Lesson 3.1

# Unit 3 Homework Key

***Determine if each of the following is a true function based on the equation or table. Explain how you know.***

1. $y = x^2$

| $x$ | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|
| $y$ | $4$ | $1$ | $0$ | $1$ | $4$ |

Function, one input gives only one output

2. $x^2 + y^2 = 25$

| $x$ | $-4$ | $-3$ | $0$ | $3$ | $4$ |
|---|---|---|---|---|---|
| $y$ | $\pm 3$ | $\pm 4$ | $\pm 5$ | $\pm 4$ | $\pm 3$ |

Not a function, one input gives more than one output

3. $y = \sqrt{x+5}$

| $x$ | $-5$ | $-4$ | $-1$ | $4$ | $11$ |
|---|---|---|---|---|---|
| $y$ | $0$ | $1$ | $2$ | $3$ | $4$ |

Function, one input gives only one output

4. $y = \frac{1}{4}x^3 - 5x$

| $x$ | $-4$ | $-2$ | $0$ | $2$ | $4$ |
|---|---|---|---|---|---|
| $y$ | $4$ | $8$ | $0$ | $-8$ | $-4$ |

Function, one input gives only one output

5. $x^2 + y^2 = 100$

| $x$ | $-8$ | $-6$ | $0$ | $6$ | $8$ |
|---|---|---|---|---|---|
| $y$ | $\pm 6$ | $\pm 8$ | $\pm 10$ | $\pm 8$ | $\pm 6$ |

Not a function, one input gives more than one output

6. $y = 2x + 5$

| $x$ | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|
| $y$ | $1$ | $3$ | $5$ | $7$ | $9$ |

Function, one input gives only one output

7. $x = y^2$

| $x$ | $0$ | $1$ | $4$ | $9$ | $25$ |
|---|---|---|---|---|---|
| $y$ | $0$ | $\pm 1$ | $\pm 2$ | $\pm 3$ | $\pm 5$ |

Not a function, one input gives more than one output

8. $y = 2x^2 - 1$

| $x$ | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|
| $y$ | $7$ | $1$ | $-1$ | $1$ | $7$ |

Function, one input gives only one output

9. $x^2 - y^2 = 9$

| $x$ | $-5$ | $-3$ | $3$ | $5$ |
|---|---|---|---|---|
| $y$ | $\pm 4$ | $0$ | $0$ | $\pm 4$ |

Not a function, one input gives more than one output

10. $\frac{x^2}{4} + \frac{y^2}{4} = 1$

| $x$ | $-2$ | $0$ | $2$ |
|---|---|---|---|
| $y$ | $0$ | $\pm 4$ | $0$ |

Not a function, one input gives more than one output

11. $y = -\frac{1}{2}x$

| $x$ | $-4$ | $-2$ | $0$ | $2$ | $4$ |
|---|---|---|---|---|---|
| $y$ | $2$ | $1$ | $0$ | $-1$ | $-2$ |

Function, one input gives only one output

12. $y = \frac{2}{x}$

| $x$ | $-2$ | $-1$ | $1$ | $2$ |
|---|---|---|---|---|
| $y$ | $-1$ | $-2$ | $2$ | $1$ |

Function, one input gives only one output

13. Explain how to determine whether or not an equation models a function.

If there is an exponent on the $y$ it is not a function.

14. Explain how to determine whether or not a table models a function.

If there is more than one output for an input, it's not.

***Determine if the following descriptions of relationships represent true functions. Explain why they do or why they do not.***

15. Input: Time elapsed, Output: Distance run around the track.
Not a function, in 2 minutes you could run a single lap and the next time in 2 minutes run only half a lap.
16. Input: Store's name, Output: Number of letters in the name.
Function, the number of letters is constant meaning inputting "Wal-Mart" will always give only one output of 7.
17. Input: Person's age, Output: Yearly salary.
Not a function, two 45 year olds could be making very different salaries.
18. Input: Amount of food eaten, Output: A dog's weight.
Not a function, the same dog could eat the same amount of food each day and weight different amounts.
19. Input: Person's name/identity, Output: That person's birthday.
Function, a person only has one birthday.
20. Input: Person's age, Output: Height.
Not a function, the same age has different heights.
21. Input: Name of a food, Output: Classification of that food (such as meat, dairy, grain, fruit, vegetable).
Function, a tomato is always a fruit and only a fruit.
22. Input: Time studied for test, Output: Test score.
Not a function, you could study for 30 minutes and get different scores.

***Evaluate the given function using the given input.***

23. $a = 4b$
$b = -2$
$a = -8$

24. $y = \frac{1}{2}x + 3$
$x = 10$
$y = 8$

25. $g = h^2 + 2$
$h = -3$
$g = 11$

26. $c = t + 75$
$t = 100$
$c = 175$

27. $a = -4b$
$b = -3$
$a = 12$

28. $y = \frac{1}{4}x - 3$
$x = -8$
$y = -5$

29. $g = h^2 - 6$
$h = -2$
$g = -2$

30. $c = t - 85$
$t = 40$
$c = -45$

31. $a = 2b + 5$
$b = 5$
$a = 15$

32. $y = -\frac{1}{3}x + 2$
$x = 9$
$y = -1$

33. $g = 2h^2 + 1$
$h = 3$
$g = 19$

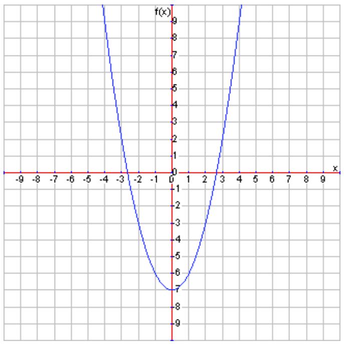
34. $c = t + 55$
$t = 70$
$c = 125$

## Lesson 3.2

***Graph the following functions by filling out the*** x/y ***chart using the given inputs (***x ***values).***

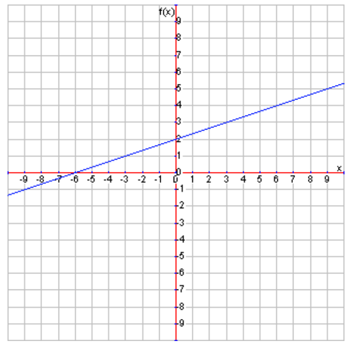
1. $y = x^2 - 7$

| $x$ | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|
| $y$ | $-3$ | $-6$ | $-7$ | $-6$ | $-3$ |



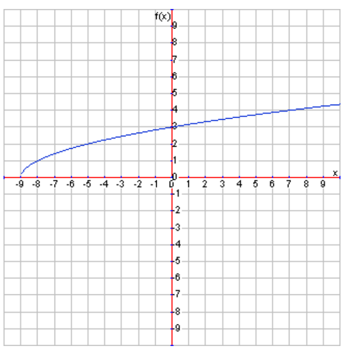
2. $y = \frac{1}{3}x + 2$

| $x$ | $-6$ | $-3$ | $0$ | $3$ | $6$ |
|---|---|---|---|---|---|
| $y$ | $0$ | $1$ | $2$ | $3$ | $4$ |



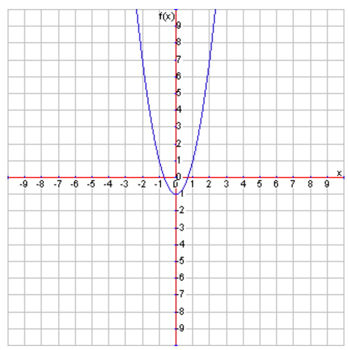
3. $y = \sqrt{x + 9}$

| $x$ | $-9$ | $-8$ | $-5$ | $0$ | $7$ |
|---|---|---|---|---|---|
| $y$ | $0$ | $1$ | $2$ | $3$ | $4$ |



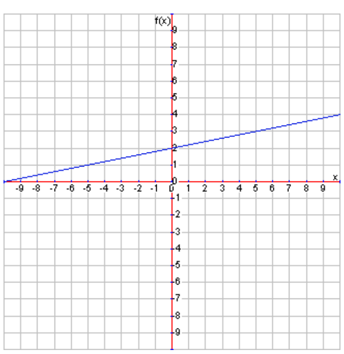
4. $y = 2x^2 - 1$

| $x$ | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|
| $y$ | $7$ | $1$ | $-1$ | $1$ | $7$ |



