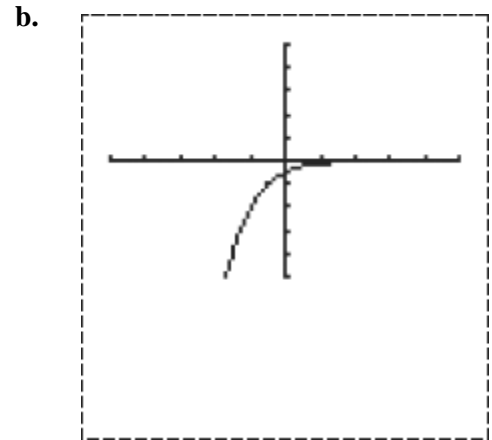
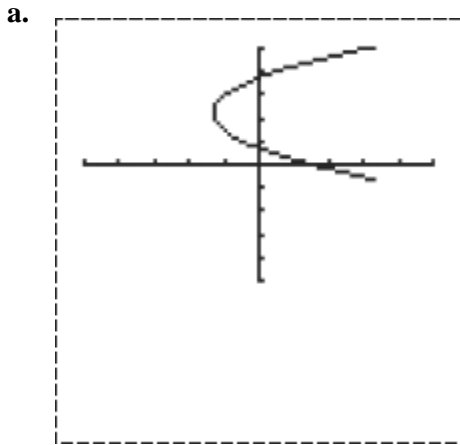


IM1 Midterm Review

- Hector knows there is a relationship between the number of cars he washes and the time it takes him to wash those cars. Identify the independent quantity and the dependent quantity in the problem situation.
- Tell whether each graph represents a function and explain why.



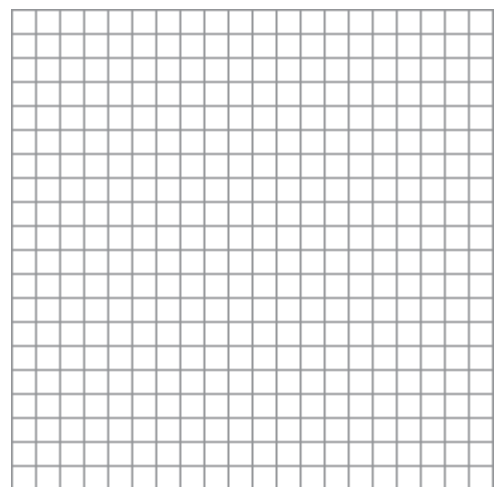
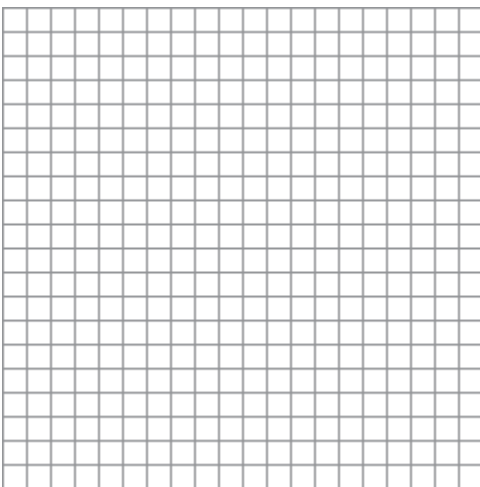
- Classify each function as a linear function, a linear absolute value function, a quadratic function, or an exponential function.

a. $f(x) = -7x$ b. $f(x) = 3x^2$ c. $f(x) = -4^x$ d. $f(x) = 8$

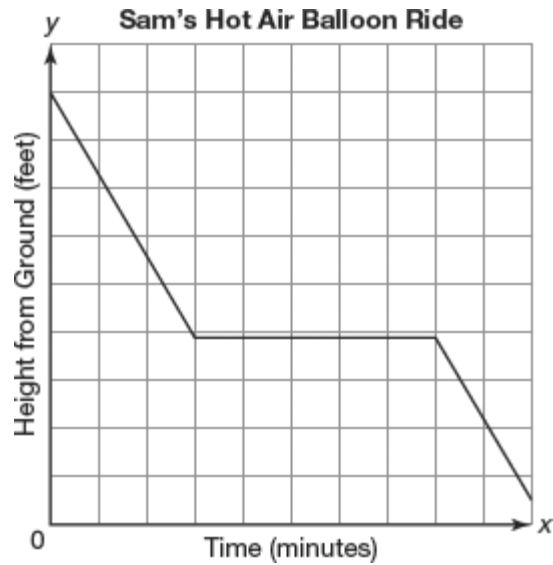
- Create an equation and sketch a graph for each set of given characteristics.

