statement. Using the ordered pair $(-3, 5)$, -3 will be substituted into the inequality for the *x*-value and 5 will be substituted for the *y*-value. This gives $8(-3) + 16(5) > 32$, which simplifies to $-24 + 80 > 32$, which is a true statement. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified an ordered pair on the *y*-axis (vertical axis) that represents the inequality $32 > 32$ as being a true statement. The student needs to focus on understanding how to determine whether an ordered pair is in the solution set of an inequality.
	Option C is incorrect	The student likely interpreted the "$>$" symbol in the inequality as meaning "less than" and identified an ordered pair in that solution set. The student needs to focus on understanding the meaning of the inequality symbol.
	Option D is incorrect	The student likely identified an ordered pair on the *x*-axis (horizontal axis) that represents the inequality $32 > 32$ as being a true statement. The student needs to focus on understanding how to determine whether an ordered pair is in the solution set of an inequality.

Item#	Rationale	
6	Option H is correct	To determine the equation of a line in slope-intercept form ($y = mx + b$, where m represents the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) and b represents the y-intercept (value where a line crosses the y-axis)), the student could have found the slope of the line using the coordinates of the two given points. The student could have substituted the x- and y-coordinates of $(-26, -11)$ and $(39, 34)$ into the slope formula, resulting in $m = \frac{34 - (-11)}{39 - (-26)} = \frac{45}{65} = \frac{9}{13}$. Next, the student could have substituted the x- and y-values of the point $(39, 34)$ and $m = \frac{9}{13}$ into the point-slope formula, $y - y_1 = m(x - x_1)$, resulting in $y - 34 = \frac{9}{13}(x - 39)$. Next, the student could have distributed (multiplied) $\frac{9}{13}$ to the terms inside the parentheses, resulting in $y - 34 = \frac{9}{13}x - 27$. Finally, the student could have added 34 to both sides of the equation, resulting in $y = \frac{9}{13}x + 7$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely found the correct value of b but used $-\frac{9}{13}$ for m instead of $\frac{9}{13}$. The student needs to focus on understanding how to perform arithmetic with rational numbers.
	Option G is incorrect	The student likely made sign errors when identifying the values of m and b, using $-\frac{9}{13}$ for m instead of $\frac{9}{13}$ and -7 for b instead of 7. The student needs to focus on understanding how to perform arithmetic with rational numbers.
	Option J is incorrect	The student likely found the correct value of m but used -7 for b instead of 7. The student needs to focus on understanding how to perform arithmetic with rational numbers.

Item#	Rationale	
7	Option A is correct	To determine which graph could represent function p, the student should have identified the graph that has an axis of symmetry at $x = -3$ and exactly one zero (where the curve touches the x-axis). The axis of symmetry is an imaginary vertical line that goes through the vertex (high or low point of the curve) of a parabola (U-shaped graph) and is represented by the equation $x = n$, with n representing the x-coordinate of the vertex. The vertex of the graph is located on the x-axis (horizontal) at $(-3, 0)$. Since the vertex is on the x-axis, the vertex is also the only zero of the function represented by the graph. Therefore, this graph could represent p because the equation for the axis of symmetry is $x = -3$, and the function has only one zero at $(-3, 0)$.
	Option B is incorrect	The student correctly identified the axis of symmetry of the graph but likely identified exactly one zero as requiring the parabola to pass through the origin $(0, 0)$. The student needs to focus on understanding how to identify the key attributes of a quadratic function on a graph.
	Option C is incorrect	The student likely made a sign error in the equation of the axis of symmetry ($x = -h$ instead of $x = h$), identifying the equation as $x = 3$, and likely identified exactly one zero as requiring the parabola to pass through the origin $(0, 0)$. The student needs to focus on understanding how to identify the key attributes of a quadratic function on a graph.
	Option D is incorrect	The student correctly identified exactly one zero but likely made a sign error in the equation of the axis of symmetry ($x = -h$ instead of $x = h$), identifying the equation as $x = 3$. The student needs to focus on understanding how to identify the key attributes of a quadratic function on a graph.

Item#	Rationale	
8	Option J is correct	To determine the equivalent expression, the student could have applied the power of a power property ($(a^m)^n = a^{mn}$), resulting in $x^{9 \bullet 5}y^{1 \bullet 5}z^{4 \bullet 5} = x^{45}y^5z^{20}$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student added instead of multiplying the exponents (numbers raised to a power), resulting in $x^{9+5}y^{1+5}z^{4+5} = x^{14}y^6z^9$. The student needs to focus on understanding how to use the properties of exponents to simplify expressions with powers raised to a power.
	Option G is incorrect	The student identified the exponent (number raised to a power) of the variable (symbol used to represent an unknown number) y as 0 and added instead of multiplying the exponents, resulting in $x^{9+5}y^{0+5}z^{4+5} = x^{14}y^5z^9$. The student needs to focus on understanding how to use the properties of exponents to simplify expressions with powers raised to a power.
	Option H is incorrect	The student only multiplied the exponents (numbers raised to a power) greater than 1 inside the parentheses by 5, resulting in $x^{9 \bullet 5}y^1z^{4 \bullet 5} = x^{45}yz^{20}$. The student needs to focus on understanding how to use the properties of exponents to simplify expressions with powers raised to a power.

Item#	Rationale	
9	Option B is correct	To determine the values that best represent the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$), the student could have substituted the coordinates of the two given points, $(-7, -4)$ and $(7, 6)$, into the slope formula, resulting in $m = \frac{6 - (-4)}{7 - (-7)} = \frac{10}{14} = \frac{5}{7}$. Then, the student could have substituted $\frac{5}{7}$ and the point $(7, 6)$ into the point-slope form of a line $(y - y_1 = m(x - x_1))$, resulting in $y - 6 = \frac{5}{7}(x - 7) \rightarrow y - 6 = \frac{5}{7}x - 5 \rightarrow y = \frac{5}{7}x + 1$. Simplifying, the student would find the y-intercept (value where a line crosses the y-axis) to be $(0, 1)$. The value of 1 best represents the y-intercept of the graph of the function. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely found the correct value of the slope but identified the integer (a set of numbers that includes counting numbers, their opposites, and zero) closest to the x-intercept (value where a line crosses the x-axis) as the value of the y-intercept (-1), since the value of the x-intercept is -1.4. The student needs to focus on understanding how to identify the key features of linear functions.
	Option C is incorrect	The student likely calculated the slope as $m = \frac{x_2 - x_1}{y_2 - y_1}$, resulting in $m = \frac{7 - (-7)}{6 - (-4)} = \frac{14}{10} = \frac{7}{5}$, and identified the integer (a set of numbers that includes counting numbers, their opposites, and zero) closest to the x-intercept (value where a line crosses the x-axis) as the value of the y-intercept (-1), since the value of the x-intercept is -1.4. The student needs to focus on understanding how to calculate and identify the key features of linear functions.

Item#	Rationale	
	Option D is incorrect	The student likely found the correct value of the y-intercept but calculated the slope as $m = \frac{x_2 - x_1}{y_2 - y_1}$, resulting in $m = \frac{7 - (-7)}{6 - (-4)} = \frac{14}{10} = \frac{7}{5}$. The student needs to focus on understanding how to calculate and identify the key features of linear functions.

Item#	Rationale	
10	Option H is correct	To determine the solution, the student could have solved the equation for y. The student could have first distributed (multiplied) the numbers immediately in front of the parentheses by the terms inside the parentheses. This step results in the equation $4(y) - 4(3) + 19 = 8(2y) + 8(3) + 7$, which is $4y + 7 = 16y + 31$. The student could have then subtracted $16y$ from both sides of the equation, resulting in $-12y + 7 = 31$. The student could have then subtracted 7 from both sides of the equation, resulting in $-12y = 24$. To solve for y, the student could have divided both sides of the equation by -12, resulting in $y = -2$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely distributed the numbers immediately in front of the parentheses to only the first terms in the parentheses and made a sign error when solving for y, solving $4y - 3 + 19 = 16y + 3 + 7 \rightarrow 4y + 16 = 16y + 10 \rightarrow -12y = -6 \rightarrow y = -\frac{1}{2}$. The student needs to focus on understanding how to apply the distributive property and dividing negative numbers correctly when solving equations.
	Option G is incorrect	The student likely distributed the numbers immediately in front of the parentheses to only the first terms in the parentheses, solving $4y - 3 + 19 = 16y + 3 + 7 \rightarrow 4y + 16 = 16y + 10 \rightarrow -12y = -6 \rightarrow y = \frac{1}{2}$. The student needs to focus on understanding how to apply the distributive property correctly when solving equations.
	Option J is incorrect	The student likely made a sign error when solving for y, solving $-12y = 24$ by dividing both sides of the equation by 12 and getting $y = 2$. The student needs to focus on the arithmetic of solving equations.

Item#	Rationale	
11	Option B is correct	To determine the function, the student could have determined that the relationship can be represented by the exponential function $g(x) = ab^x$, where a is the initial (beginning) value (the value of $g(x)$ when $x = 0$), b is the common factor (ratio of the successive terms of the function), and x is the variable (symbol used to represent an unknown number). To write the exponential function, the student could have identified 25.5 as the initial value. Next, the student could have determined the common factor of 0.6 by dividing each y-coordinate by the next y-coordinate: $\frac{9.18}{15.3} = 0.6$ and $\frac{15.3}{25.5} = 0.6$. Lastly, the student could have substituted 25.5 for a and 0.6 for b in the function $g(x) = ab^x$, resulting in $g(x) = 25.5(0.6)^x$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely reversed the initial value and the common factor in the exponential function, resulting in $g(x) = 0.6(25.5)^x$. The student needs to focus on understanding how to determine the initial value and common factor of an exponential function when given a graph.
	Option C is incorrect	The student likely identified the initial value as the absolute value (how far a number is from zero) of the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) between the points (1, 15.3) and (2, 9.18), calculating $\left\lvert \frac{9.18 - 15.3}{2 - 1} \right\rvert = \left\lvert \frac{-6.12}{1} \right\rvert = \lvert -6.12 \rvert = 6.12$. The student likely identified the common factor as the y-intercept (value where a graph crosses the y-axis), resulting in $b = 25.5$. Lastly, the student likely substituted 6.12 for a and 25.5 for b in the function $g(x) = ab^x$, resulting in $g(x) = 6.12(25.5)^x$. The student needs to focus on understanding how to determine the initial value and common factor of an exponential function when given a graph.