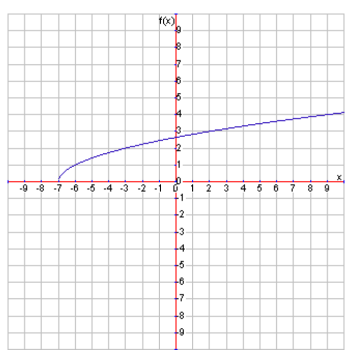
5. $y = \frac{1}{5}x + 2$

| $x$ | $-10$ | $-5$ | $0$ | $5$ | $10$ |
|---|---|---|---|---|---|
| $y$ | $0$ | $1$ | $2$ | $3$ | $4$ |



6. $y = \sqrt{x + 7}$

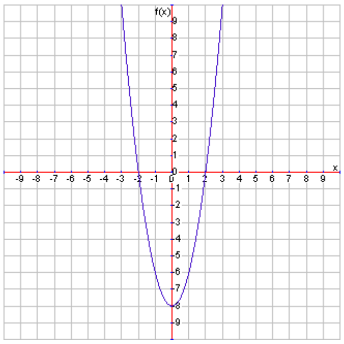
| $x$ | $-7$ | $-6$ | $-3$ | $2$ | $9$ |
|---|---|---|---|---|---|
| $y$ | $0$ | $1$ | $2$ | $3$ | $4$ |



***Graph the following functions by filling out the x/y chart using the inputs (x values) that you think are appropriate.***

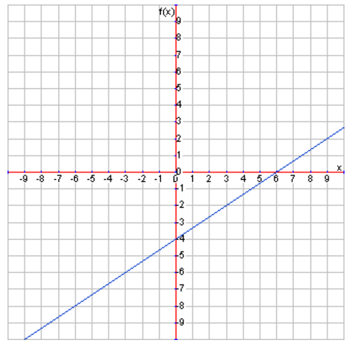
7. $y = 2x^2 - 8$

| $x$ | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|
| $y$ | $0$ | $-6$ | $-8$ | $-6$ | $0$ |



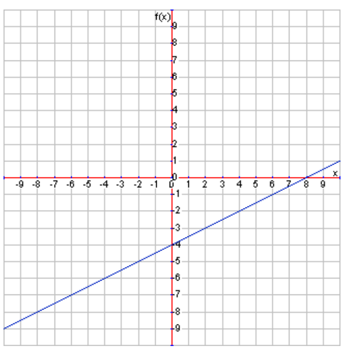
8. $y = \frac{2}{3}x - 4$

| $x$ | $-6$ | $-3$ | $0$ | $3$ | $6$ |
|---|---|---|---|---|---|
| $y$ | $-8$ | $-6$ | $-4$ | $-2$ | $0$ |



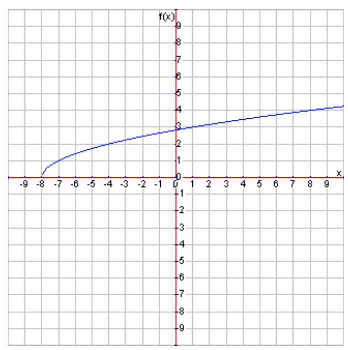
9. $y = \frac{1}{2}x - 4$

| $x$ | $-4$ | $-2$ | $0$ | $2$ | $4$ |
|---|---|---|---|---|---|
| $y$ | $-6$ | $-5$ | $-4$ | $-3$ | $-2$ |



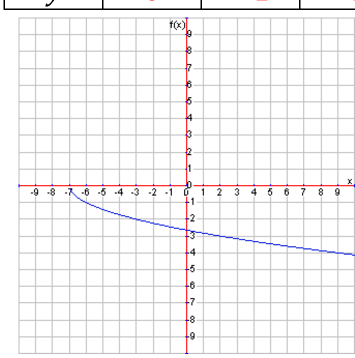
10. $y = \sqrt{x + 8}$

| $x$ | $-8$ | $-7$ | $-4$ | $1$ | $8$ |
|---|---|---|---|---|---|
| $y$ | $0$ | $1$ | $2$ | $3$ | $4$ |



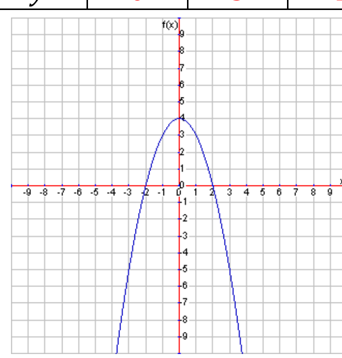
11. $y = -\sqrt{x + 7}$

| $x$ | $-7$ | $-6$ | $-3$ | $2$ | $9$ |
|---|---|---|---|---|---|
| $y$ | $0$ | $-1$ | $-2$ | $-3$ | $-4$ |



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

| $x$ | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|
| $y$ | $0$ | $3$ | $4$ | $3$ | $0$ |



13. Explain why it would be beneficial to choose the inputs $-2$, $-1$, $0$, $1$, and $2$ for the function $y = x^2 + 1$.
Answers will vary. Sample: They are the smallest inputs making it easier to square them.

14. Explain why it would be beneficial to choose the inputs $-8$, $-4$, $0$, $4$, and $8$ for the function $y = \frac{3}{4}x - 2$.
Answers will vary. Sample: They are all divisible by $4$ since we have a slope of $\frac{3}{4}$.

15. Explain why it would be beneficial to choose the inputs $-9$, $-8$, $-5$, $0$, and $7$ for the function $y = \sqrt{x + 9}$.
Answers will vary. Sample: They give perfect squares which we can square root.

16. Explain how you would choose $5$ different inputs for the function $y = \sqrt{x + 6}$. Explain why you feel these are the best input values for this function.
Answers will vary. Sample: I would look for inputs that would give the perfect squares $(-6, -5, -2, 3, and\ 10)$ because then I could easily take the square root.

17. For problems 2, 5, 8, 9, describe a pattern in the change in the $y$ values for each function.
Answer will vary. Sample: The change in $y$ values are equal to the numerator of the fraction multiplied by $x$.

18. For problems 2, 5, 8, 9, explain similarities and differences in the structure of the equations.
Answers will vary. Sample: They each have a fraction times $x$ then plus or minus a number, but the numbers are all different.

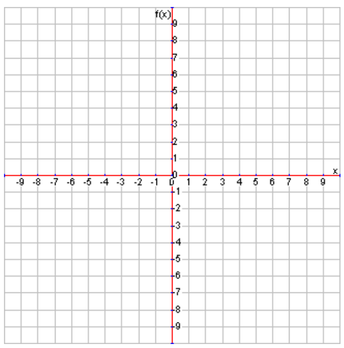
19. For problems 2, 5, 8, 9, explain similarities and differences in the graph of each function.
Answers will vary. Sample: They each are a line but they are tilted different.

## Lesson 3.3

***Determine whether the following functions are linear or non-linear and explain how you know. Blank*** x/y ***charts and coordinate planes have been given to graph the functions if that helps you.***

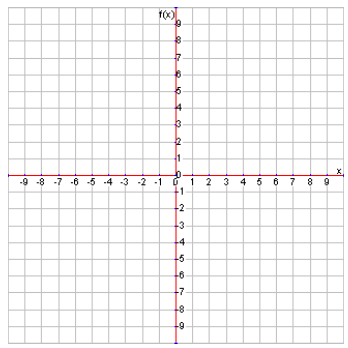
1. $y = x^2 - 2x$ non-linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



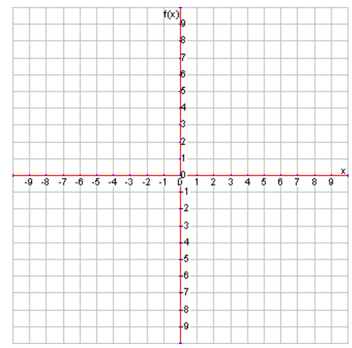
2. $y = \frac{1}{3}x - 2$ linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



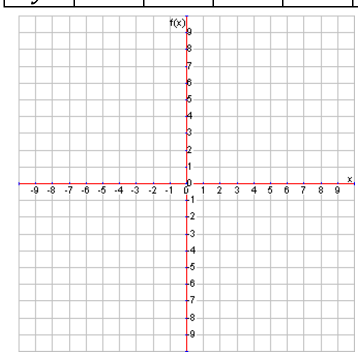
3. $y = -2x + 2$ linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



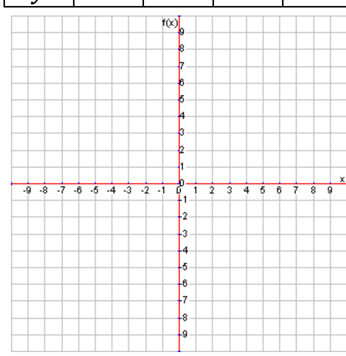
4. $y = x^2 + 3$ non-linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