- a.
- is a function
 - is linear
 - is discrete
 - is increasing

- b.
- is a function
 - is a linear absolute value function
 - is discrete
 - has an absolute maximum



5. Sam rode in a hot air balloon. After the balloon began its initial descent, it stayed in the air at a constant height for a few minutes, then it continued its descent to the ground. The graph shows this relationship. In the graph, what is the independent quantity and what is the dependent quantity?



6. Solve the equation and justify your reasoning.

$$5(x + 4) - 4 = x + 32$$

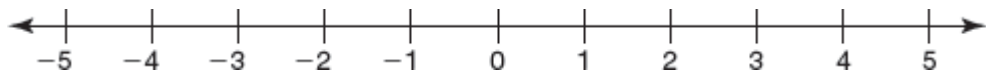
7. Solve the inequality and graph the solution on the number line.

$$4(x + 1) \leq -12$$



8. Graph the compound inequality on the number line.

$$-1 \leq x < 4$$



9. Solve the absolute value equation.

$$|2x - 5| = 7$$

10. Evaluate each expression. Show your work.

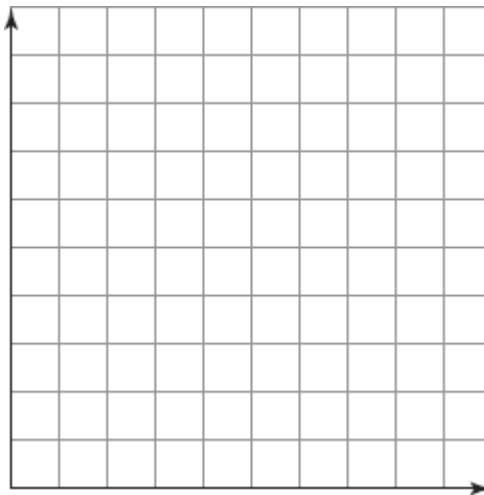
a. $|-7 - 11|$ b. $\left| \frac{-48}{-4} \right|$

11. Solve the equation.

$$-7(x + 1) - 6 = -41x + 55$$

12. Gina has saved \$420. She plans to spend \$35 each month for music lessons. The function $s(t) = -35t + 420$ describes her savings s in dollars as a function of the time t in months.

a. Graph the function that describes Gina's savings s as a function of the time she works, t .



b. Estimate how much Gina will have left of her savings after 10 months.

13. Solve each inequality, and graph the solution on the number line.

a. $-\frac{3}{7}x \leq 2$



b. $81 > 69 - x$



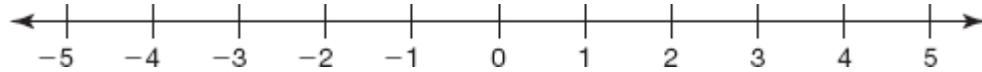
14. Evaluate each linear absolute value equation. Show your work.