Item#	Rationale	
	Option D is incorrect	The student correctly identified the initial value but likely identified the common factor as the absolute value (how far a number is from zero) between the points (1, 15.3) and (2, 9.18), calculating $\left\lvert \frac{9.18 - 15.3}{2 - 1} \right\rvert = \left\lvert \frac{-6.12}{1} \right\rvert = \lvert -6.12 \rvert = 6.12$, resulting in $g(x) = 25.5(6.12)^x$. The student needs to focus on understanding how to determine the common factor of an exponential function when given a graph.

Item#	Rationale	
12	Option H is correct	To determine the range (all possible *y*-values) for this situation, the student could have plotted the eight ordered pairs presented in the table on a coordinate grid and analyzed the shape of the graph. The student could have plotted points at $(0, 0)$, $(0.25, 2.76)$, $(0.50, 4.90)$, $(0.75, 6.43)$, $(1.00, 7.35)$, $(1.25, 7.66)$, $(1.50, 7.35)$, and $(1.75, 6.43)$ on a coordinate grid, determining that the points of the graph represent a U-shaped graph, also known as a parabola. As the graph of the parabola opens downward, the maximum value should be identified as 7.66 because the vertex (high point of the curve) $(1.25, 7.66)$ is the same distance horizontally from the points $(1.00, 7.35)$ and $(1.50, 7.35)$, which means the vertex must be halfway between the two points. The graph of the parabola is bounded below at 0, or ground level, because the distance from the ground can only be represented by 0 and positive numbers. Therefore, the range for this situation can be described as all real numbers greater than or equal to 0 and less than or equal to 7.66. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely did not consider the ground, 0, as a natural lower bound for the ball in this situation. The student needs to focus on understanding how to represent the range of a quadratic function from a table of values representing a situation.
	Option G is incorrect	The student likely identified the *x*-coordinate of the ordered pair $(1.25, 7.66)$ as representing the upper bound of the range. The student needs to focus on understanding the difference between domain (all possible *x*-values) and range for a quadratic function represented as a table of values.
	Option J is incorrect	The student correctly identified the situational restriction of the distance from the ground as being positive. However, the student chose the *x*-value for the upper bound instead of the *y*-value. The student needs to focus on understanding how to represent the range of a quadratic function from a table of values representing a situation.

Item#	Rationale	
13	Option A is correct	To determine which graph best represents the solution set of $x + y < 1$ and $x - y \leq 2$, the student could have graphed each inequality and its solution set and determined where the two solution sets overlap with each other. To graph the first inequality, the student could have isolated the y on one side of the inequality. The student could have subtracted x from both sides of the inequality, resulting in $y < -x + 1$. This line will cross the y-axis (vertical) at 1 and have a slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) of –1. The student could have then determined that the "<" symbol means "less than," and the correct solutions will be shaded below a dashed line (to indicate no points on the line are part of the solution set). To graph the second inequality, the student could have isolated the y on one side of the inequality. The student could have first added y to both sides of the inequality, resulting in $x \leq y + 2$. The student could have then subtracted 2 from both sides of the inequality, resulting in $x - 2 \leq y$ or $y \geq x - 2$. This line will cross the y-axis at –2 and will have a slope of 1. The student could have then determined that the "≥" symbol means "greater than or equal to," and the correct solutions will be shaded above a solid line (to indicate points on the line are part of the solution set). Lastly, the student could have verified where the shaded regions overlap with each other. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely reversed the meaning of each inequality symbol when identifying the shaded regions representing the solution set of each inequality. The student needs to focus on understanding how to graph the solution set of a system of inequalities.
	Option C is incorrect	The student likely reversed both the line types (shaded or solid) and the shading (solution set). The student needs to focus on understanding how to graph the solution set of a system of inequalities.
	Option D is incorrect	The student correctly identified the shaded regions representing the solution set of each inequality but likely reversed the meaning of each inequality symbol when determining whether the line should be dashed or solid. The student needs to focus on understanding how to graph the solution set of a system of inequalities.

Item#	Rationale	
14	-254 and any equivalent values are correct	To determine the value of $p(7)$, the student could have substituted 7 for x in the function (a relationship where each input has a single output) and then simplified the function, resulting in $p(7) = -4(7 - 15)^2 + 2 = -4(-8)^2 + 2 = -4(64) + 2 = -256 + 2 = -254$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.

Item#	Rationale	
15	Option D is correct	To determine which system of equations (two or more equations containing the same set of variables (symbols used to represent unknown numbers)) can be used to represent the number of black-and-white copies and the number of color copies the customer paid for at the print shop, the student could have written one equation to represent the total number of black-and-white and color copies paid for by the customer. The number of black-and-white copies, b, plus the number of color copies, c, equals 68, which can be represented by the equation $b + c = 68$. Then, the student could have created a second equation to represent the total cost of the black-and-white and color copies paid for by the customer. Each black-and-white copy cost \$0.08, each color copy cost \$0.15, and the customer paid a total of \$6.00, which can be represented by the equation $0.08b + 0.15c = 6.00$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely reversed the total number of black-and-white and color copies paid for by the customer with the total cost of the black-and-white and color copies paid for by the customer between the two equations. The student needs to focus on understanding how to write a system of equations from a verbal description.
	Option B is incorrect	The student likely reversed the cost of each black-and-white copy with the cost of each color copy in the second equation. The student needs to focus on understanding how to write a system of equations from a verbal description.
	Option C is incorrect	The student likely reversed the total number of black-and-white and color copies paid for by the customer with the total cost of the black-and-white and color copies paid for by the customer between the two equations and likely reversed the cost of each black-and-white copy with the cost of each color copy in the second equation. The student needs to focus on understanding how to write a system of equations from a verbal description.

Item#	Rationale	
16	Option H is correct	To determine which function is best represented by the graph, the student could have identified the solutions (x-values when y is equal to 0) of the function as u and v and used the solutions to construct and simplify the equation of a quadratic function using $f(x) = a(x - u)(x - v)$, where a, u, and v represent values. The solutions can be identified by where the parabola (U-shaped graph) crosses the x-axis (at $x = -4$ and $x = 4$). Letting $u = -4$ and $v = 4$, the student could have substituted those values into the equation $f(x) = a(x - u)(x - v)$, resulting in $f(x) = a(x - (-4))(x - 4) \rightarrow f(x) = a(x + 4)(x - 4)$. The student could have then multiplied the expressions $(x + 4)$ and $(x - 4)$, resulting in $f(x) = a(x^2 - 4x + 4x - 16)$. The student could have then combined like terms (terms that contain the same variables raised to the same powers), resulting in $f(x) = a(x^2 - 16)$. Next, the student could have solved for a by substituting the coordinates of the vertex (high or low point of the curve), (0, 8), into the function $f(x) = a(x^2 - 16)$, resulting in $8 = a((0)^2 - 16) \rightarrow a(0 - 16) \rightarrow 8 = -16a \rightarrow a = \frac{8}{-16} \rightarrow a = -\frac{8}{16} \rightarrow a = -\frac{1}{2}$. The student could have then substituted the value of a into the function $f(x) = a(x^2 - 16)$, resulting in $f(x) = -\frac{1}{2}(x^2 - 16)$. Lastly, the student could have distributed (multiplied) $-\frac{1}{2}$ to both terms in the parentheses, resulting in $f(x) = -\frac{1}{2}x^2 + 8$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely made a sign error when multiplying the constants (numbers) in the expressions $(x + 4)$ and $(x - 4)$ and distributed $-\frac{1}{2}$ to only the first term in the parentheses, resulting in $f(x) = -\frac{1}{2}(x^2 + 16) \rightarrow f(x) = -\frac{1}{2}x^2 + 16$. The student needs to focus on understanding how to multiply binomial expressions and apply the distributive property.

Item#	Rationale	
	Option G is incorrect	The student likely made a sign error when multiplying the constants (numbers) in the expressions $(x + 4)$ and $(x - 4)$, identified the value of a as -1 since the parabola opens downward, and distributed -1 to only the first term in the parentheses, resulting in $f(x) = -(x^2 + 16) \rightarrow f(x) = -x^2 + 16$. The student needs to focus on understanding how to multiply binomial expressions and apply the distributive property.
	Option J is incorrect	The student likely combined the constants (numbers) in the expressions $(x + 4)$ and $(x - 4)$, made the 8 a negative value, identified the value of a as -1 since the parabola opens downward, and distributed -1 to both terms in the parentheses, resulting in $f(x) = -(x^2 - 8) \rightarrow f(x) = -x^2 + 8$. The student needs to focus on understanding how to identify the solutions of a quadratic function and write the equation of the function using those solutions.

Item#	Rationale	
17	Option A is correct	To determine the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) of the line represented by the table of values, the student could have chosen two sets of values from the table and calculated the slope. The student could have substituted the first and last sets of values from the table into the slope formula, resulting in $m = \frac{-15 - 9}{8 - (-7)} = \frac{-24}{15} = -\frac{24}{15} = -\frac{8}{5}$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely calculated the slope as the change in the *x*-values divided by the change in the *y*-values: $m = \frac{x_2 - x_1}{y_2 - y_1} = \frac{8 - (-7)}{-15 - 9} = \frac{15}{-24} = -\frac{15}{24} = -\frac{5}{8}$. The student needs to focus on understanding how to use the formula for the slope of a line when given a table of values.
	Option C is incorrect	The student likely calculated the slope as the change in the *y*-values divided by the change in the *x*-values but made a sign error: $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-15 - 9}{8 - (-7)} = \frac{24}{15} = \frac{8}{5}$. The student needs to focus on understanding how to use the formula for the slope of a line when given a table of values and integer arithmetic.
	Option D is incorrect	The student likely calculated the slope as the change in the *x*-values divided by the change in the *y*-values and made a sign error: $m = \frac{x_2 - x_1}{y_2 - y_1} = \frac{8 - (-7)}{-15 - 9} = \frac{-15}{-24} = \frac{5}{8}$. The student needs to focus on understanding how to use the formula for the slope of a line when given a table of values and integer arithmetic.