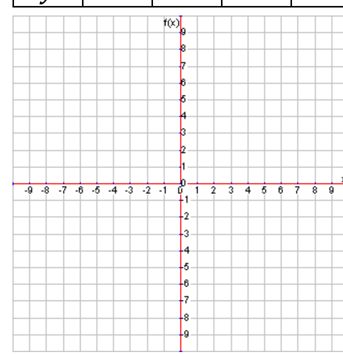
5. $5x + 3y = 0$ linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



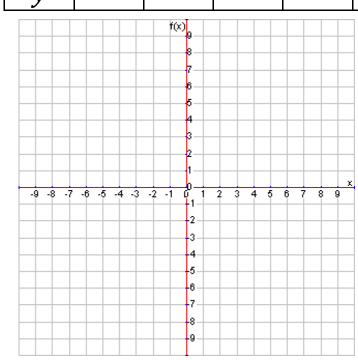
6. $y - 4x = -5$ linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



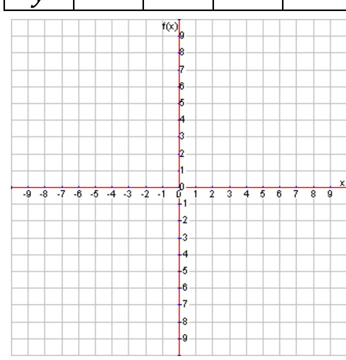
7. $y = \sqrt{x + 9}$ non-linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



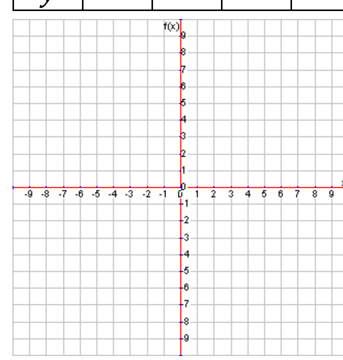
8. $y = 3^x - 2$ non-linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



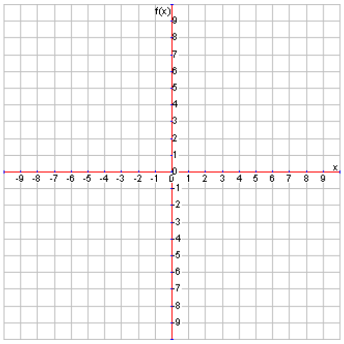
9. $y = x^3 - x^2$ non-linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



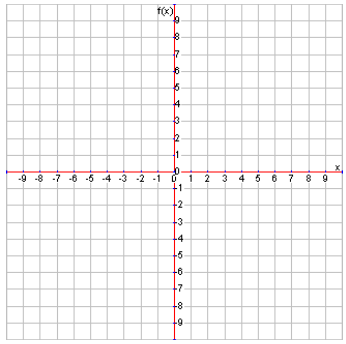
10. $y = x^3 - 7x$ non-linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



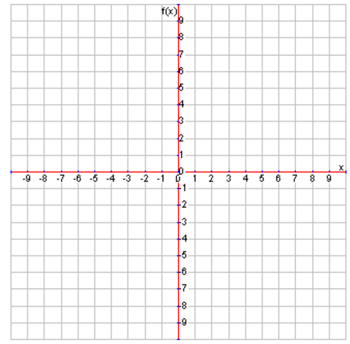
11. $y = 2^x + 3$ non-linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |



12. $y = \sqrt{x - 2}$ non-linear

| $x$ | | | | | |
|---|---|---|---|---|---|
| $y$ | | | | | |

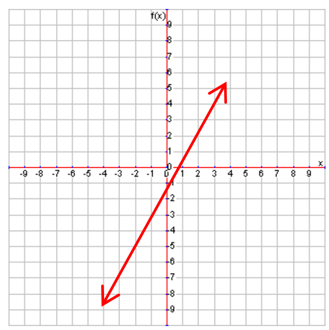


13. Give an example of a linear function in equation form.
Answers will vary. Sample: $y = 2x + 1$

14. Give an example of a linear function in table form.
Answers will vary. Sample:

| $x$ | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| $y$ | 2 | 4 | 6 | 8 | 10 |

15. Sketch an example of a linear function in graph form.
Answers will vary. Sample:

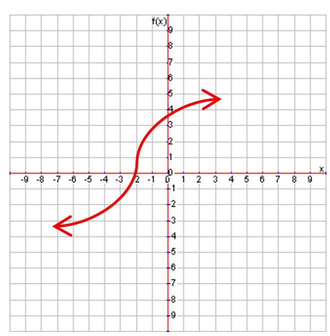


16. Give an example of a non-linear function in equation form.
Answers will vary. Sample: $y = x^2$

17. Give an example of a non-linear function in table form.
Answers will vary. Sample:

| $x$ | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| $y$ | 1 | 4 | 9 | 16 | 25 |

18. Sketch an example of a non-linear function in graph form.
Answers will vary. Sample:



## Lesson 3.4

***Identify the rate of change, initial value, independent variable, and dependent variable. Then describe what the rate of change and initial value mean in the context of each situation. Finally, write the equation of each linear function.***

1. A 2.5 foot rocket's distance traveled in meters $(d)$ based on time in seconds $(t)$ is modeled by the following function: $d = 5t + 2$.

Rate of Change:__5__________

Initial Value:___2___________

Independent Variable:_$t$____

Dependent Variable:_$d$_______

**Contextual Description of Rate of Change**

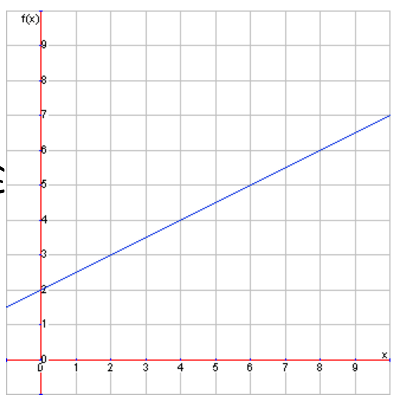
The rocket travels 5 meters per second,

**Contextual Description of Initial Value**

Before the rocket launches (when time is 0), it is two meters off the ground.

2. The cost for 6 people to travel in a taxi in New York $(c)$ based on the number of miles driven $(m)$ is shown by the following graph:

Cost ($)



***Miles driven***

Rate of Change:__$\frac{1}{2}$__________

Initial Value:__2_____________

Independent Variable:_$m$_____

Dependent Variable:__$c$______

EQ of Line:___$c = \frac{1}{2}m + 2$ ____

**Contextual Description of Rate of Change**

The taxi charges one dollar per two miles traveled.

**Contextual Description of Initial Value**

A passenger is charged $2 when 0 miles are traveled.

3. Planet Wiener receives $2.25 for every hotdog sold. They spend $105 for 25 packages of hot dogs and 10 packages of buns. Think of the linear function that demonstrates the profit $(p)$ based on the number of hotdogs sold $(h)$.

Rate of Change:___2.25_________

Initial Value:____$-105$__________

Independent Variable:__$h$____

Dependent Variable:___$p$_____

**Contextual Description of Rate of Change**

Planet Wiener makes $2.25 for every hotdog sold.

**Contextual Description of Initial Value**

Planet Wiener spends $105 on food and supplies.

EQ of Line:_$p = 2.25h - 105$ _

4. The weight (in pounds) of a 20′ x 10” x 12” aquarium tank $(w)$ based on the number of gallons of water inside $(g)$ is modeled by the following function: $w = 8.5g + 20$.