a. $41 = |x - 6| + 18$

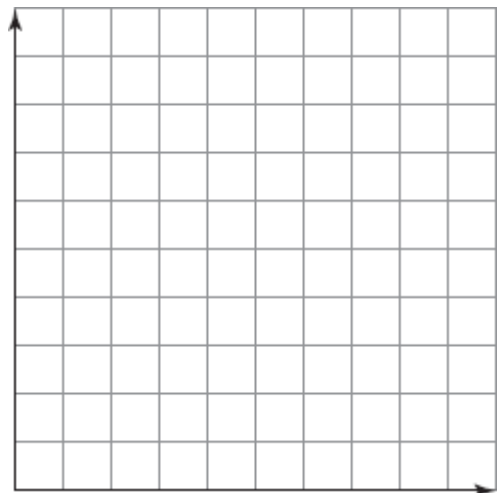
b. $52 = 7|x - 2| - 4$

15. Solve the linear absolute value inequality. Then graph the solution on the number line.

$$8 \leq |3x - 2|$$



16. What is the y -intercept for the equation $7x + 2y = -12$?
17. What is the x -intercept for the equation $-3x - 5y = 21$?
18. Susan saved \$85. She has already spent \$35. She plans to spend \$10 on a movie ticket each month. Which inequality represents the number of movie tickets she can buy?
- a. $10t + 35 \leq 85$
 - b. $10t - 35 \leq 85$
 - c. $-10t + 35 \leq 85$
 - d. $-10t - 35 \leq 85$
19. Determine the rate of change of the ordered pairs $(1250, 1)$ and $(-520, 4)$.
20. Holly has \$150 to spend at the shopping mall. She decides to buy sweaters and pants with her money. Sweaters cost \$35 each and pants cost \$20 each.
- a. Write an equation to represent this problem situation. Use s to represent the number of sweaters and p to represent the number of pants.
 - b. Holly buys 3 sweaters, what is the greatest number of pants she can buy? Show your work and explain your reasoning.
 - c. If Holly buys no pants, what is the greatest number of sweaters she can buy? Show your work and explain your reasoning.
 - d. Graph this situation showing the s and p - intercepts.



21. Solve the formula $C = 2\pi r$ for r . Show your work.

22. Write the equation $y = -\frac{1}{4}x + 3$ in standard form.

23. Write the equation $2x + 3y = 9$ in slope-intercept form.

24. Consider the sequence shown.



a. Describe the pattern.

b. Draw the next two figures of the pattern.

c. Write a numeric sequence to represent the first 5 figures.

25. Identify each sequence as arithmetic or geometric. Then determine the common difference or common ratio for each sequence.

a. 2, 5, 8, 11, 14, 17

b. 26, 12, -24, 48, -96

c. $1, \frac{1}{4}, \frac{1}{16}, \frac{1}{64}, \frac{1}{256}$

d. 0.13, 0.38, 0.63, 0.88, 1.13

26. For each sequence, write an explicit formula. Then determine the 15th term in the sequence.

a. 5, 10, 20, 40, 80, 160

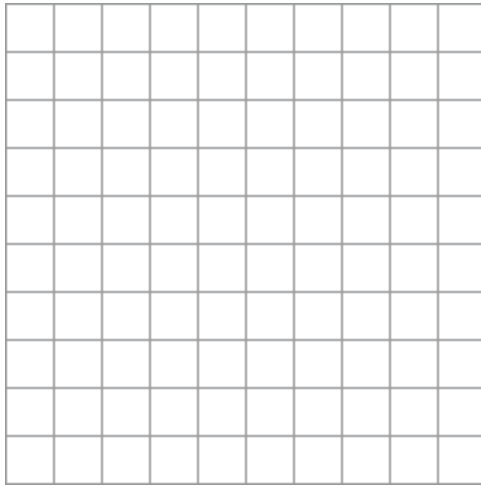
b. $\frac{1}{2}, 1, \frac{3}{2}, 2, \frac{5}{2}, 3, \frac{7}{2}$

27. Rewrite each explicit formula in function form.

a. $a_n = 5 + 0.2(n - 1)$

b. $g_n = 3 \cdot (-2)^{n-1}$

28. Graph the ordered pairs for the sequence given by the formula $g_n = 32 \cdot \left(\frac{1}{2}\right)^{n-1}$



29. The formula for an account that earns simple interest is $P_t = P_0 + (P_0 \cdot r)t$ where P_t represents the balance in the account after t years, P_0 represents the initial deposit, and r represents the interest rate. The formula for an account that earns compound interest is $P_t = P_0 \cdot (1 + r)^t$ where P_t represents the balance in the account after t years, P_0 represents the initial deposit, and r represents the interest rate.

a. Complete the table below for an initial deposit of \$20,000 at a rate of 2.5%. Round each amount to the nearest dollar.

Time	6 months	1 year	5 years	20 years
Simple Interest Balance				
Compound Interest Balance				

b. Determine the rate of change for each function. Show your work or explain your reasoning.

c. Compare the rates of change. What does this tell you about the graphs of the functions? Explain your reasoning.

30. Write the equation of each function after the translation described.

a. $f(x) = -10x$ after a translation 5 units to the right

b. $g(x) = 3^x$ after a translation 4 units up

c. $h(x) = 2x^2$ after a translation 2 units left and 1 unit down

31. Describe each graph in relation to its basic function.

a. Compare $f(x) = (x + 3)^2$ to the basic function $h(x) = x^2$.

b. Compare $f(x) = b^x + 1$ to the basic function $h(x) = b^x$.

c. Compare $f(x) = b^{-x}$ to the basic function $h(x) = b^x$.

