Pre-Test Unit 3: Functions KEY

No calculator necessary. Please do not use a calculator.

Determine if each of the following is a true function based on the equation or table. Explain how you know. *(5 pts; 2 pts for answer only)*

1. $y = x^2$

x	-2	-1	0	1	2
y	4	1	0	1	4

Function, each input has only one output

2. $y^2 = x$

x	0	1	4	9	16
y	0	±1	±2	±3	±4

Not a function, some inputs have more than one output

Evaluate the given function using the given value as inputs. *(5 pts; 3 pts for computation error only)*

3. $a = 3b - 2$
   $b = -2$
   $a = -8$

4. $g = h^2 - 3$
   $h = 3$
   $g = 6$

Answer the following question in complete sentences. *(5 pts; partial credit at teacher discretion)*

5. Determine if the following describes a true function or not. Explain why or why not.

Input: Age of an author, Output: Amount of money earned

Not a true function, two people could be the same age but make different amounts of money.

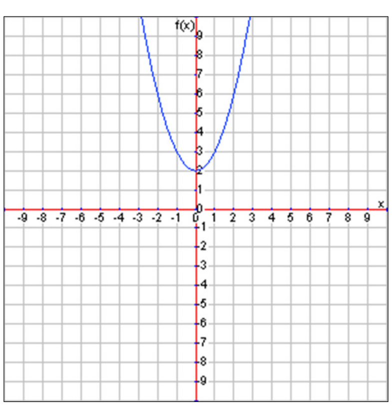
6. Give an example of a function in words and explain what the input and output are.

Answers will vary. Sample: Input a person's social security number and output their age.

Graph the following functions by filling out the x/y chart using the inputs (x values) that you think are appropriate. *(5 pts; 1 pt for appropriate x values, 2 pts for correct table, 2 pts for graph following table)*

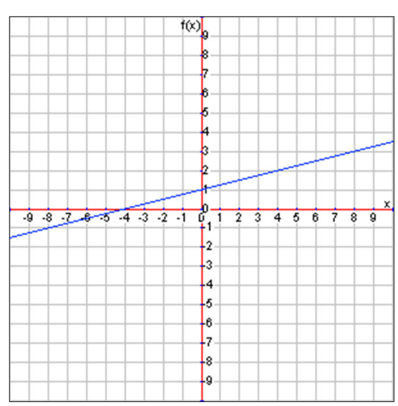
7. $y = x^2 + 2$ values may vary

x	-2	-1	0	1	2
y	6	3	2	3	6



8. $y = \frac{1}{4}x + 1$ values may vary

x	-8	-4	0	4	8
y	-1	0	1	2	3



Determine whether the following functions are linear or non-linear and explain how you know. *(5 pts; 2 pts for correct answer only)*

9. $y = x^3$

Non-linear because of the exponent on x

10. $y = \frac{3}{4}x + 1$

Linear because it's in slope-intercept form.

Answer the following question about different types of functions. *(5 pts; 3 pts for correct example with incorrect or missing explanation)*

11. Give an example of a linear function in equation form and explain how you know it is linear.

Answer will vary. Sample: $y = 2x + 1$ because it's in slope-intercept form.

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, give the equation of the line if necessary. *(6 pts; 1 pt for each)*

12. The amount of money in dollars a farmer gets paid (p) to leave land fallow for a season based on the acres of land he or she owns (a) is modeled by the following function: $p = 300a - 50$.

Rate of Change:_300_______

Initial Value:____50_________

Independent Variable:_a____

Dependent Variable:_p_____

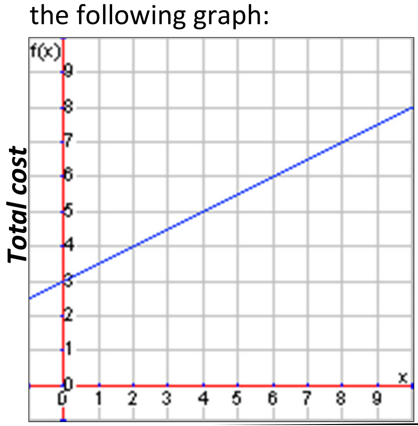
Contextual Description of Rate of Change

The farmer gets paid $300 per acre left fallow.

Contextual Description of Initial Value

If the farmer leaves no land fallow he gets charged $50. This may be a $50 fee that he pays regardless.