Item#	Rationale	
18	Option G is correct	To determine the factored form of the given expression, the student could have found the factors (numbers or expressions that can be multiplied to get another number or expression) of $2x^2 - 25x + 63$. The student could have first multiplied $2x^2$ by 63, resulting in $126x^2$. The student could have then identified two terms that have a product of $126x^2$ and a sum of $-25x$, which are $-18x$ and $-7x$. The student could have then written out an expression representing the first and last terms of the given expression, $-18x$, and $-7x$, resulting in $2x^2 - 18x - 7x + 63$. The student could have then grouped the first two terms and last two terms of the expression and factored out the greatest (largest) common factor from each group of terms, resulting in $2x(x - 9) - 7(x - 9)$. Lastly, the student could have factored out $(x - 9)$ from the expression, resulting in $(x - 9)(2x - 7)$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely identified the two terms that had a product of $126x^2$ and a sum of $-25x$ as $18x$ and $7x$, writing out the expression $2x^2 + 18x + 7x + 63$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $2x(x + 9) + 7(x + 9)$. Lastly, the student likely factored out $(x + 9)$ from the expression, resulting in $(x + 9)(2x + 7)$. The student needs to focus on understanding how to factor an expression of the form $ax^2 - bx + c$.
	Option H is incorrect	The student likely identified two terms that had a product of $126x^2$ but had a sum of $23x$ ($14x$ and $9x$), writing out the expression $2x^2 + 14x + 9x + 63$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $2x(x + 7) + 9(x + 7)$. Lastly, the student likely factored out $(x + 7)$ from the expression, resulting in $(x + 7)(2x + 9)$. The student needs to focus on understanding how to factor an expression of the form $ax^2 - bx + c$.
	Option J is incorrect	The student likely identified two terms that had a product of $126x^2$ but had a sum of $-23x$ ($-14x$ and $-9x$), writing out the expression $2x^2 - 14x - 9x + 63$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $2x(x - 7) - 9(x - 7)$. Lastly, the student likely factored out $(x - 7)$ from the expression, resulting in $(x - 7)(2x - 9)$. The student needs to focus on understanding how to factor an expression of the form $ax^2 - bx + c$.

Item#	Rationale	
19	Option C is correct	To determine the equation of a line parallel (lines that do not intersect (cross over) and are always the same distance from each other) to another line, the student could have first changed the equation $8x + 3y = 15$ from standard form ($Ax + By = C$) to slope-intercept form ($y = mx + b$, where m represents the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) and b represents the y-intercept (value where a line crosses the y-axis)) by isolating the variable (symbol used to represent an unknown number) y, resulting in $y = -\frac{8}{3}x + 5$. Since parallel lines have the same slope, the student could have substituted $m = -\frac{8}{3}$ into the slope-intercept form, resulting in $y = -\frac{8}{3}x + b$. To determine b, the student could have substituted the point $(6, -1)$ for x and y in the slope-intercept form, resulting in $-1 = -\frac{8}{3}(6) + b$. The student could have then multiplied $-\frac{8}{3}$ by 6, resulting in $-1 = -16 + b$. To solve the equation for b, the student could have added 16 to both sides of the equation, resulting in $15 = b$. Substituting the value of b into the slope-intercept form results in $y = -\frac{8}{3}x + 15$. To convert the equation from slope-intercept form to standard form, the student could have first multiplied both sides of the equation by 3, resulting in $3y = -8x + 45$, and then added $8x$ to both sides of the equation, resulting in $8x + 3y = 45$. The equation $8x + 3y = 45$ represents the line that passes through the point $(6, -1)$ and is parallel to the line represented by $8x + 3y = 15$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely calculated the value of b as -15 ($-1 = -16 + b \rightarrow b = -16 + 1 \rightarrow b = -15$) instead of 15 before converting the equation from slope-intercept form to standard form, resulting in $y = -\frac{8}{3}x - 15 \rightarrow 3y = -8x - 45 \rightarrow 8x + 3y = -45$. The student needs to focus on understanding how to determine the y-intercept of a line that is parallel to a given line represented by an equation in standard form.

Item#	Rationale	
	Option B is incorrect	The student likely calculated the value of m as $\frac{8}{3}$ $(8x + 3y = 15 \rightarrow 3y = 8x + 15 \rightarrow y = \frac{8}{3}x + 3$, so $m = \frac{8}{3})$ instead of $-\frac{8}{3}$ and the value of b as 17 $(-1 = 16 + b \rightarrow b = 16 + 1 \rightarrow b = 17)$ instead of 15 before converting the equation from slope-intercept form to standard form, resulting in $y = \frac{8}{3}x + 17 \rightarrow 3y = 8x + 51 \rightarrow 8x - 3y = -51$. The student needs to focus on understanding how to determine the slope and y-intercept of a line that is parallel to a given line represented by an equation in standard form.
	Option D is incorrect	The student likely calculated the value of m as $\frac{8}{3}$ $(8x + 3y = 15 \rightarrow 3y = 8x + 15 \rightarrow y = \frac{8}{3}x + 3$, so $m = \frac{8}{3})$ instead of $-\frac{8}{3}$ and the value of b as -17 $(-1 = 16 + b \rightarrow b = -16 - 1 \rightarrow b = -17)$ instead of 15 before converting the equation from slope-intercept form to standard form, resulting in $y = \frac{8}{3}x - 17 \rightarrow 3y = 8x - 51 \rightarrow 8x - 3y = 51$. The student needs to focus on understanding how to determine the slope and y-intercept of a line that is parallel to a given line represented by an equation in standard form.

Item#	Rationale	
20	0.8 and any equivalent values are correct	To determine the value of a, the student could have first identified $f(x) = x$ as representing the equation of the linear parent function. The student could have determined that $h(x) = af(x)$ means $h(x) = ax$, which is the same form as $y = mx$, where m represents the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) of the line. The student could have substituted the x- and y-coordinates of the two given points on the graph, $(-5, -4)$ and $(10, 8)$, into the slope formula, resulting in $m = \frac{8 - (-4)}{10 - (-5)} = \frac{12}{15} = 0.8$. The student could have then substituted the value of the slope into the equation $y = mx$, resulting in $y = 0.8x$. Lastly, the student could have substituted $h(x)$ for y and $f(x)$ for x, resulting in $h(x) = 0.8f(x)$. Therefore, the value of a is equal to 0.8 because $h(x) = af(x)$ and $h(x) = 0.8f(x)$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.

Item#	Rationale	
21	Option B is correct	To determine which function (relationship where each input has a single output) best models the data, the student could have used a graphing calculator to generate the function using exponential regression (method of determining the exponential function, $n(x) = ab^x$, where a is the initial (beginning) value (the value of $n(x)$ when $x = 0$), b is the common factor (ratio of successive terms of the function), and x is the variable (symbol used to represent an unknown number)). The function that best models the data is $n(x) = 46{,}797.94(0.93)^x$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely reversed the order of the values in the second column of the table when calculating the exponential regression ((1, 27,691), (2, 31,746), (3, 34,082), (4, 29,368), (5, 40,513), (6, 37,994), (7, 46,125)), resulting in $n(x) = 25{,}956.80(1.08)^x$. The student needs to focus on understanding how to pair up the values given in a table when generating a function using exponential regression.
	Option C is incorrect	The student likely reversed the order of the values in the second column of the table when calculating the exponential regression ((1, 27,691), (2, 31,746), (3, 34,082), (4, 29,368), (5, 40,513), (6, 37,994), (7, 46,125)) and reversed the values of a and b in the exponential function, resulting in $n(x) = 1.08(25{,}956.80)^x$. The student needs to focus on understanding how to pair up the values given in a table when generating a function using exponential regression and how to identify the different parts of an exponential function.
	Option D is incorrect	The student likely reversed the values of a and b in the exponential function, resulting in $n(x) = 0.93(46{,}797.94)^x$. The student needs to focus on understanding how to identify the different parts of an exponential function.

Item#	Rationale	
22	Option J is correct	To determine the domain (all possible x-values) of the part of linear function g shown, the student could have identified all the x-values for which the graph has a y-value. The graph extends from -7 on the left to 6 on the right and includes those two x-values and all the x-values in between them. Therefore, the domain is all real numbers greater than or equal to -7 and less than or equal to 6, or $-7 \leq x \leq 6$. To determine the range (all possible y-values) of the part of linear function g shown, the student could have identified all the values of y for which the graph has an x-value. The graph extends from -4 at its lowest point to 5 at its highest point and includes those two y-values and all the y-values in between them. Therefore, the range is all real numbers greater than or equal to -4 and less than or equal to 5, or $-4 \leq y \leq 5 \rightarrow -4 \leq g(x) \leq 5$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely switched the values of the domain and range and did not include the values at the ends of the intervals. The student needs to focus on understanding how to identify and express the domain and range from a graph using inequalities.
	Option G is incorrect	The student correctly identified the values of the domain and range but likely did not include the values at the ends of the intervals. The student needs to focus on understanding how to express the domain and range from a graph using inequalities.
	Option H is incorrect	The student likely switched the values of the domain and range. The student needs to focus on understanding how to identify the domain and range from a graph using inequalities.