Rate of Change:___8.5__________

Initial Value:______20___________

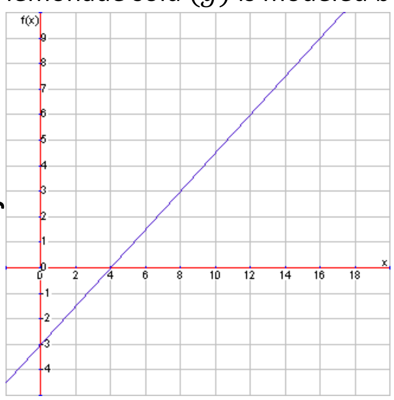
Independent Variable:__$g$_____

Dependent Variable:__$w$_______

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| Each gallon of water weighs 8.5 pounds. | The tank weighs 20 pounds without water in it. |

5. The amount of profit of the lemonade stand on 120 W Main Street $(p)$ based on the number of glasses of lemonade sold $(g)$ is modeled by the following graph:

***Profit***



***Number of glasses sold***

Rate of Change:____ $\frac{3}{4}$________

Initial Value:_____$-3$___________

Independent Variable:__$g$_____

Dependent Variable:____$p$_____

EQ of Line:___ $p = \frac{3}{4}g - 3$ ___

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| The sellers make $\frac{3}{4}$ of a dollar (\$0.75) per glass of lemonade sold. | If the sellers sell 0 glasses of lemonade, they will have lost \$3 |

6. A candle starts at a height of 5 inches and diameter of 3 inches and burns down 1 inch every 2 hours. Think of the linear function that demonstrates the height of the candle $(h)$ in terms of the time it has been burning $(t)$.

Rate of Change:___ $\frac{1}{2}$ _________

Initial Value:_____5___________

Independent Variable:__$t$_____

Dependent Variable:__$h$_______

EQ of Line:___ $h = \frac{1}{2}t + 5$ ___

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| The candle burns 1 inch every 2 hours. | The candle starts at a height of 5 inches. |

7. The cost $(c)$ to stay in a 4 star hotel each night $(n)$ is modeled by the following function: $c = 104n + 15$

Rate of Change: 104

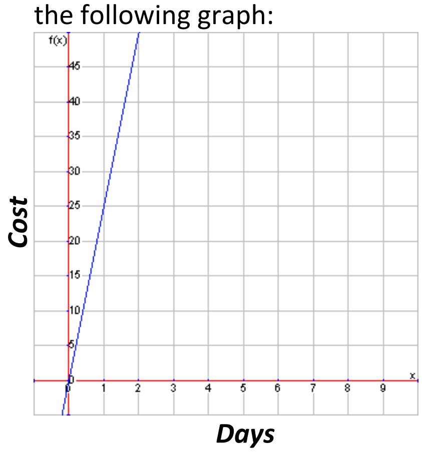
Initial Value: 15

Independent Variable: $n$

Dependent Variable: $c$

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| It costs $104 each night | There is a $15 fee. |

8. The cost $(c)$ to attend a sports clinic 37 miles away based on the number of days attended $(d)$ is modeled by the following graph:




Rate of Change: 25

Initial Value: 0

Independent Variable: $c$

Dependent Variable: $d$

EQ of Line: $c = 25d$

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| It costs $25 per day to attend the sports clinic. | There is no initial value. |

9. A dog kennel charges $40 for each night the dog stays in the kennel. Each day includes a 2 hour play time and 1 hour etiquette training. The kennel also charges a $10 bathing fee for a bath before the dog returns home. Think of the linear function that demonstrates the cost of putting a dog in the kennel $(c)$ in terms of the number of nights $(n)$.

Rate of Change: 40

Initial Value: 10

Independent Variable: $n$

Dependent Variable: $c$

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| It costs $40 per night. | There is a $10 bathing fee. |

EQ of Line: $c = 40n + 10$

10. The number of gallons of gas in your 15 gallon gas tank $(g)$ based on the number of miles traveled $(m)$ is modeled y the following function: $g = -\frac{1}{25}m + 12$.

Rate of Change:___$-\frac{1}{25}$_________

Initial Value:___12_____________

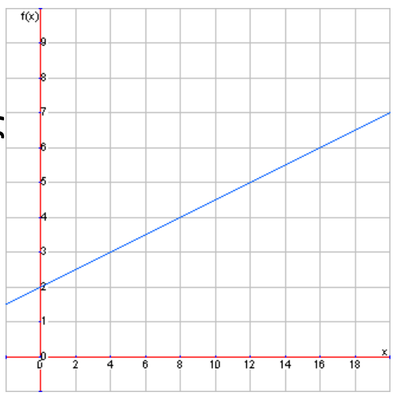
Independent Variable:__$m$____

Dependent Variable:___$g$_____

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| The car uses 1 gallons of gas every 25 miles. | 12 gallons of gas are in the tank to begin with. |

11. The number of pizzas ordered for 8th grade night $(p)$ based on the number of students $(s)$ is shown by the following graph:

*Number of pizzas*




*Number of students*

Rate of Change:__$\frac{1}{4}$__________

Initial Value:____2____________

Independent Variable:__$s$____

Dependent Variable:___$p$_____

EQ of Line:___ $p = \frac{1}{4}s + 2$ ____

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| $\frac{1}{4}$ of a pizza was ordered for each student, or 1 pizza was ordered for every 4 students. | 2 pizzas are ordered when there are 0 students. |

12. It costs \$5.50 to mail a large package to New Zealand. The post office will weigh your package and charge you an extra \$0.30 per pound. The delivery takes 2 weeks. Think of the linear function that demonstrates the cost to mail a large package to New Zealand $(c)$ based on the number pounds it weighs $(p)$.

Rate of Change:___0.30_________

Initial Value:_____5.50_________

Independent Variable:__$p$____

Dependent Variable:__$c$______

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| A package sent to New Zealand costs \$0.30 per pound of weight. | It costs \$5.50 to mail a package that weighs 0 pounds. |

EQ of Line:____$c = 0.30p + 5.50$ __

13. An author wrote an 876-page book. The amount of profit $(p)$ based on the number books sold $(b)$ is modeled by the following function: $p = 7b + 1050$.

Rate of Change: $7$

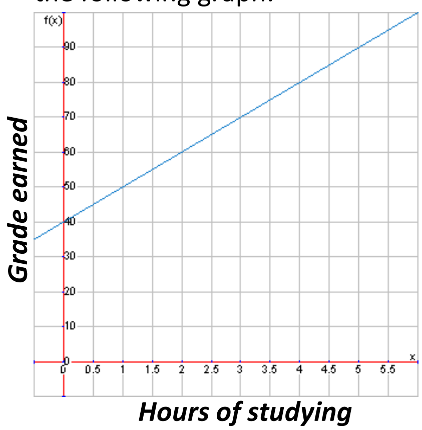
Initial Value: $1050$

Independent Variable: $b$

Dependent Variable: $p$

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
| --- | --- |
| There is a \$7 profit for each book sold. | There is a \$1050 profit when no books are sold. |

14. The average grade earned on the Unit 3 test $(g)$ based on the number of hours of studying $(h)$ is modeled by the following graph:




Rate of Change: $10$

Initial Value: $40$

Independent Variable: $h$

Dependent Variable: $g$

EQ of Line: $g = 10h + 40$

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
| --- | --- |
| A student earns an extra 10% for every hour of studying. | A student earns 40% when he/she studies for 0 hours. |

15. Kiley invited 32 people to her 13th birthday party at the bowling alley. She hopes most people can come! It costs \$40 to reserve the bowling alley. It will cost an additional \$2 per friend to bowl. Think of the linear function that demonstrates the cost of the birthday party $(c)$ in terms of the number of friends who attend and bowl $(f)$.

Rate of Change: $2$

Initial Value: $40$

Independent Variable: $f$

Dependent Variable: $c$

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
| --- | --- |
| It costs \$2 per friend to bowl. | It costs \$40 if 0 friends bowl. |

EQ of Line: $c = 2f + 40$

16. You started a mowing business so you could buy a 2015 Chevy Camaro when you turn 16. The amount of money $(m)$ in your bank account based on the number of yards you mow $(y)$ is modeled by the following function: $m = 30y$.

Rate of Change: 30

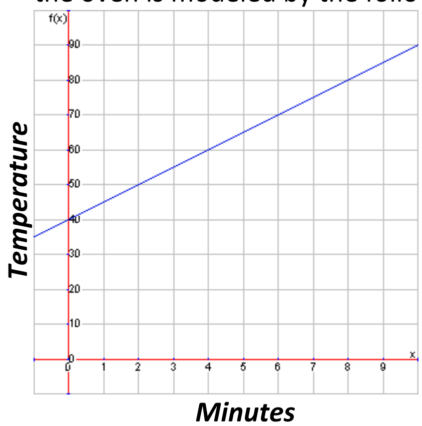
Initial Value: 0

Independent Variable: $y$

Dependent Variable: $m$

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| You earn $30 for each yard you mow. | You have $0 in your account before you mow any yards. |

17. When an oven is set at 350°F, the internal temperature $(t)$ of a chicken breast after every minute $(m)$ it's in the oven is modeled by the following graph:




Rate of Change: 5

Initial Value: 40

Independent Variable: $m$

Dependent Variable: $t$

EQ of Line: $t = 10m + 40$

| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| The temperature increases 5°F every minute it's in the oven. | The chicken breast is 40°F before it goes in the oven. |

18. Walter's Water Adventures charges $34 to enter. This fee helps pay for maintenance and lifeguards. They always have 3 lifeguards at each slide plus 2 watching the wave pool. Think of the linear function that demonstrates the number of lifeguards on duty $(l)$ based on the number of slides open $(s)$ on a given day.