32. Solve each exponential equation for x .

a. $5^{x+3} = 15,625$

b. $\frac{1}{4^{x-1}} = 4,096$

33. The expenses for a company this year were \$74,000. Write a function that represents the company's expenses as a function of time in years for each situation.

a. expenses increase at a rate of 2.3% per year

b. expenses decrease at a rate of 1.7% per year

34. Determine the solution to each system of equations.

a.
$$\begin{cases} 3x - y = 5 \\ 2x + 7y = -12 \end{cases}$$

b.
$$\begin{cases} -2x = -10y - 2 \\ -x + 8y = 5 \end{cases}$$

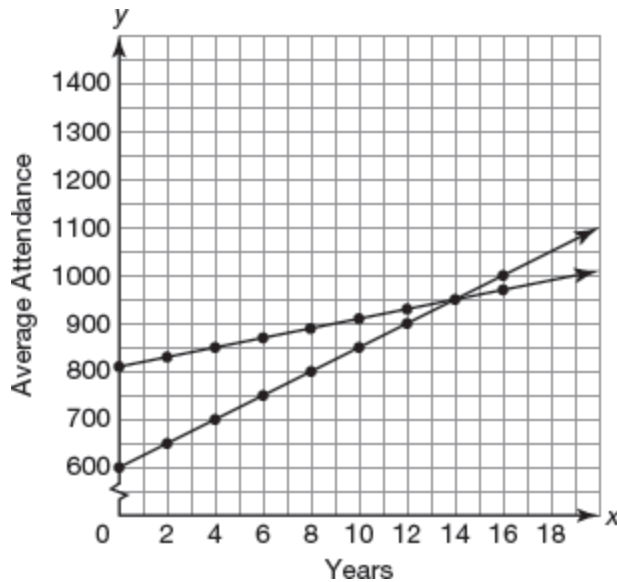
35. Determine the number of solutions for each system of equations.

a.
$$\begin{cases} 4y = 3x - 28 \\ 4y = 3x + 8 \end{cases}$$

b.
$$\begin{cases} 5y = -5x + 10 \\ y + x = 2 \end{cases}$$

c.
$$\begin{cases} 2y = x - 6 \\ y = 2x + 4 \end{cases}$$

36. The graph shows the average attendance for two schools. What does the solution $x = 14$ represent?



37. Determine the solution to each system of equations.

a.
$$\begin{cases} 6x + 2y = 2 \\ -3x - 4y = -13 \end{cases}$$

b.
$$\begin{cases} 0.5x = 0.25y - 0.5 \\ 0.2x + 0.75y = 6.6 \end{cases}$$

38. Brittany and Lynn each earn a base salary plus commission. Brittany earns \$2000 plus 15% of her sales each month. Lynn earns \$2200 plus 10% of her sales each month. How much will Brittany and Lynn need to sell in order to earn the same amount each month.

**IM1 Midterm Review
Answer Section**

1. ANS:

The independent quantity is the number of cars washed. The dependent quantity is the time it takes to wash the cars.