Item#	Rationale	
23	Option C is correct	To determine which value of x is a solution to the equation, the student could have found the factors (numbers or expressions that can be multiplied to get another number or expression) of $3x^2 - 30x - 72 = 0$ and solved the factors for x. The student could have first factored out a 3 from the equation, resulting in $3(x^2 - 10x - 24) = 0$. The student could have then found the factors of $x^2 - 10x - 24$. The student could have first multiplied x^2 by -24, resulting in $-24x^2$. The student could have then identified two terms that have a product of $-24x^2$ and a sum of $-10x$, which are $-12x$ and $2x$. The student could have then written out an expression representing the first and last terms of the given expression, $-12x$, and $2x$, resulting in $x^2 - 12x + 2x - 24$. The student could have then grouped the first two terms and last two terms of the expression and factored out the greatest (largest) common factor from each group of terms, resulting in $x(x - 12) + 2(x - 12)$. Lastly, the student could have factored out $(x - 12)$ from the expression, resulting in $(x - 12)(x + 2)$. The student could have then set each of these factors equal to 0 and solved for x, resulting in $x - 12 = 0 \rightarrow x = 12$ and $x + 2 = 0 \rightarrow x = -2$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely used $x^2 - 10x - 24$ and identified the two terms that had a product of $-24x^2$ and a sum of $-10x$ as $12x$ and $-2x$, writing out the expression $x^2 + 12x - 2x - 24$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $x(x + 12) - 2(x + 12)$. Lastly, the student likely factored out $(x + 12)$ from the expression, resulting in $(x + 12)(x - 2)$. The student likely then set each of these factors equal to 0 and solved for x, resulting in $x + 12 = 0 \rightarrow x = -12$ and $x - 2 = 0 \rightarrow x = 2$. The student needs to focus on understanding how to find the factors and solutions of a quadratic equation.
	Option B is incorrect	The student likely used $x^2 - 10x - 24$ and identified two terms that had a product of $-24x^2$ but a sum of $-2x$ as $-6x$ and $4x$, writing out the expression $x^2 - 6x + 4x - 24$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $x(x - 6) + 4(x - 6)$. Lastly, the student likely factored out $(x - 6)$ from the expression, resulting in $(x - 6)(x + 4)$. The student likely then set each of these factors equal to 0 and solved for x, resulting in $x - 6 = 0 \rightarrow x = 6$ and $x + 4 = 0 \rightarrow x = -4$. The student needs to focus on understanding how to find the factors and solutions of a quadratic equation.

Item#	Rationale	
	Option D is incorrect	The student likely used $x^2 - 10x - 24$ and identified two terms that had a product of $-24x^2$ but a sum of $2x$ as $6x$ and $-4x$, writing out the expression $x^2 + 6x - 4x - 24$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $x(x + 6) - 4(x + 6)$. Lastly, the student likely factored out $(x + 6)$ from the expression, resulting in $(x + 6)(x - 4)$. The student likely then set each of these factors equal to 0 and solved for x, resulting in $x + 6 = 0 \rightarrow x = -6$ and $x - 4 = 0 \rightarrow x = 4$. The student needs to focus on understanding how to find the factors and solutions of a quadratic equation.

Item#	Rationale	
24	Option F is correct	To determine the system of equations represented by lines f and g, the student could have determined the equation of each line in slope-intercept form ($y = mx + b$, where m represents the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) and b represents the y-intercept (value where a line crosses the y-axis)). For line f, the student could have substituted the x- and y-coordinates of $(2, 7)$ and $(4, 10.5)$ into the slope formula, resulting in $m = \frac{10.5 - 7}{4 - 2} = \frac{3.5}{2} = 1.75$. The student could have then substituted the x- and y-values of the point $(2, 7)$ and $m = 1.75$ into the point-slope formula, $y - y_1 = m(x - x_1)$, resulting in $y - 7 = 1.75(x - 2)$. The student could have then distributed (multiplied) 1.75 to the terms inside the parentheses, resulting in $y - 7 = 1.75x - 3.5$. The student could have then added 7 to both sides of the equation, resulting in $y = 1.75x + 3.5$. For line g, the student could have substituted the x- and y-coordinates of $(-3, 4)$ and $(-2, 0)$ into the slope formula, resulting in $m = \frac{0 - 4}{-2 - (-3)} = \frac{-4}{1} = -4$. The student could have then substituted the x- and y-values of the point $(-2, 0)$ and $m = -4$ into the point-slope formula, $y - y_1 = m(x - x_1)$, resulting in $y - 0 = -4(x - (-2)) \rightarrow y - 0 = -4(x + 2)$. The student could have then distributed -4 to the terms inside the parentheses, resulting in $y - 0 = -4x - 8$. The student could have then added 0 to both sides of the equation, resulting in $y = -4x - 8$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option G is incorrect	The student calculated the correct equation for line f but likely identified the x-intercept (value where a line crosses the x-axis) as the value of b in the equation for line g. The student needs to focus on understanding how to identify the y-intercept of a line when given tables of values.
	Option H is incorrect	The student calculated the correct equation for line g but likely switched the values of m and b in the equation for line f. The student needs to focus on understanding how to identify the slope and y-intercept of a line when given tables of values.

Item#	Rationale	
	Option J is incorrect	The student likely switched the values of *m* and *b* in the equation for line *f* and identified the *x*-intercept (value where a line crosses the *x*-axis) as the value of *b* in the equation for line *g*. The student needs to focus on understanding how to identify the slopes and *y*-intercepts of lines when given tables of values.

Item#	Rationale	
25	Option D is correct	To determine the rate of change (constant increase or decrease) of y with respect to x of the function, the student could have identified the coordinates of the two points given on the line and calculated the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) of the line. Using $(-4, 7)$ and $(4, 1)$ in the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, results in $m = \frac{1 - 7}{4 - (-4)} = \frac{-6}{8} = -\frac{3}{4}$. Therefore, the rate of change can be identified as $-\frac{3}{4}$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely calculated the rate of change by counting the number of units of the vertical length and the number of units of the horizontal length from point $(4, 1)$ to point $(-4, 7)$, including one additional unit in each length to represent each point, and identifying the rate of change as a positive value because the counting of the number of units went from bottom to top, resulting in $\frac{6 + 1}{8 + 1} = \frac{7}{9}$. The student needs to focus on understanding how to find the rate of change from a graph.
	Option B is incorrect	The student likely calculated the rate of change by counting the number of units of the vertical length and the number of units of the horizontal length from point $(-4, 7)$ to point $(4, 1)$, including one additional unit in each length to represent each point, and identifying the rate of change as a negative value because the counting of the number of units went from top to bottom, resulting in $-\frac{(6 + 1)}{(8 + 1)} = -\frac{7}{9}$. The student needs to focus on understanding how to find the rate of change from a graph.
	Option C is incorrect	The student likely made a sign error when calculating the rate of change, resulting in $m = \frac{1 - 7}{4 - (-4)} = \frac{6}{8} = \frac{3}{4}$. The student needs to focus on understanding how to find the rate of change from a graph.

Item#	Rationale	
26	Option H is correct	To determine the equivalent expression, the student could have first applied the power of a power property ($(a^m)^n = a^{mn}$) to the denominator (bottom number) of the fraction, resulting in $\frac{36x^4y^5}{3^{1\cdot2}x^{1\cdot2}y^{1\cdot2}} = \frac{36x^4y^5}{9x^2y^2}$. The student could have then divided 36 by 9 and applied the quotient of powers property $\left(\frac{a^m}{a^n} = a^{(m-n)}\right)$ to the fraction, resulting in $\frac{36}{9} \cdot x^{4-2} \cdot y^{5-2} = 4x^2y^3$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely did not apply the power of a power property to the denominator, calculating $\frac{36x^4y^5}{3xy} = \frac{36}{3} \cdot x^{4-1} \cdot y^{5-1} = 12x^3y^4$. The student needs to focus on understanding how to apply the power of a power property when simplifying expressions.
	Option G is incorrect	The student correctly applied the quotient of powers property but likely calculated the difference of the coefficients (numbers used to multiply variables), calculating $(36-9) \cdot x^{4-2} \cdot y^{5-2} = 27x^2y^3$. The student needs to focus on understanding how to divide the coefficients in a fraction when simplifying expressions.
	Option J is incorrect	The student likely multiplied 3 by 2 instead of squaring 3 and did not apply the power of a power property to the variables (symbols used to represent unknown numbers) in the denominator, calculating $\frac{36x^4y^5}{6xy} = \frac{36}{6} \cdot x^{4-1} \cdot y^{5-1} = 6x^3y^4$. The student needs to focus on understanding how to apply the power of a power property and how to square a number when simplifying expressions.

Item#	Rationale	
27	73 and any equivalent values are correct	The student could have realized $g(x) = 73\left(\frac{4}{5}\right)^x$ represents an exponential function, $g(x) = a(b)^x$, where a is the y-intercept (value where the graph crosses the y-axis), b is the growth factor, and x is the variable (symbol used to represent an unknown number). Therefore, the value of the y-intercept of the graph of $g(x) = 73\left(\frac{4}{5}\right)^x$ is 73. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.

Item#	Rationale	
28	Option J is correct	To determine which graph best represents $g(x)$, the student could have first identified $f(x) = x^2$ as the quadratic parent function. The student could have then determined that if the graph of $f(x) = x^2$ is reflected over the x-axis and is stretched horizontally, the graph of function g should open downward from the x-axis and be wider than the graph of the quadratic parent function. The student could have then realized that this graph shows both characteristics of the graph of function g. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student correctly identified the horizontal stretch but likely applied the reflection over the y-axis instead of the x-axis when identifying the graph of function g. The student needs to focus on understanding how a reflection affects the graph of the quadratic parent function on a coordinate grid.
	Option G is incorrect	The student correctly identified the reflection over the x-axis but likely identified a vertical stretch as a horizontal stretch when identifying the graph of function g. The student needs to focus on understanding how a horizontal stretch affects the graph of the quadratic parent function on a coordinate grid.
	Option H is incorrect	The student likely applied the reflection over the y-axis instead of the x-axis and identified a vertical stretch as a horizontal stretch when identifying the graph of function g. The student needs to focus on understanding how a reflection and horizontal stretch affect the graph of the quadratic parent function on a coordinate grid.