Rate of Change: 3

Initial Value: 2

Independent Variable: $s$

Dependent Variable: $l$

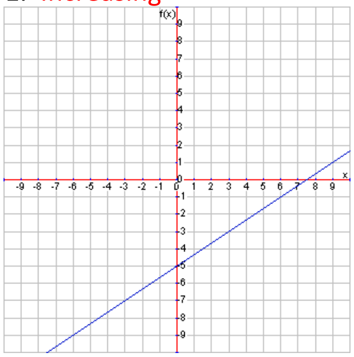
| Contextual Description of Rate of Change | Contextual Description of Initial Value |
|---|---|
| There are 3 lifeguards for each slide. | There are 2 lifeguards at the wave pool |

EQ of Line: $l = 3s + 2$

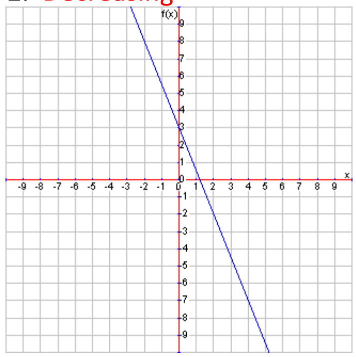
## Lesson 3.5

***For each linear graph tell whether it is increasing, decreasing, or constant.***

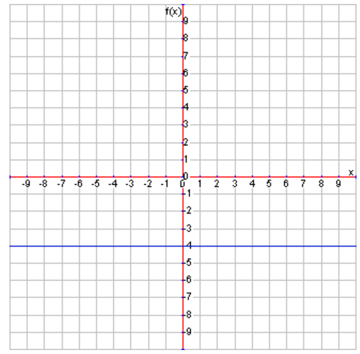
1. Increasing



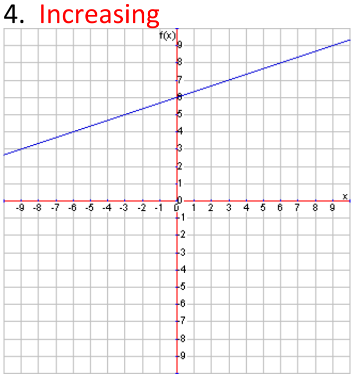
2. Decreasing



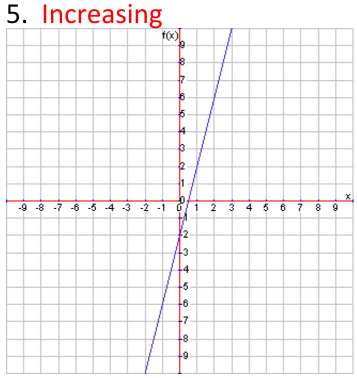
3. Constant



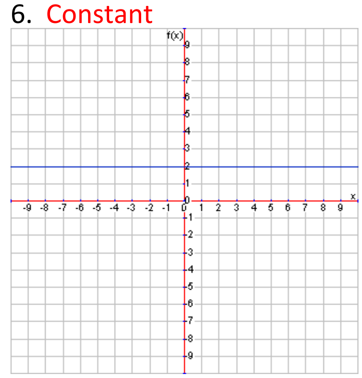
4. Increasing



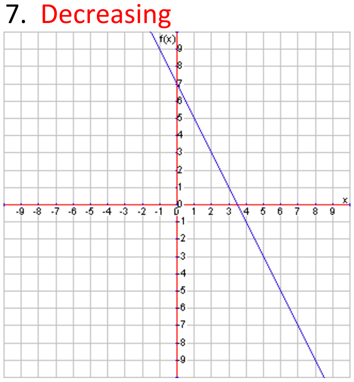
5. Increasing



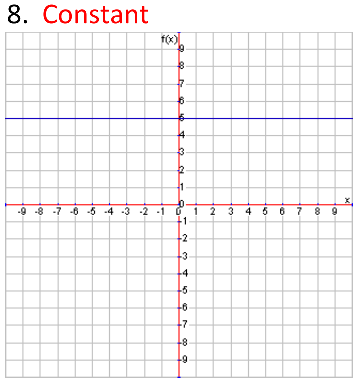
6. Constant



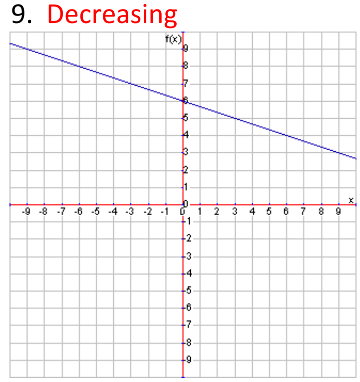
7. Decreasing



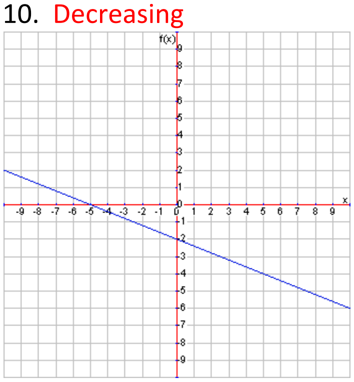
8. Constant



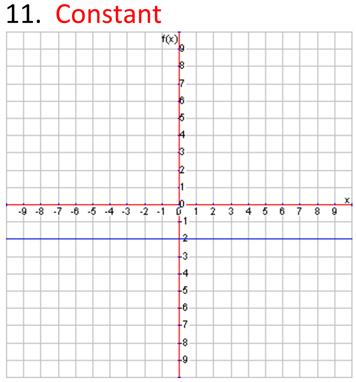
9. Decreasing



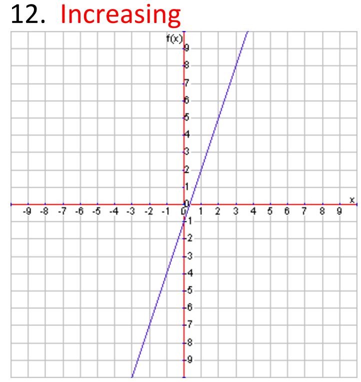
10. Decreasing



11. Constant

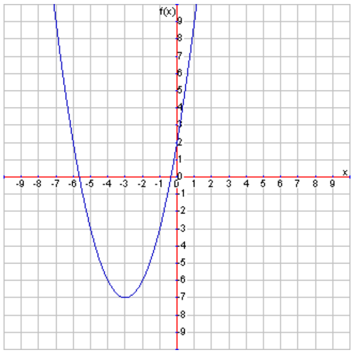


12. Increasing



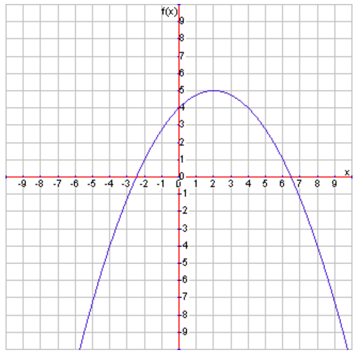
***For each non-linear graph tell where it is increasing and decreasing and identify any maximum, minimum, local maximum, or local minimum.***

13.



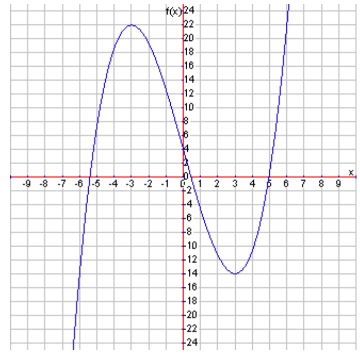
Increasing: $x > -3$
Decreasing: $x < -3$
Minimum: $y = -7$

14.



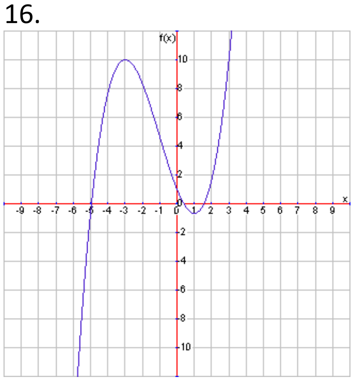
Increasing: $x < 2$
Decreasing: $x > 2$
Maximum: $y = 5$

15.