REF: 1.1

2. ANS:

a. not a function

b. function

REF: 1.2

3. ANS:

a. linear function

b. quadratic function

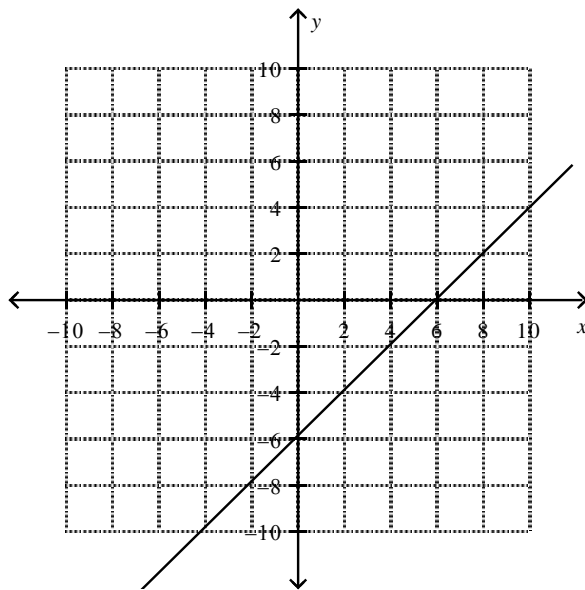
c. exponential function

d. linear function

REF: 1.3

4. ANS:

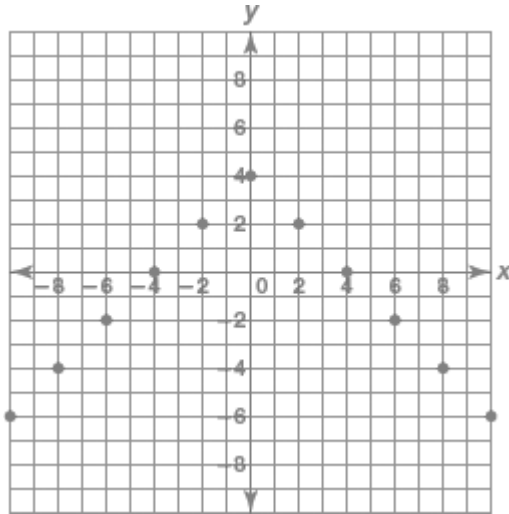
Sample answers shown.



a.

$x - 6$, where x is an integer

b.



$$-|x| + 4$$

REF: 1.4

5. ANS:

The independent quantity is the time in minutes. The dependent quantity is the height, in feet, that the balloon is from the ground.

REF: 1.1

6. ANS:

$$5x + 20 - 4 = x + 32$$

$$5x + 16 = x + 32$$

$$5x = x + 16$$

$$4x = 16$$

$$\frac{4x}{4} = \frac{16}{4}$$

$$x = 4$$

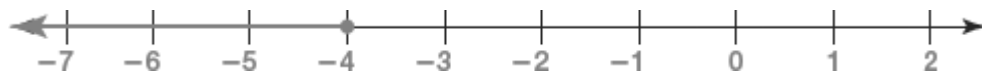
REF: 2.1

7. ANS:

$$4x + 4 \leq -12$$

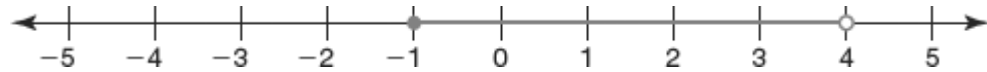
$$4x \leq -16$$

$$x \leq -4$$



REF: 2.3

8. ANS:



REF: 2.4

9. ANS:

$$\begin{array}{l} (2x - 5) = 7 \quad -(2x - 5) = 7 \\ 2x - 5 = 7 \quad 2x - 5 = -7 \\ 2x = 12 \quad 2x = -2 \\ x = 6 \quad x = -1 \end{array}$$

REF: 2.5

10. ANS:

a. $|-18| = 18$

b. $|12| = 12$

REF: 2.5

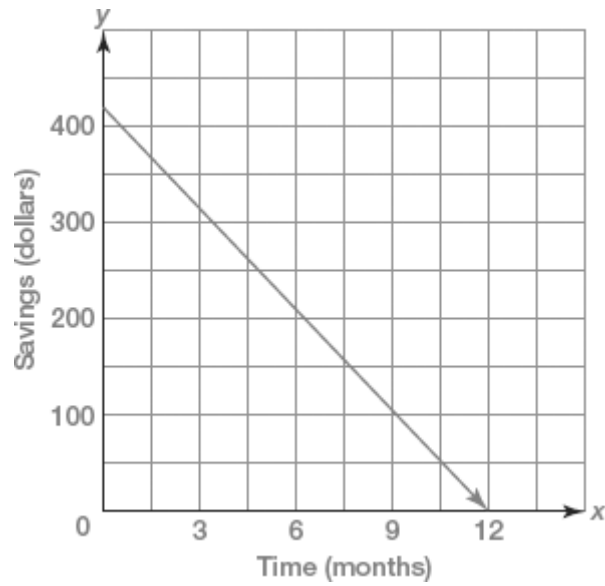
11. ANS:

$$\begin{array}{l} -7x - 7 - 6 = -41x + 5 \\ -7x - 13 = -41x + 55 \\ -7x - 13 + 13 = -41x + 55 + 13 \\ -7x = -41x + 68 \\ -7x + 41x = -41x + 41x + 68 \\ 34x = 68 \\ \frac{34x}{34} = \frac{68}{34} \\ x = 2 \end{array}$$

REF: 2.1

12. ANS:

a.



b. The graph appears to show that Gina will have about \$70 left after 10 months.