Item#	Rationale	
29	Option C is correct	To determine the equivalent expression, the student could have multiplied each term in $\left(\frac{3}{2}p + 1\right)$ by each term in $\left(\frac{1}{2}p + 3\right)$ and then combined the like terms (terms that contain the same variables raised to the same powers). The multiplication steps are $\left(\frac{3}{2}p \cdot \frac{1}{2}p\right) + \left(\frac{3}{2}p \cdot 3\right) + \left(1 \cdot \frac{1}{2}p\right) + (1 \cdot 3)$, resulting in $\frac{3}{4}p^2 + \frac{9}{2}p + \frac{1}{2}p + 3$. The student could have then combined the like terms, resulting in $\frac{3}{4}p^2 + \frac{10}{2}p + 3$. Lastly, the student could have simplified the fraction $\frac{10}{2}$, resulting in $\frac{3}{4}p^2 + 5p + 3$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely added the first terms and multiplied the second terms of $\left(\frac{3}{2}p + 1\right)$ and $\left(\frac{1}{2}p + 3\right)$, identifying $p + p$ as p^2, resulting in $\left(\frac{3}{2}p + \frac{1}{2}p\right) + (1 \cdot 3) = \frac{4}{2}p^2 + 3 = 2p^2 + 3$. The student needs to focus on understanding how to multiply binomials.
	Option B is incorrect	The student likely added the first terms incorrectly and multiplied the second terms of $\left(\frac{3}{2}p + 1\right)$ and $\left(\frac{1}{2}p + 3\right)$, identifying $p + p$ as p^2, resulting in $\left(\frac{3}{2}p + \frac{1}{2}p\right) + (1 \cdot 3) = \frac{4}{4}p^2 + 3 = 4p^2 + 3$. The student needs to focus on understanding how to multiply binomials.

Item#	Rationale	
	Option D is incorrect	The student correctly multiplied $\left(\frac{3}{2}p + 1\right)$ and $\left(\frac{1}{2}p + 3\right)$ but only identified the numerator of the p-term after combining the like terms, resulting in $\frac{3}{4}p^2 + \frac{9}{2}p + \frac{1}{2}p + 3 = \frac{3}{4}p^2 + 10p + 3$. The student needs to focus on understanding how to simplify the terms of an expression after multiplying binomials.

Item#	Rationale	
30	Option J is correct	To determine the inequality that is best represented by the graph, the student could have determined the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) and y-intercept (value where a line crosses the y-axis) of the boundary line and changed the inequality from slope-intercept form to standard form. The student could have used the coordinates $(0, 7)$ and $(4, 0)$ from the boundary line and substituted the x- and y-coordinates into the slope formula, resulting in $m = \frac{0-7}{4-0} = \frac{-7}{4} = -\frac{7}{4}$. The student could have then identified the y-intercept as 7 from the given graph. The student could have then substituted $m = -\frac{7}{4}$ and $b = 7$ into the equation $y = mx + b$, resulting in $y = -\frac{7}{4}x + 7$. The student could have identified the inequality symbol as "$<$" because the graph of the line is dashed. To change the inequality from slope-intercept form to standard form, the student could have taken $y < -\frac{7}{4}x + 7$ and multiplied both sides of the inequality by 4, resulting in $4y < -7x + 28$. Lastly, the student could have added $7x$ to both sides of the inequality, resulting in $7x + 4y < 28$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely calculated the slope as $m = \frac{x_2 - x_1}{y_2 - y_1}$, resulting in $m = \frac{4-0}{0-7} = \frac{4}{-7} = -\frac{4}{7}$, and identified the inequality symbol "$\leq$" as meaning "less than" instead of "less than or equal to." The student then identified the inequality as $y \leq -\frac{4}{7}x + 7$ and changed it from slope-intercept form to standard form, resulting in $4x + 7y \leq 49$. The student needs to focus on understanding how to use the slope formula when determining the slope of a line and how to use inequality symbols when representing the graph of an inequality.

Item#	Rationale	
	Option G is incorrect	The student likely calculated the slope as $m = \frac{x_2 - x_1}{y_2 - y_1}$, resulting in $m = \frac{4 - 0}{0 - 7} = \frac{4}{-7} = -\frac{4}{7}$. The student then identified the inequality as $y < -\frac{4}{7}x + 7$ and changed it from slope-intercept form to standard form, resulting in $4x + 7y < 49$. The student needs to focus on understanding how to use the slope formula when determining the slope of a line representing the graph of an inequality.
	Option H is incorrect	The student correctly calculated the terms of the inequality but likely identified the inequality symbol "$\leq$" as meaning "less than" instead of "less than or equal to." The student needs to focus on understanding how to use inequality symbols when representing the graph of an inequality.

Item#	Rationale	
31	Option B is correct	To determine the situation that best shows causation (an event that is the result of the occurrence of another event), the student could have recognized that the amount of time a cell phone is used causes the charge of the cell phone battery to change. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified a situation that shows association (relationship) but not causation. The length of a rectangle can be associated with the width of a rectangle; however, the length does not necessarily cause any changes to the width. The student needs to focus on understanding causation in real-world problems.
	Option C is incorrect	The student likely identified a situation with a common attribute between the ice-cream bars and milkshakes, milk, as showing causation. The student needs to focus on understanding causation in real-world problems.
	Option D is incorrect	The student likely identified a situation with a concept presented twice in the statement, soccer, as showing causation. The student needs to focus on understanding causation in real-world problems.

Item#	Rationale	
32	Option F is correct	To determine the expression equivalent to $16w^2 + 24w + 9$, the student could have also recognized that $16w^2 + 24w + 9$ is a trinomial containing only positive coefficients (numbers used to multiply variables). The student could have also recognized that $16w^2$ and 9 represent perfect squares (numbers made by squaring whole numbers). Using this, the student could have also noticed that the square root of $16w^2$ is $4w$ and the square root of 9 is 3. Multiplying the two square roots gives $4w \cdot 3 = 12w$. Since $24w$ is twice $12w$, the student could have correctly realized that $16w^2 + 24w + 9$ has the form of a perfect square trinomial, $a^2 + 2ab + b^2$. This factors as $(a + b)^2$. In this case, $a = 4w$ and $b = 3$, so the factors can be written as $(4w + 3)^2$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option G is incorrect	The student correctly determined the value of a but likely determined the value of b as -3, calculating $\sqrt{9}$ as -3 instead of 3. Therefore, the student identified the factors as $(4w - 3)^2$. The student needs to focus on understanding how to find the square root of a perfect square.
	Option H is incorrect	The student correctly determined the value of b but likely determined the value of a as $8w$, calculating $\frac{16w^2}{2}$ as $\frac{16}{2} \cdot w^{\frac{2}{2}} = 8w$. Therefore, the student identified the factors as $(8w + 3)^2$. The student needs to focus on understanding how to find the square root of a perfect square.
	Option J is incorrect	The student likely determined the value of a as $8w$, calculating $\frac{16w^2}{2}$ as $\frac{16}{2} \cdot w^{\frac{2}{2}} = 8w$, and determined the value of b as -3, calculating $\sqrt{9}$ as -3 instead of 3. Therefore, the student identified the factors as $(8w - 3)^2$. The student needs to focus on understanding how to find the square roots of perfect squares.

Item#	Rationale	
33	Option A is correct	To determine which graph best represents a function with a domain (all possible *x*-values) of all real numbers less than or equal to 6, the student should have identified a graph with a closed starting point containing an *x*-coordinate of 6 and with a ray (a part of a line with a starting point that goes in one direction forever) extending to the left of that point forever. This graph has both requirements because it contains a closed starting point at $(6, -2)$ and continues up forever (as represented by the arrow) to the left. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option B is incorrect	The student likely identified a graph with a range (all possible *y*-values) of all real numbers less than or equal to 6. The student needs to focus on understanding how to identify the domain of a function from a graph.
	Option C is incorrect	The student likely identified a graph with a domain of all real numbers greater than or equal to 6. The student needs to focus on understanding how to identify the domain of a function from a graph.
	Option D is incorrect	The student likely identified a graph with a range (all possible *y*-values) of all real numbers greater than or equal to 6. The student needs to focus on understanding how to identify the domain of a function from a graph.

Item#	Rationale	
34	225 and any equivalent values are correct	To determine the maximum (greatest) value of the graph of the function, the student should have identified the *y*-coordinate of the vertex (high point of the curve) of the graph. The student should have identified the coordinates of the vertex as $(3.75, 225)$ because that point is an equal distance from points $(1.5, 144)$ and $(6, 144)$. Therefore, the maximum value of the graph of the function is 225, or 225 feet. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.

Item#	Rationale	
35	Option D is correct	To determine the equivalent expression, the student could have multiplied the coefficients (numbers used to multiply variables) and applied the product of powers property ($a^m a^n = a^{(m+n)}$), resulting in $(15 \cdot 3)a^{0+16}b^{2+(-29)}c^{34+0} = 45a^{16}b^{-27}c^{34}$. The student could have then used the negative exponent property $\left(a^{-n} = \frac{1}{a^n}\right)$, resulting in $45a^{16}b^{-27}c^{34} = \frac{45a^{16}c^{34}}{b^{27}}$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely added the coefficients and multiplied the exponents (numbers raised to a power), resulting in $(15+3)a^{0 \cdot 16}b^{2 \cdot (-29)}c^{34 \cdot 0} = 18a^0b^{-58}c^0 = 18(1)b^{-58}(1) = 18b^{-58} = \frac{18}{b^{58}}$. The student needs to focus on understanding how to multiply coefficients and how to apply the product of powers property when simplifying expressions.
	Option B is incorrect	The student likely multiplied both the coefficients and the exponents (numbers raised to a power), resulting in $(15 \cdot 3)a^{0 \cdot 16}b^{2 \cdot (-29)}c^{34 \cdot 0} = 45a^0b^{-58}c^0 = 45(1)b^{-58}(1) = 45b^{-58} = \frac{45}{b^{58}}$. The student needs to focus on understanding how to apply the product of powers property when simplifying expressions.
	Option C is incorrect	The student correctly applied the product of powers property but likely added the coefficients, resulting in $(15+3)a^{0+16}b^{2+(-29)}c^{34+0} = 18a^{16}b^{-27}c^{34} = \frac{18a^{16}c^{34}}{b^{27}}$. The student needs to focus on understanding how to multiply coefficients when simplifying expressions.