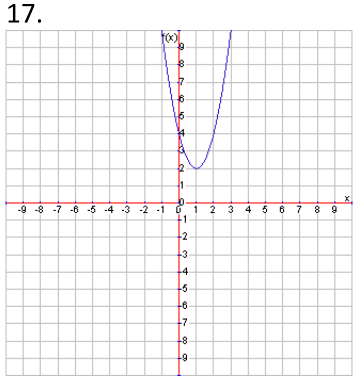
Increasing: $x < -3 \text{ and } x > 3$
Decreasing: $-3 < x < 3$
Local Maximum: $y = 22$
Local Minimum: $y = -14$

16.



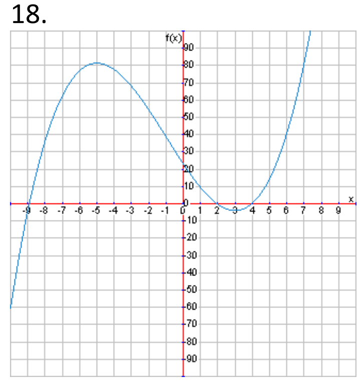
Increasing: $x < -3 \text{ and } x > 1$
Decreasing: $-3 < x < 1$
Local Maximum: $y = 10$
Local Minimum: $y \approx -\frac{1}{2}$

17.



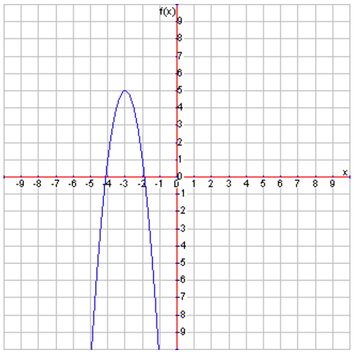
Increasing: $x > 1$
Decreasing: $x < 1$
Minimum: $y = 2$

18.



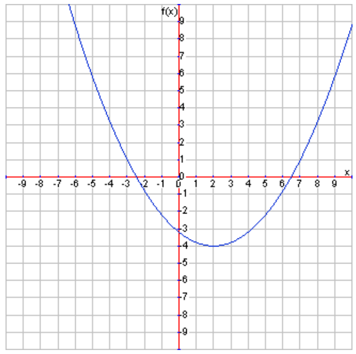
Increasing: $x < -5 \text{ and } x > 3$
Decreasing: $-5 < x < 3$
Local Maximum: $y \approx 80$
Local Minimum: $y \approx -5$

19.



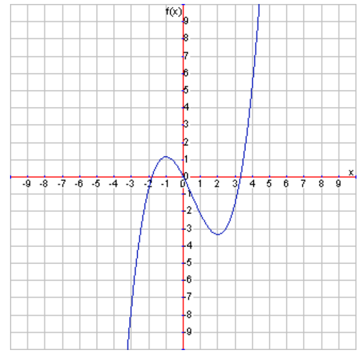
Increasing: $x < -3$
Decreasing: $x > -3$
Maximum: $y = 5$

20.



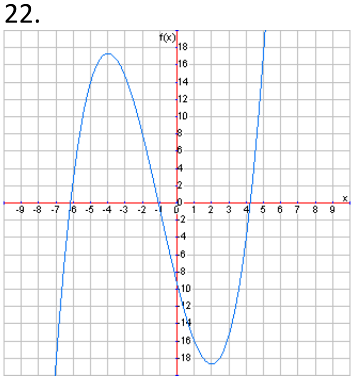
Increasing: $x > 2$
Decreasing: $x < 2$
Minimum: $y = -4$

21.



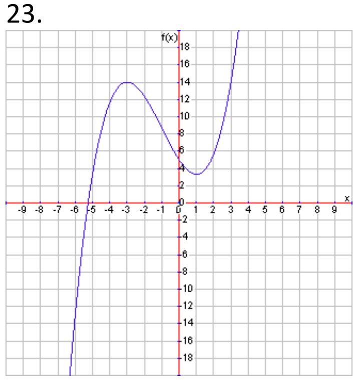
Increasing: $x < -1 \; and \; x > 2$
Decreasing: $-1 < x < 2$
Local Maximum: $y \approx 1$
Local Minimum: $y \approx -3$

22.



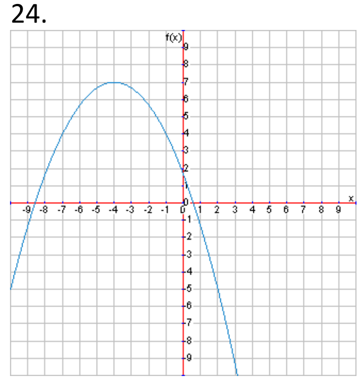
Increasing: $x < -4 \; and \; x > 2$
Decreasing: $-4 < x < 2$
Local Maximum: $y \approx 17$
Local Minimum: $y \approx -18$

23.



Increasing: $x < -3, and x > 1$
Decreasing: $-3 < x < 1$
Local Maximum: $y = 14$
Local Minimum: $y \approx 4$

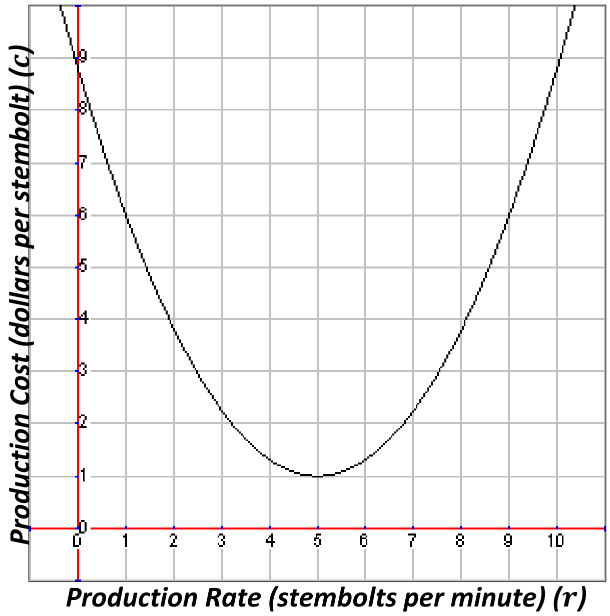
24.



Increasing: $x < -4$
Decreasing: $x > -4$
Maximum: $y = 7$

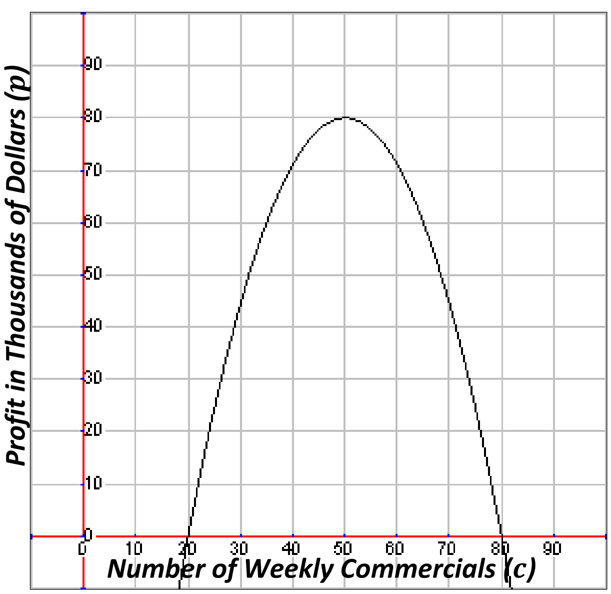
Lesson 3.6

***Use the following graph showing a function modeling the production cost per stembolt (c) a factory gets in terms of the production rate of how many stembolts it produces per minute (r) to answer the questions.***



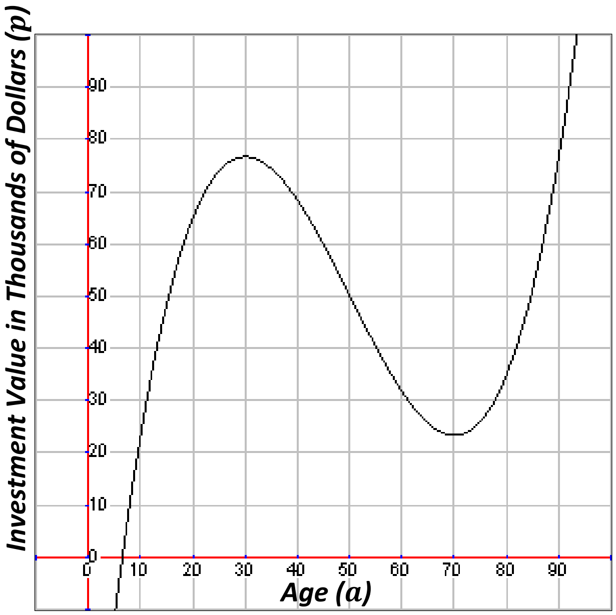

1. If the possible inputs for this function are between one and nine, what does that mean in the context of this problem?
The factory can produce between 1 and 9 stembolts per minute.
2. Within those inputs, what are all the different costs per stembolt that the company could have?
1 to 6 dollars per stembolt.
3. At what production rate does the company get the cheapest production cost?
5 stembolts per minute.
4. What is the cheapest production cost?
1 dollar per stembolt.
5. Between what production rates does the company get cheaper and cheaper production costs?
Between 1 and 5 stembolts per minute.
6. Between what production rates does the company get higher and higher production costs?
Between 5 and 9 stembolts per minute.