REF: 2.2

13. ANS:

a. $\left(-\frac{7}{3}\right)\left(-\frac{3}{7}\right)x \leq \left(-\frac{7}{3}\right)^2$

$$x \geq -\frac{14}{3}$$



b. $81 - 69 > 69 - 69 - x$

$$12 > -x$$

$$-12 < x$$

$$x > -12$$



REF: 2.3

14. ANS:

$$\begin{array}{ll} \text{a.} & 41 = (x - 6) + 18 & 41 = -(x - 6) + 18 \\ & 41 = x + 12 & 41 = -x + 6 + 18 \\ & 29 = x & 41 = -x + 24 \\ & x = 29 & 17 = -x \\ & & x = -17 \end{array}$$

$$\begin{array}{l} \text{b.} \quad 52 + 4 = 7|x - 2| - 4 + 4 \\ \quad 56 = 7|x - 2| \\ \quad \frac{56}{7} = \frac{7|x - 2|}{7} \\ \quad 8 = |x - 2| \end{array}$$

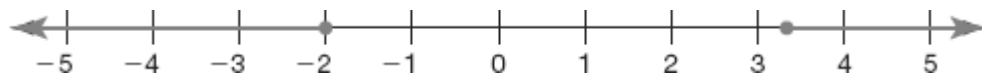
$$\begin{array}{ll} 8 = (x - 2) & 8 = -(x - 2) \\ 8 = x - 2 & -8 = x - 2 \\ 10 = x & -6 = x \\ x = 10 & x = -6 \end{array}$$

REF: 2.5

15. ANS:

$$\begin{array}{ll} 8 \leq (3x - 2) & 8 \leq -(3x - 2) \\ 10 \leq 3x & 8 \leq -3x + 2 \\ & 6 \leq -3x \end{array}$$

$$\frac{10}{3} \leq x \quad \text{or} \quad -2 \geq x$$



REF: 2.5

16. ANS:

$$(0, -6)$$

REF: 3.2

17. ANS:

$$(-7, 0)$$

REF: 3.2

18. ANS: A REF: 2.3

19. ANS:

$$\frac{-1770}{3}$$

20. ANS:

a. $35s + 20p = 150$

b. $35s + 20p = 150$

$$35(3) + 20p = 150$$

$$105 + 20p = 150$$

$$20p = 45$$

$$p = 2.25$$

If Holly buys 3 sweaters, the greatest number of pants she can buy is 2. If she wants to buy more than 2, she will need more than \$150.

c. $35s + 20p = 150$

$$35s + 20(0) = 150$$

$$35s + 0 = 150$$

$$35s = 150$$

$$s = 4.29$$

If Holly buys no pants, the greatest number of sweaters she can buy is 4. If she wants to buy more than 4, she will need more than \$150.

REF: 3.2

21. ANS:

$$C = 2\pi r$$

$$\frac{C}{2\pi} = r$$

REF: 3.3

22. ANS:

$$x + 4y = 12$$

REF: 3.3

23. ANS:

$$y = -\frac{2}{3}x + 3$$

REF: 3.3

24. ANS:

a. Each figure has 1 more row of dots at the bottom. That row has one more dot than the bottom row in the previous figure.

b.