Item#	Rationale	
36	Option F is correct	To determine the rate of change (constant increase or decrease) of the contractor's total earnings in dollars with respect to the number of hours worked, the student could have chosen two points from the table and calculated the amount of change. The student could have used the first and last sets of values in the table and substituted those values into the slope formula, $m = \frac{y_2 - y_1}{x_2 - x_1}$, resulting in $\frac{370.00 - 20.00}{40 - 0} = \frac{350.00}{40} = 8.75$. Therefore, the rate of change is \$8.75 per hour worked. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option G is incorrect	The student likely divided the last set of values in the table to determine the rate of change, calculating $\frac{370.00}{40} = 9.25$, resulting in a rate of change of \$9.25 per hour worked. The student needs to focus on understanding how to calculate the rate of change from a table of values.
	Option H is incorrect	The student likely identified the common difference of the number of hours worked between 5 hours and 35 hours, 10, and identified that value as a dollar amount, resulting in a rate of change of \$10.00 per hour worked. The student needs to focus on understanding how to calculate the rate of change from a table of values.
	Option J is incorrect	The student likely identified the initial (beginning) value of the linear relationship as the rate of change, resulting in a rate of change of \$20.00 per hour worked. The student needs to focus on understanding how to calculate the rate of change from a table of values.

Item#	Rationale	
37	Option D is correct	To determine the solution set for $2x^2 + 15 = -11x$, the student could have solved the equation for the values of x. The student could have first added $11x$ to both sides of the equation, resulting in $2x^2 + 11x + 15 = 0$. The student could have then found the factors of $2x^2 + 11x + 15$. The student could have first multiplied $2x^2$ by 15, resulting in $30x^2$. The student could have then identified two terms that have a product of $30x^2$ and a sum of $11x$, which are $6x$ and $5x$. The student could have then written out an expression representing the first and last terms of the given expression, $6x$, and $5x$, resulting in $2x^2 + 6x + 5x + 15$. The student could have then grouped the first two terms and last two terms of the expression and factored out the greatest (largest) common factor from each group of terms, resulting in $2x(x + 3) + 5(x + 3)$. Lastly, the student could have factored out $(x + 3)$ from the expression, resulting in $(x + 3)(2x + 5)$. The student could have then set each of these factors equal to 0 and solved for x, resulting in $x + 3 = 0 \rightarrow x = -3$ and $2x + 5 = 0 \rightarrow 2x = -5 \rightarrow x = -\frac{5}{2} = -2.5$. Therefore, the solution set of $2x^2 + 15 = -11x$ is $\{-3, -2.5\}$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely used $2x^2 + 11x + 15$ and identified the two terms that had a product of $30x^2$ but a sum of $13x$ ($10x$ and $3x$), writing out the expression $2x^2 + 10x + 3x + 15$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $2x(x + 5) + 3(x + 5)$. Lastly, the student likely factored out $(x + 5)$ from the expression, resulting in $(x + 5)(2x + 3)$. The student likely then set each of these factors equal to 0 and solved for x, resulting in $x + 5 = 0 \rightarrow x = -5$ and $2x + 3 = 0 \rightarrow 2x = -3 \rightarrow x = -\frac{3}{2} = -1.5$. The student needs to focus on understanding how to find the factors and solutions of a quadratic equation.

Item#	Rationale	
	Option B is incorrect	The student likely used $2x^2 + 11x + 15$ and identified the two terms that had a product of $30x^2$ but a sum of $-11x$ ($-6x$ and $-5x$), writing out the expression $2x^2 - 6x - 5x + 15$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $2x(x - 3) - 5(x - 3)$. Lastly, the student likely factored out $(x - 3)$ from the expression, resulting in $(x - 3)(2x - 5)$. The student likely then set each of these factors equal to 0 and solved for x, resulting in $x - 3 = 0 \rightarrow x = 3$ and $2x - 5 = 0 \rightarrow 2x = 5 \rightarrow x = \frac{5}{2} = 2.5$. The student needs to focus on understanding how to find the factors and solutions of a quadratic equation.
	Option C is incorrect	The student likely used $2x^2 + 11x + 15$ and identified the two terms that had a product of $30x^2$ but a sum of $-13x$ ($-10x$ and $-3x$), writing out the expression $2x^2 - 10x - 3x + 15$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $2x(x - 5) - 3(x - 5)$. Lastly, the student likely factored out $(x - 5)$ from the expression, resulting in $(x - 5)(2x - 3)$. The student likely then set each of these factors equal to 0 and solved for x, resulting in $x - 5 = 0 \rightarrow x = 5$ and $2x - 3 = 0 \rightarrow 2x = 3 \rightarrow x = \frac{3}{2} = 1.5$. The student needs to focus on understanding how to find the factors and solutions of a quadratic equation.

Item#	Rationale	
38	Option F is correct	To determine which function represents the relationship, the student could have determined that the relationship can be represented by an exponential function, $f(x) = ab^x$, where a is the y-intercept (value where the graph crosses the y-axis), b is the common factor (ratio of the successive terms of the function), and x is the variable (symbol used to represent an unknown number). To write the exponential function, the student could have determined the common factor by dividing each $f(x)$-value by the previous $f(x)$-value, calculating $\frac{54}{36} = \frac{3}{2}$, $\frac{81}{54} = \frac{3}{2}$, $\frac{121.5}{81} = \frac{3}{2}$, and $\frac{182.25}{121.5} = \frac{3}{2}$. Then, the student could have determined the y-intercept by dividing the first $f(x)$-value of 36 by $\frac{3}{2}$, which gives the point $(1, 24)$. Doing this once more, the student could have attained the point $(0, 16)$, the y-intercept. The student could have then substituted 16 for a and $\frac{3}{2}$ for b, resulting in $f(x) = 16\left(\frac{3}{2}\right)^x$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option G is incorrect	The student correctly identified the y-intercept but likely determined the common factor as $\frac{2}{3}$ by dividing each $f(x)$-value by the next $f(x)$-value, calculating $\frac{36}{54} = \frac{2}{3}$, $\frac{54}{81} = \frac{2}{3}$, $\frac{81}{121.5} = \frac{2}{3}$, and $\frac{121.5}{182.25} = \frac{2}{3}$. The student likely then substituted 16 for a and $\frac{2}{3}$ for b, resulting in $f(x) = 16\left(\frac{2}{3}\right)^x$. The student needs to focus on understanding how to find the common factor of an exponential function from a table of values.
	Option H is incorrect	The student correctly identified the common factor but likely identified the first $f(x)$-value in the table as the y-intercept, resulting in $f(x) = 36\left(\frac{3}{2}\right)^x$. The student needs to focus on understanding how to find the y-intercept of an exponential function from a table of values.

Item#	Rationale	
	Option J is incorrect	The student likely identified the first $f(x)$-value in the table as the y-intercept and determined the common factor as $\frac{2}{3}$ by dividing each $f(x)$-value by the next $f(x)$-value, calculating $\frac{36}{54} = \frac{2}{3}$, $\frac{54}{81} = \frac{2}{3}$, $\frac{81}{121.5} = \frac{2}{3}$, and $\frac{121.5}{182.25} = \frac{2}{3}$. The student likely then substituted 36 for a and $\frac{2}{3}$ for b, resulting in $f(x) = 36\left(\frac{2}{3}\right)^x$. The student needs to focus on understanding how to find the y-intercept and common factor of an exponential function from a table of values.

Item#	Rationale	
39	Option C is correct	To determine which statement best represents the equation of the line shown on the grid and its relationship to the x-axis, the student could have first recognized that because the line is horizontal, the equation of the line can be written as $y = c$, where c is the value through which the line intersects (crosses) the y-axis, resulting in $y = 2.5$. The student could have then recognized that since the line shown on the grid represents a horizontal line and the x-axis represents the horizontal axis of the grid, the horizontal line and x-axis are parallel (lines that do not intersect and are always the same distance from each other). Therefore, the student could state that the equation of the line is $y = 2.5$ and the line is parallel to the x-axis. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student correctly identified that the horizontal line and the x-axis are parallel to each other but likely used the variable (symbol used to represent an unknown number) x for the equation of the horizontal line because the line is parallel to the x-axis. The student needs to focus on understanding how to write the equation of a horizontal line.
	Option B is incorrect	The student likely used the variable (symbol used to represent an unknown number) x for the equation of the horizontal line because the line is parallel to the x-axis and reversed the characteristics of parallel and perpendicular (lines that intersect at a 90-degree angle) lines. The student needs to focus on understanding the characteristics of parallel and perpendicular lines and how to write the equation of a horizontal line.
	Option D is incorrect	The student correctly identified the equation of the horizontal line but likely reversed the characteristics of parallel and perpendicular (lines that intersect at a 90-degree angle) lines. The student needs to focus on understanding the characteristics of parallel and perpendicular lines.

Item#	Rationale	
40	Option G is correct	To determine the equivalent expression, the student could have recognized that $9n^2 - 25$ can be rewritten as $(3n)^2 - (5)^2$, which represents the difference of squares (an expression we get after multiplying an expression by itself). Since the difference of squares is $a^2 - b^2 = (a + b)(a - b)$, the factors (numbers or expressions that can be multiplied to get another number or expression) of $(3n)^2 - (5)^2$ are $(3n + 5)(3n - 5)$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely identified the difference of squares as $a^2 - b^2 = (a - b)(a - b) = (a - b)^2$, resulting in $(3n - 5)^2$. The student needs to focus on understanding how to factor an expression representing the difference of squares.
	Option H is incorrect	The student likely factored out 9 from n^2 but subtracted 9 from 25, resulting in $9(n^2 - 16)$. The student likely then recognized that $(n^2 - 16)$ represents a difference of squares $((n)^2 - (4)^2)$ but identified the difference of squares as $a^2 - b^2 = (a - b)(a - b) = (a - b)^2$, resulting in $9(n - 4)^2$. The student needs to focus on understanding how to factor an expression representing the difference of squares.
	Option J is incorrect	The student likely factored out 9 from n^2 but subtracted 9 from 25, resulting in $9(n^2 - 16)$. The student likely then recognized that $(n^2 - 16)$ represents a difference of squares $((n)^2 - (4)^2)$, resulting in $9(n + 4)(n - 4)$. The student needs to focus on understanding how to factor an expression representing the difference of squares.