***Use the following graph showing a function modeling the company's weekly profit in thousands of dollars (p) in terms of the number of weekly commercials it airs (c) to answer the questions.***



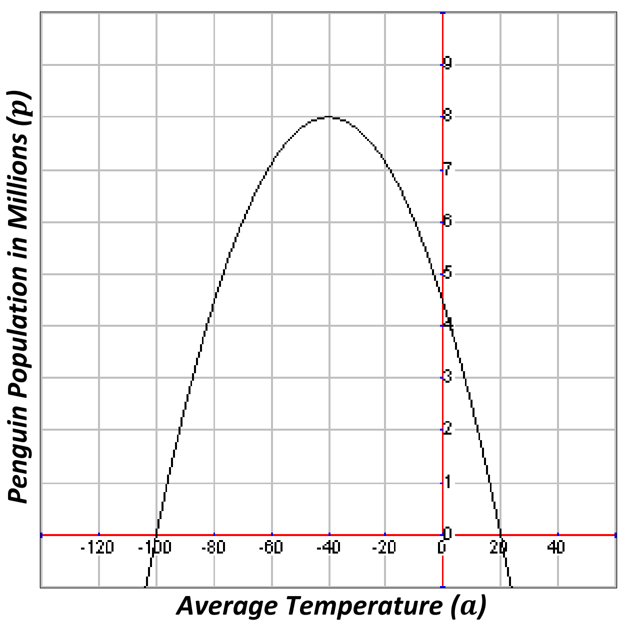

7. What inputs make sense in the context of this problem?
Between 20 and 80 weekly commercials.
8. What are all the different profits that the company could have?
0 to $80,000
9. How many weekly commercials gives the best profit for the company?
50 weekly commercials
10. What is the best profit the company can expect?
$80,000
11. Between how many weekly commercials does the company get better and better profits?
Between 20 and 50 weekly commercials.
12. Between how many weekly commercials does the company get worse and worse profits?
Between 50 and 80 weekly commercials.

***Use the following graph showing a function modeling a man's stock market investment value in thousands of dollars (v) in terms of his age (a) to answer the questions.***




13. If the man began investing at 20 years old and retired at the age of 80 (at which point he sold all his stocks), what inputs make sense in the context of this problem?
20 to 80
14. What are all the different investment values the man had during the time he was investing?
\$25,000 to \$75,000
15. At what age was his investment value the highest? How high was it?
30 years old; \$75,000
16. At what age was his investment value the lowest? How low was it?
70 years old; \$25,000
17. Between what ages was his investment growing in value?
Between 20 and 30 and then between 70 and 80.
18. Between what ages was his investment losing value?
Between 30 and 70.
19. Overall, since he started investing at 20 years old and retired at 80 years old, did he make or lose money? How much?
He lost about \$30,000 since he started with \$65,000 and retired with \$35,000.
20. What appears to be the earliest age he should have retired (after 80 years old) in order to have at least broken even on his investments?
Somewhere around 87 or 88 years old.

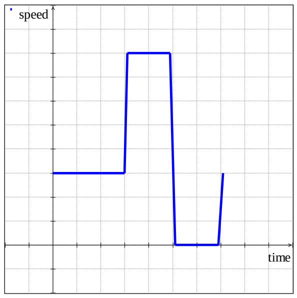
***Use the following graph showing a function modeling the penguin population in millions (p) in terms of average temperature of the Antarctic in degrees Fahrenheit (t) to answer the questions.***

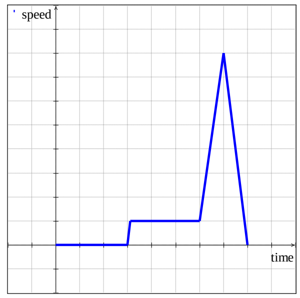


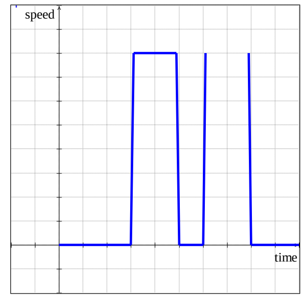

21. What inputs make sense in the context of this problem?
Between −100 and 20 degrees.
22. What are all the different populations that the penguins could have?
0 to 8 million
23. What average temperature gives the highest penguin population?
−40 degrees
24. What is the highest population of the penguins?
8 million
25. Between what temperatures does the population grow?
Between −100 and −40 degrees.
26. Between what temperatures does the population shrink?
Between −40 and 20 degrees.

## Lesson 3.7

***Match each description with its function graph showing speed in terms of time.***

A. 


B. 

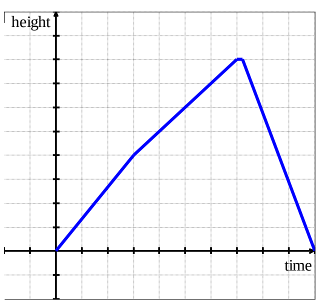

C. 

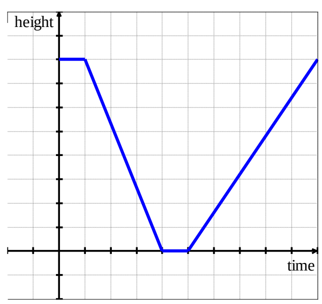

1. A squirrel chews on an acorn for a little while before hearing a car coming down the street. It then runs quickly to the base of a nearby tree where it sits for a second listening again for the car. Still hearing the car, the squirrel climbs up the tree quickly and sits very still on a high branch. *Graph C*

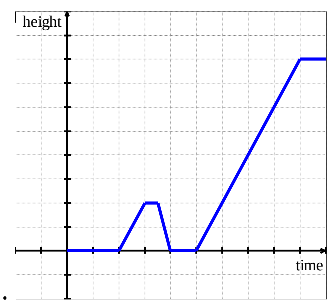
2. A possum is slowly walking through a backyard when a noise scares it causing it to hurry to a hiding place. It waits at the hiding place for a little while to make sure it's safe and then continues its slow walk through the backyard. *Graph A*

3. A frog is waiting quietly in a pond for a fly. Noticing a dragonfly landing on the water nearby, the frog slowly creeps its way to within striking distance. Once the frog is in range, it explodes into action quickly jumping towards the dragonfly and latching onto with its tongue. The frog then settles down to enjoy its meal. *Graph B*

***Match each description with its function graph showing height in terms of time.***

D. 


E. 

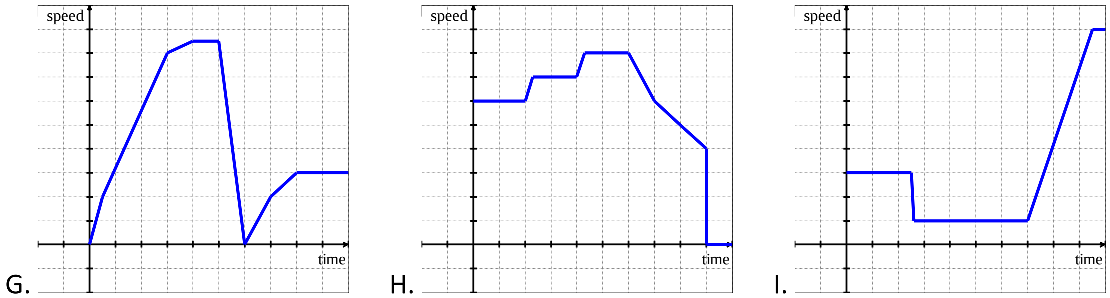

F. 