13. The function relating the cost in dollars of entering a carnival (c) to how many tickets you buy (t) is shown by the following graph:



Rate of Change:__0.5________

Initial Value:_____3__________

Independent Variable:_t____

Dependent Variable:__c______

EQ of Line:__$c = 0.5t + 3$____

Contextual Description of Rate of Change

The carnival charges $0.50 per ticket.

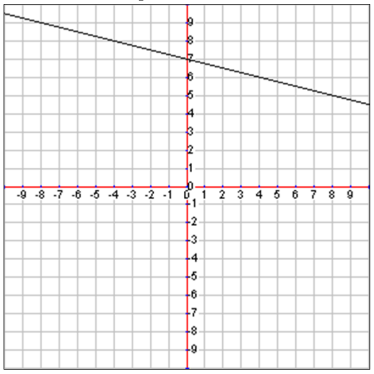
Contextual Description of Initial Value

The carnival charges a $3 entry fee regardless of the number of tickets purchased.

bought

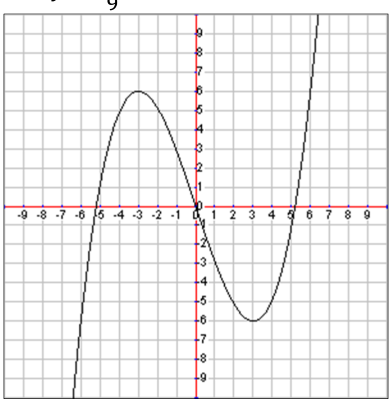
Tell whether the following linear function is increasing, decreasing, or constant. *(3 pts; no partial credit)*

14. $y = -\frac{1}{4}x + 7$ Decreasing



For the following functions tell where they are increasing and where they are decreasing. Then give the max or min of the function. *(5 pts; 3 pts for increasing/decreasing, 2 pts for max/min)*

15. $y = \frac{1}{9}x^3 - 3x$



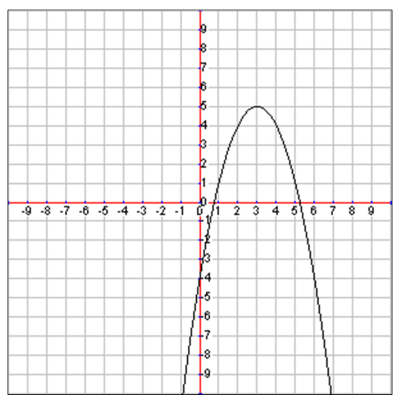
Increasing: $x < -3$ and $x > 3$

Decreasing: $-3 < x < 3$

Local max: $y = 6$

Local min: $y = -6$

16. $y = -(x-3)^2 + 5$

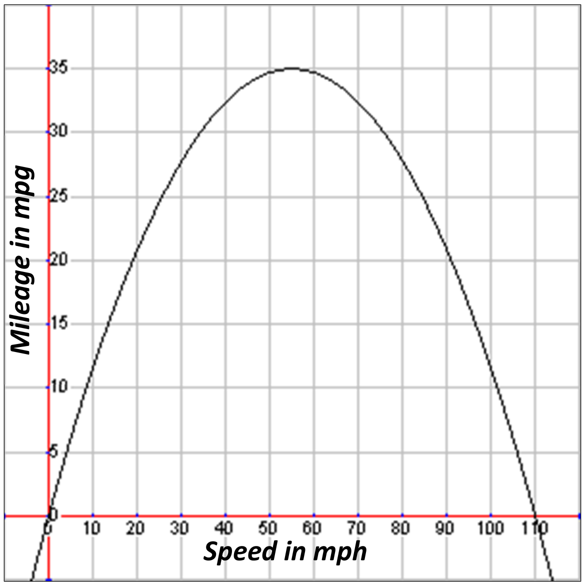


Increasing: $x < 3$

Decreasing: $x > 3$

Max: $y = 5$

Use the following graph showing a function modeling the miles per gallon (m) a car gets in terms of its speed (s) to answer the questions. *(5 pts; partial credit at teacher discretion)*