Item#	Rationale	
41	Option D is correct	To determine which graph best represents linear function *t*, the student could have identified the graph of a line that appears to have an *x*-intercept (value where a line crosses the *x*-axis (horizontal axis)) of -1 and a *y*-intercept (value where a line crosses the *y*-axis (vertical axis)) of 5. The student could have determined that the line intersects (crosses) the *x*-axis at $(-1, 0)$ and the *y*-axis at $(0, 5)$, representing an *x*-intercept of -1 and a *y*-intercept of 5. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely reversed the values of the intercepts, identifying the graph of a line with an *x*-intercept of 5 and a *y*-intercept of -1. The student needs to focus on understanding how to identify the intercepts of a linear function.
	Option B is incorrect	The student correctly identified the *y*-intercept but likely identified the opposite value of the *x*-intercept, identifying the graph of a line with an *x*-intercept of 1 and a *y*-intercept of 5. The student needs to focus on understanding how to identify the *x*-intercept of a linear function.
	Option C is incorrect	The student correctly identified the *x*-intercept but likely identified the opposite value of the *y*-intercept, identifying the graph of a line with an *x*-intercept of -1 and a *y*-intercept of -5. The student needs to focus on understanding how to identify the *y*-intercept of a linear function.

Item#	Rationale	
42	112 and any equivalent values are correct	To determine the value of y when $x = 28$, the student could have recognized that when the two variables (symbols used to represent unknown numbers) x and y are directly proportional to each other, their relation can be represented by the equation $y = kx$. To determine the value of k, the student could have substituted $x = 3.5$ and $y = 14$ into $y = kx$ and solved for k, resulting in $14 = k(3.5) \rightarrow \frac{14}{3.5} = k \rightarrow 4 = k$. The student could have then substituted $k = 4$ and $x = 28$ into $y = kx$ to solve for y, resulting in $y = (4)(28) = 112$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.

Item#	Rationale	
43	Option B is correct	To determine the domain (all possible *x*-values) and range (all possible *y*-values) of the quadratic function, the student could have analyzed the parabola (U-shaped graph) graphed on the grid. To identify the domain of the function, the student could have identified all the *x*-values for which the graph has a *y*-value. The student could have determined that the graph continues to expand upward and outward indefinitely, making the domain all real numbers. To identify the range of the function, the student could have identified all the *y*-values for which the graph has an *x*-value. The student could have identified the *y*-coordinate of the graph's lowest point, $(-3, 5)$, and all the *y*-values greater than that *y*-coordinate, resulting in all values greater than or equal to 5, or $y \geq 5$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student identified the range of the function correctly but likely identified the domain of the function as the *x*-coordinate of the graph's lowest point and all the *x*-values greater than that *x*-coordinate, resulting in all values greater than or equal to -3, or $x \geq -3$. The student needs to focus on understanding how to represent the domain of a quadratic function when given a graph.
	Option C is incorrect	The student likely identified the domain of the function as the *x*-coordinate of the graph's lowest point and all the *x*-values greater than that *x*-coordinate, resulting in all values greater than or equal to -3, or $x \geq -3$. The student likely identified the range of the function as all real numbers because the parabola expands upward and outward indefinitely. The student needs to focus on understanding how to represent the domain and range of a quadratic function when given a graph.
	Option D is incorrect	The student likely identified the domain of the function as the *y*-coordinate of the graph's lowest point and all the *y*-values greater than that *y*-coordinate, resulting in all values greater than or equal to 5, or $y \geq 5$. The student likely identified the range of the function as the *x*-coordinate of the graph's lowest point and all the *x*-values greater than that *x*-coordinate, resulting in all values greater than or equal to -3, or $x \geq -3$. The student needs to focus on understanding how to represent the domain and range of a quadratic function when given a graph.

Item#	Rationale	
44	Option F is correct	To determine which linear function represents *f*, the student could have found the slope (steepness of a straight line when graphed on a coordinate grid; $m = \frac{y_2 - y_1}{x_2 - x_1}$) of the line and substituted the slope and one ordered pair from the table into the point-slope formula, $y - y_1 = m(x - x_1)$. The student could have calculated the slope using the ordered pairs (2, 0) and (5, 78), resulting in $m = \frac{78 - 0}{5 - 2} = \frac{78}{3} = 26$. The student could have then substituted the *x*- and *y*-values of (2, 0) and $m = 26$ into the point-slope formula, resulting in $y - 0 = 26(x - 2)$. Lastly, the student could have replaced *y* with $f(x)$ and subtracted 0, resulting in $f(x) = 26(x - 2)$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option G is incorrect	The student likely reversed the values of the slope and *y*-intercept (value where a line crosses the *y*-axis) in the equation $f(x) = 26x - 52$ before factoring out a common factor, resulting in $f(x) = -52x + 26 \rightarrow f(x) = -26(2x - 1)$. The student needs to focus on understanding how to determine a linear function from a table of values.
	Option H is incorrect	The student likely identified an equation that is true for only the ordered pair representing the *x*-intercept (value where a line crosses the *x*-axis) of the graph, (2, 0), identifying the function as $f(x) = 13(x - 2)$. The student needs to focus on understanding how to determine a linear function from a table of values.
	Option J is incorrect	The student likely identified the value of the slope as the *y*-intercept (value where a line crosses the *y*-axis) of –52 and the value of the *y*-intercept as the *x*-intercept (value where a line crosses the *x*-axis) of 2 before factoring out a common factor, resulting in $f(x) = -52x + 2 \rightarrow f(x) = -2(26x - 1)$. The student needs to focus on understanding how to determine a linear function from a table of values.

Item#	Rationale	
45	Option D is correct	To determine the expression equivalent to $x^2 + 10x + 24$, the student could have found the factors (numbers or expressions that can be multiplied to get another number or expression) of $x^2 + 10x + 24$. The student could have first multiplied x^2 by 24, resulting in $24x^2$. The student could have then identified two terms that have a product of $24x^2$ and a sum of $10x$, which are $4x$ and $6x$. The student could have then written out an expression representing the first and last terms of the given expression, $4x$, and $6x$, resulting in $x^2 + 4x + 6x + 24$. The student could have then grouped the first two terms and last two terms of the expression and factored out the greatest (largest) common factor from each group of terms, resulting in $x(x + 4) + 6(x + 4)$. Lastly, the student could have factored out $(x + 4)$ from the expression, resulting in $(x + 4)(x + 6)$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely identified two terms that had a product of $24x^2$ but a sum of $25x$ (x and $24x$), writing out the expression $x^2 + x + 24x + 24$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $x(x + 1) + 24(x + 1)$. Lastly, the student likely factored out $(x + 1)$ from the expression, resulting in $(x + 1)(x + 24)$. The student needs to focus on understanding how to find the factors of an expression in the form $ax^2 + bx + c$.
	Option B is incorrect	The student likely identified two terms that had a product of $24x^2$ but a sum of $14x$ ($2x$ and $12x$), writing out the expression $x^2 + 2x + 12x + 24$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $x(x + 2) + 12(x + 2)$. Lastly, the student likely factored out $(x + 2)$ from the expression, resulting in $(x + 2)(x + 12)$. The student needs to focus on understanding how to find the factors of an expression in the form $ax^2 + bx + c$.
	Option C is incorrect	The student likely identified two terms that had a product of $24x^2$ but a sum of $11x$ ($3x$ and $8x$), writing out the expression $x^2 + 3x + 8x + 24$. The student likely then grouped the terms and factored out the greatest common factors, resulting in $x(x + 3) + 8(x + 3)$. Lastly, the student likely factored out $(x + 3)$ from the expression, resulting in $(x + 3)(x + 8)$. The student needs to focus on understanding how to find the factors of an expression in the form $ax^2 + bx + c$.

Item#	Rationale	
46	Option F is correct	To determine which graph best represents the solution set of $y \leq \frac{3}{4}x - 4$, the student could have recognized that the "$\leq$" symbol means "less than or equal to," which can be represented by a solid line (to indicate points on the line are part of the solution set). The student could have determined the area to be shaded by substituting an ordered pair, such as the origin $(0, 0)$, into the inequality $y \leq \frac{3}{4}x - 4$ to test for a true statement. Since $0 \leq \frac{3}{4}(0) - 4$ is equivalent to $0 \leq -4$, which is a false statement, the origin should not be included in the shaded part of the graph. Therefore, the student should have shaded the part of the graph that does not contain the origin. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option G is incorrect	The student likely identified the inequality symbol "$\leq$" as meaning "greater than," which could be represented by a dashed line (to indicate no points on the line are part of the solution set), and identified the shaded part of the graph to include the origin $(0, 0)$, interpreting $0 \leq -4$ as being a true statement. The student needs to focus on understanding how inequality symbols affect the graph of a solution set.
	Option H is incorrect	The student likely identified the inequality symbol "$\leq$" as meaning "greater than or equal to," which could be represented by a solid line, and identified the shaded part of the graph to include the origin $(0, 0)$, interpreting $0 \leq -4$ as being a true statement. The student needs to focus on understanding how inequality symbols affect the graph of a solution set.
	Option J is incorrect	The student correctly identified the shaded part of the graph that does not include the origin $(0, 0)$ but likely identified the inequality symbol "$\leq$" as meaning "less than," which could be represented by a dashed line (to indicate no points on the line are part of the solution set). The student needs to focus on understanding how inequality symbols affect the graph of a solution set.