4. Sean starts to bike up a long steep hill. Half way up, he gets off his bike to walk the rest of the hill. When he makes it to the top, he races down the other side until he makes it to the bottom. *Graph D*

5. Micah is racing down a flat road. He comes to a small hill and charges up as fast as he can. Coming down the other side, Micah gains speed for the big hill ahead. Micah climbs the hill to the top, and hops off his bike to stretch. *Graph F*

6. Jerika hops on her bike as she comes out of her garage which sits at the top of a large hill. She coasts down the hill and starts pedaling as the road flattens. She realizes she forgot something, so she rides back up to her house. *Graph E*

***Match each description with its function graph showing speed in terms of time.***



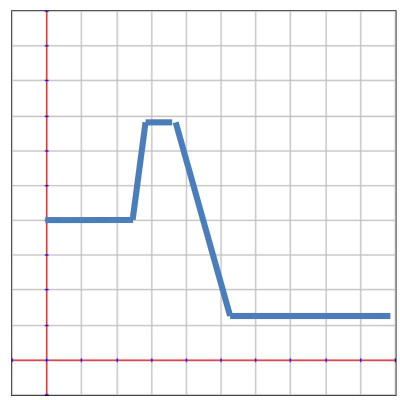

7. Sean starts to bike up a long steep hill. Half way up, he gets off his bike to walk the rest of the hill. When he makes it to the top, he races down the other side until he makes it to the bottom. *Graph I*

8. Micah is racing down a flat road. He comes to a small hill and charges up as fast as he can. Coming down the other side, Micah gains speed for the big hill ahead. Micah climbs the hill to the top, and hops off his bike to stretch. *Graph H*

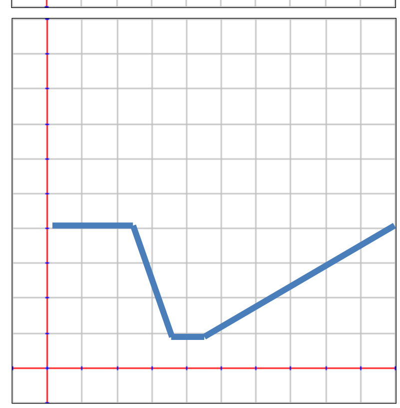
9. Jerika hops on her bike as she comes out of her garage which sits at the top of a large hill. She coasts down the hill and starts pedaling as the road flattens. She realizes she forgot something, so she turns around and rides back up to her house. *Graph G*

***Sketch a graph modeling a function for the following situations.***

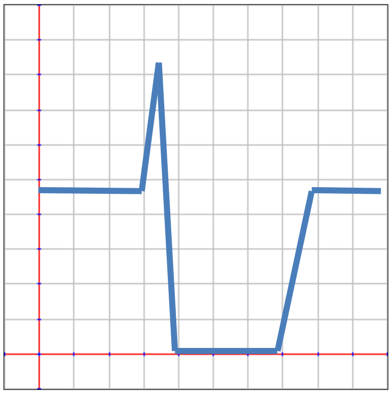
10. A runner starts off her day running at an average speed down her street. At the end of a street is a slight hill going down so she runs even faster down the hill. At the bottom of the hill she has to go back up to the level of her street and has to slow way down. Sketch a graph of a function of runner's speed in terms of time. *Graphs may vary*



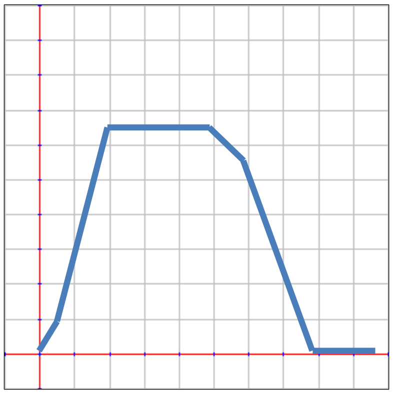
11. A runner starts off her day running at an average speed down her street. At the end of a street is a big hill going down, so she runs very fast down the hill. At the bottom of the hill she runs on flat ground at an average speed for a while before going back up another hill where she slows way down. Sketch a graph of a function of runner's height in terms of time. *Graphs may vary*



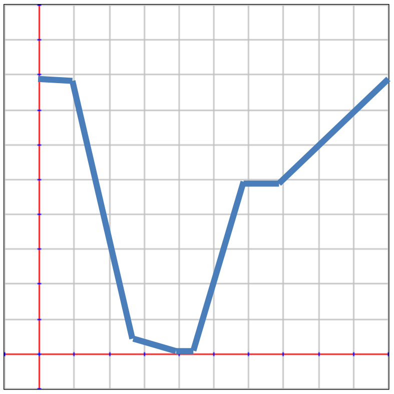
12.  A fish swims casually with her friends.  All of a sudden, she hears a boat, so she darts down toward the bottom of the ocean and hides motionlessly behind the coral.  She remains still until she hears the boat pass.  When the coast is clear, she goes back to swimming with her friends.  Sketch a graph of a function of the fish's speed in terms of time. *Graphs may vary*



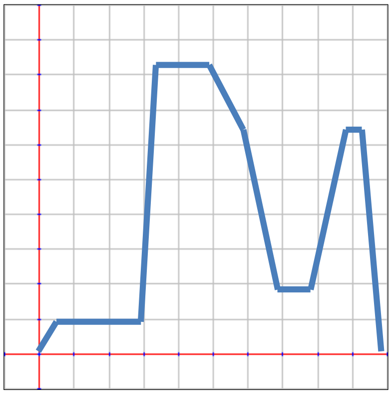
13.  My dad drove me to school this morning.  We started off by pulling out of the driveway and getting on the ramp for the interstate.  It wasn't long before my dad saw a police car, so he slowed down.  The police car pulled us over, so we sat on the side of the road until the cop finished talking to my dad.  Sketch a graph of a function of the car's speed in terms of time.  *Graphs may vary*



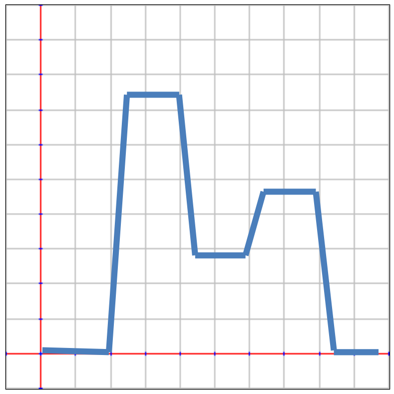
14.  Rashid starts on the top of a snow-covered hill.  He sleds down and coasts on flat ground for a few feet.  Tickled with excitement, Rashid runs up the hill for another invigorating race.  About half way up the hill, he recognizes a friend of his has fallen off his sled.  Rashid stops to help his friend and begins slowly pulling his friend back up the hill.  Tired, Rashid and his friend finally make it to the top of the hill.  Sketch a graph of a function of Rashid's height in terms of time. *Graphs may vary*



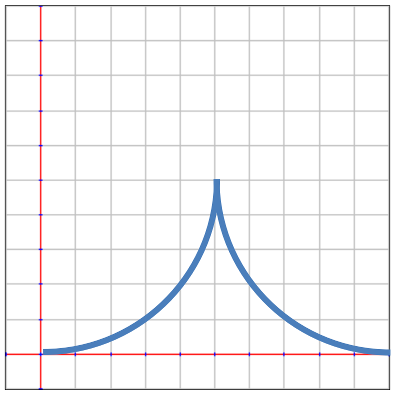
15.  Roller coaster cars start out by slowly going up a hill.  When all of the cars reach the top of the hill, the cars speed down the other side.  Next, the cars are pulled up another, but smaller, hill.  Racing down the other side, the cars race through a tunnel and come to a screeching halt where passengers are unloaded.  Sketch a graph of a function of the roller coaster cars' speed in terms of time.  *Graphs may vary*



16. A dog is sitting on his owner's lap. When the owner throws the ball, the dog sprints after the ball and catches it mid-air. The dog trots back and plops back on the owner's lap. The owner throws the ball again; tired, the dog jogs over to the ball and lies down next to it. Sketch a graph of a function of the dog's speed in terms of time. *Graphs may vary*



17. A function starts out increasing slowly then it increases faster and faster before hitting a maximum spike about halfway through the graph. From the spike it decreases quickly and then decreases slower and slower before finally leveling out toward the end of the graph. *Graphs may vary*



18. A function starts off very high and stays level for a little while. It then drops quickly to about the halfway mark and stays level again for a little while. It then drops very close to the bottom and stays level after that.
*Graphs may vary*