c. 3, 6, 10, 15, 21

REF: 4.1

25. ANS:

a. arithmetic; common difference: 3

b. geometric; common ratio: -2

c. geometric; common ratio: $\frac{1}{4}$

d. arithmetic; common difference: 0.25

REF: 4.2

26. ANS:

a. $g_n = 5 \cdot 2^{n-1}$

$$g_{15} = 81,920$$

b. $a_n = \frac{1}{2} + \frac{1}{2}(n-1)$

$$a_n = \frac{15}{2}$$

REF: 4.3

27. ANS:

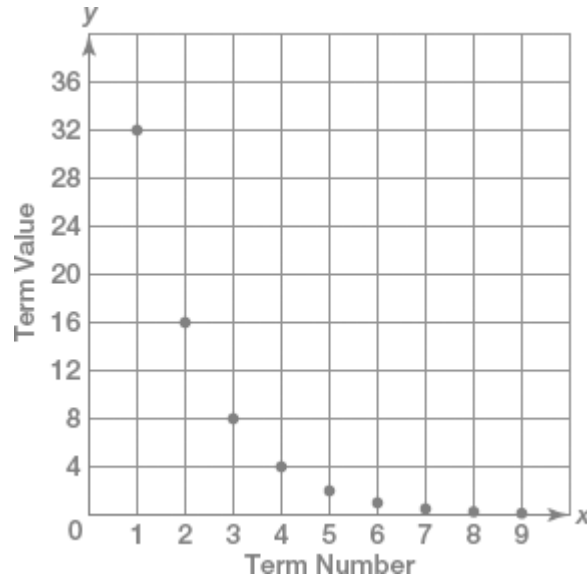
a. $f(n) = 0.2n + 4.8$

b. $f(n) = -1.5 \cdot (-2)^n$

REF: 4.5

28. ANS:

REF: 4.4



29. ANS:

a.

Time	6 months	1 year	5 years	20 years
Simple Interest Balance	20,250	20,500	22,500	30,000
Compound Interest Balance	20,248	20,500	22,628	32,772

b. Simple interest: The average rate of change for the simple interest account is \$500 per year because each year the balance increases by \$500.

Compound Interest:

$$\frac{20,500 - 20,248}{1 - 0.5} = \frac{252}{0.5} = \frac{504 \text{ dollars}}{1 \text{ year}}$$

$$\frac{22,628 - 20,500}{5 - 1} = \frac{2128}{4} = \frac{532 \text{ dollars}}{1 \text{ year}}$$

$$\frac{32,772 - 22,628}{20 - 5} = \frac{10,144}{15} \approx \frac{676.27 \text{ dollars}}{1 \text{ year}}$$

The average rate of change for the compound interest account is increasing over time.

c. A constant rate of change, such as in the simple interest account, tells me that the graph of the equation is a straight line which represents a linear function. An increasing rate of change, such as in the compound interest account, tells me that the graph of the equation is a smooth curve which represents an exponential function.

REF: 5.1

30. ANS:

a. $m(x) = -10(x - 5)$

b. $m(x) = 3^x + 4$

c. $m(x) = 2(x + 2)^2 - 1$

REF: 5.3

31. ANS:

a. The graph of $f(x)$ is 3 units to the left of the graph of $h(x)$.

b. The graph of $f(x)$ is 1 unit up from the graph of $h(x)$.

c. The graph of $f(x)$ is a reflection of the graph of $h(x)$ about the vertical line $x = 0$.

REF: 5.3 | 5.4

32. ANS:

a. $x = 3$

b. $x = -5$

REF: 5.6

33. ANS:

a. $f(t) = 74,000(1 + 0.023)^t$

b. $f(t) = 74,000(1 - 0.017)^t$

REF: 5.1

34. ANS:

a.	$y = 3x - 5$	b.	$x = 8y - 5$
	$2x + 7(3x - 5) = -12$		$-2(8y - 5) = -10y - 2$
	$2x + 21x - 35 = -12$		$-16y + 10 = -10y - 2$
	$23x = 23$		$12 = 6y$
	$x = 1$		$y = 2$
	$y = 3(1) - 5 = -2$		$x = 8(2) - 5 = 11$
	$(1, -2)$		$(11, 2)$

REF: 6.1

35. ANS:

a. 0 solutions

b. infinitely many solutions

c. 1 solution REF: 6.1

36. ANS:
After 14 years, both schools have an average attendance of 950 students.

REF: 6.1

37. ANS:

<p>a.</p> $\begin{array}{r} 6x + 2y = 2 \\ 2(-3x - 4y = -13) \\ \hline -6y = -24 \\ y = 4 \end{array}$	$\begin{array}{r} 6x + 2(4) = 2 \\ 6x = -6 \\ x = -1 \\ (-1, 4) \end{array}$
<p>b.</p> $\begin{array}{r} 3(0.5x - 0.25y = -0.5) \\ 0.2x + 0.75y = 6.6 \\ \hline 1.7x = 5.1 \\ x = 3 \end{array}$	$\begin{array}{r} 0.2(3) + 0.75y = 6.6 \\ 0.75y = 6 \\ y = 8 \\ (3, 8) \end{array}$

REF: 6.2

38. ANS:

$\begin{cases} y = 2000 + 0.15s \\ y = 2200 + 0.10s \end{cases}$	$\begin{array}{r} 2000 + 0.15s = 2200 + 0.10s \\ 0.05s = 200 \\ s = 4000 \end{array}$
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Brittany and Lynn each need to sell \$4000 in order to earn the same amount each month.
REF: 6.4