Item#	Rationale	
47	Option B is correct	To determine which function (a relationship where each input has a single output) best models the data, the student could have used a graphing calculator to generate the function using quadratic regression (a method of determining the parabola (U-shaped graph) of best fit). The function that best models the data is $y = -60.4x^2 + 348.1x - 334.2$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely reversed the x- and y-values from the table when calculating the quadratic regression ((145, 2.25), (154, 2.50), (168, 2.75), (172, 3.00), (160, 3.25), (137, 3.50), (126, 3.75)), resulting in $y = 0.001x^2 - 0.426x + 35.672$. The student needs to focus on understanding how to pair up the values given in a table when generating a function using quadratic regression.
	Option C is incorrect	The student likely reversed the x- and y-values from the table when calculating the quadratic regression ((145, 2.25), (154, 2.50), (168, 2.75), (172, 3.00), (160, 3.25), (137, 3.50), (126, 3.75)) and only included the positive terms in the function, resulting in $y = 0.001x^2 + 35.672$. The student needs to focus on understanding how to pair up the values given in a table when generating a function using quadratic regression and how to write that quadratic function.
	Option D is incorrect	The student correctly calculated the quadratic regression but likely only included the negative terms in the function, resulting in $y = -60.4x^2 - 334.2$. The student needs to focus on understanding how to write a quadratic function that was generated using quadratic regression.

Item#	Rationale	
48	Option F is correct	To determine the equivalent expression of $35m^2 - 63$, the student could have determined that 7 is the common factor (number or expression that divides another number or expression) of $35m^2$ and -63. Because $7(5) = 35$, the term $35m^2$ can be expressed as $7(5m^2)$. Similarly, -63 can be expressed as $7(-9)$. The student could have then rewritten $35m^2 - 63$ as $7(5m^2) + 7(-9)$. Lastly, the student could have factored out 7 from the expression, resulting in $7(5m^2 - 9)$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option G is incorrect	The student likely identified the common factor as -7 because the constant was a negative number, resulting in $-7(5m^2 + 9)$. The student needs to focus on understanding how to identify the common factor of an expression.
	Option H is incorrect	The student likely identified the common factor as $7m$ in order to make the m-term in the parentheses have an exponent (number raised to a power) of 1, resulting in $7m(5m - 9)$. The student needs to focus on understanding how to identify the common factor of an expression.
	Option J is incorrect	The student likely identified the common factor as $-7m$ in order to make the m-term in the parentheses have an exponent (number raised to a power) of 1 and because the constant was a negative number, resulting in $-7m(5m + 9)$. The student needs to focus on understanding how to identify the common factor of an expression.

Item#	Rationale	
49	Option C is correct	To determine the domain (all possible x-values) of the part of exponential function f, the student could have identified all the values of x for which the graph has a y-value. The graph contains an open circle at $x = -2$, meaning the graph starts but does not include the point $(-2, 1)$. The graph extends upward and to the right indefinitely from $(-2, 1)$. Therefore, the domain of the part shown is all real numbers greater than -2, or $x > -2$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student correctly identified the variable (symbol used to represent an unknown number) representing the domain but likely identified the range (all possible y-values) of the part shown, which is all real numbers greater than 1, or $x > 1$. The student needs to focus on understanding how to represent the domain of an exponential function when given a part of the graph.
	Option B is incorrect	The student likely identified the range (all possible y-values) of the part shown, which is all real numbers greater than 1, or $y > 1$. The student needs to focus on understanding how to represent the domain of an exponential function when given a part of the graph.
	Option D is incorrect	The student correctly identified the values of the domain but likely identified the variable (symbol used to represent an unknown number) representing the range (all possible y-values), which is all real numbers greater than -2, or $y > -2$. The student needs to focus on understanding how to represent the domain of an exponential function when given a part of the graph.

Item#	Rationale	
50	Option G is correct	To determine the y-value of the solution to the system of equations, the student could have used the substitution method. Since the second equation indicates that x is equal to $-2y + 9$, the student could have substituted $-2y + 9$ for x in the first equation, resulting in $6y + (-2y + 9) = -59$. The student could have then combined like terms (terms that contain the same variables raised to the same powers), resulting in $4y + 9 = -59$. The student could have then subtracted 9 from both sides of the equation, resulting in $4y = -68$. Lastly, the student could have divided both sides of the equation by 4, resulting in $y = -17$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely combined the y-terms of $6y + (-2y + 9) = -59$ and identified the value as a negative number, resulting in $-8y + 9 = -59$. The student likely then subtracted 9 from both sides of the equation, resulting in $-8y = -68$. Lastly, the student likely divided both sides of the equation by -8, resulting in $y = 8.5$. The student needs to focus on understanding how to combine like terms when calculating the solution to a system of equations.
	Option H is incorrect	The student likely determined the x-value of the solution to the system of equations, calculating $x = -2(-17) + 9 = 34 + 9 = 43$. The student needs to focus on understanding how to identify the value of y in the solution to a system of equations.
	Option J is incorrect	The student likely solved the first equation for x and then substituted $x = -6y - 59$ into the second equation, resulting in $-6y - 59 = -2y + 9$. The student likely then added 9 to the left side of the equation and $6y$ to the right side of the equation, resulting in $-50 = 4y$. Lastly, the student likely divided both sides of the equation by 4, resulting in $y = -12.5$. The student needs to focus on understanding how to complete all the steps correctly when calculating the solution to a system of equations.

Item#	Rationale	
51	Option C is correct	To determine which statement describes the x-intercept (value where a line crosses the x-axis (horizontal axis)) of the graph, the student should have determined that the line intersects (crosses) the x-axis at $(60, 0)$. The student should have then determined that the x-axis represents the number of monthly payments made on a loan and the y-axis (vertical) represents the remaining balance in dollars of the loan. Therefore, the x-intercept is 60, which represents the number of monthly payments needed to repay the loan.
	Option A is incorrect	The student correctly identified the value of the x-intercept but likely described the meaning of the y-intercept (value where a line crosses the y-axis) for the given situation. The student needs to focus on understanding and interpreting the x-intercept of a linear function representing a situation.
	Option B is incorrect	The student likely identified the value and meaning of the y-intercept (value where a line crosses the y-axis) for the given situation. The student needs to focus on understanding and interpreting the x-intercept of a linear function representing a situation.
	Option D is incorrect	The student correctly identified the meaning of the x-intercept but likely identified the value of the y-intercept (value where a line crosses the y-axis) for the given situation. The student needs to focus on understanding and interpreting the x-intercept of a linear function representing a situation.

Item#	Rationale	
52	Option G is correct	To determine which function represents g, the student should have used the function $g(x) = (x + h)^2$, which represents a horizontal translation (shift) h units to the left of the graph of $f(x) = x^2$. The student should have identified the value of h as 4.5 because the graph of $f(x) = x^2$ was translated 4.5 units to the left to create the graph of function g. Therefore, function g can be represented by $g(x) = (x + 4.5)^2$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option F is incorrect	The student likely subtracted instead of adding the value of h when identifying the function representing a horizontal translation h units to the left, resulting in the function $g(x) = (x - 4.5)^2$. The student needs to focus on understanding how a horizontal translation to the left affects the graph of the quadratic parent function and how to represent that translation in an equation.
	Option H is incorrect	The student likely identified the function representing a vertical translation downward h units, $g(x) = x^2 - h$, resulting in the function $g(x) = x^2 - 4.5$. The student needs to focus on understanding how to identify the function representing a horizontal translation to the left.
	Option J is incorrect	The student likely identified the function representing a vertical translation upward h units, $g(x) = x^2 + h$, resulting in the function $g(x) = x^2 + 4.5$. The student needs to focus on understanding how to identify the function representing a horizontal translation to the left.

Item#	Rationale	
53	Option D is correct	To determine which graph best represents the equation $y = 5\left(\frac{1}{3}\right)^x$, the student could have calculated the values of y for several values of x and determined which graph included those values. Using the values of 0, 1, and 2 for x yields the points $(0, 5)$, $(1, \frac{5}{3})$, and $(2, \frac{5}{9})$, which are all located on this graph. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option A is incorrect	The student likely multiplied 5 and $\frac{1}{3}$ in the given equation, identifying the graph of $y = \left(\frac{5}{3}\right)^x$. The student needs to focus on understanding how to identify the graph of an exponential function.
	Option B is incorrect	The student likely identified 3 as the base instead of $\frac{1}{3}$, identifying the graph of $y = 5(3)^x$. The student needs to focus on understanding how to identify the graph of an exponential function.
	Option C is incorrect	The student likely did not include 5 in the equation, identifying the graph of $y = \left(\frac{1}{3}\right)^x$. The student needs to focus on understanding how to identify the graph of an exponential function.

Item#	Rationale	
54	Option F is correct	To determine the solution to the equation, the student could have solved the equation for m. The student could have first distributed (multiplied) the numbers immediately in front of the parentheses by the terms inside the parentheses, resulting in $-8m + 28 = 156 - 12m$. The student could have then added $12m$ to both sides of the equation, resulting in $4m + 28 = 156$. The student could have then subtracted 28 from both sides of the equation, resulting in $4m = 128$. To solve for m, the student could have divided both sides of the equation by 4, resulting in $m = 32$. The rationale for the correct answer is an efficient way to solve the problem. However, other methods could be used to solve the problem correctly.
	Option G is incorrect	The student likely made a sign error when multiplying -4 and -7 on the left side of the equation, solving $-8m - 28 = 156 - 12m \rightarrow 4m = 184 \rightarrow m = 46$. The student needs to focus on understanding how to apply the distributive property and multiplying negative numbers correctly when solving equations.
	Option H is incorrect	The student likely made a sign error when multiplying 3 and $-4m$ on the right side of the equation, solving $-8m + 28 = 156 + 12m \rightarrow -20m = 128 \rightarrow m = -6.4$. The student needs to focus on understanding how to apply the distributive property and multiplying positive and negative numbers correctly when solving equations.
	Option J is incorrect	The student likely distributed the numbers immediately in front of the parentheses to only the first terms in the parentheses, solving $-8m - 7 = 156 - 4m \rightarrow -4m = 163 \rightarrow m = -40.75$. The student needs to focus on understanding how to apply the distributive property correctly when solving equations.