17. What appears to be the best mileage this car will get and at what speed does it occur?

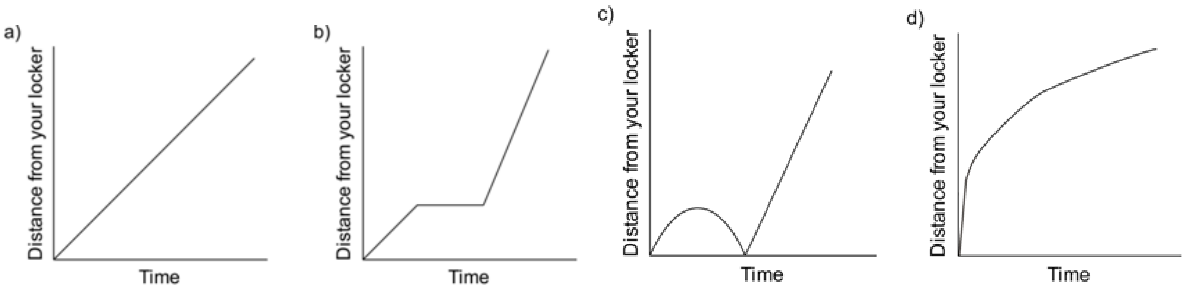
$35\ mpg\ at\ 55\ mph$

18. What are all the possible speeds this car can drive at?

$0\ to\ 110\ mph$

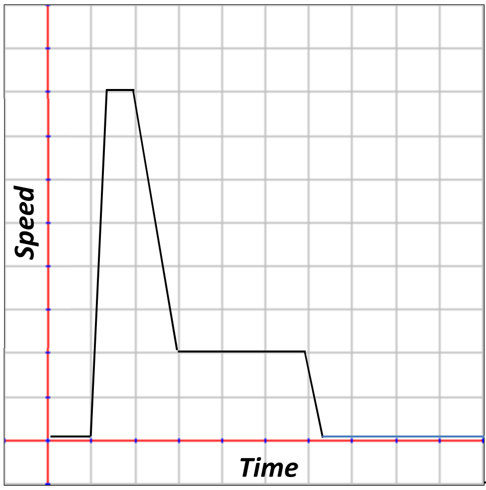
Determine which graph matches the story and explain why. *(5 pts; 2 pts for correct answer with no explanation)*

19. I started to walk to class, but I realized I had forgotten my notebook, so I went back to my locker and then I went quickly at a constant rate to class.



Graph C

Sketch a graph modeling a function for the following situations. *(5 pts; partial credit at teacher discretion)*



20. A dog is sleeping when he hears the cat "meow" in the next room. He quickly runs to the next room where he slowly walks around looking for the cat. When he doesn't find the cat, he sits down and goes back to sleep. Sketch a graph of a function of the dog's speed in terms of time.

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	± 3	± 4	± 5	± 4	± 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	± 6	± 8	± 10	± 8	± 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	± 1	± 2	± 3	± 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	± 4	0	0	± 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	± 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. $g = 2h^2 + 1$
$h = 3$
$g = 19$

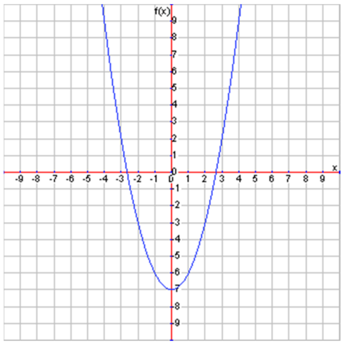
34. $c = t + 55$
$t = 70$
$c = 125$

Lesson 3.2

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

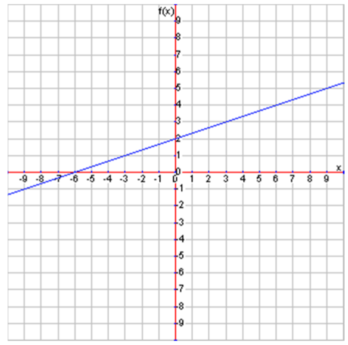
1. $y = x^2 - 7$

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



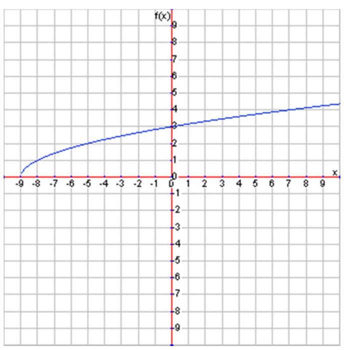
2. $y = \frac{1}{3}x + 2$

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



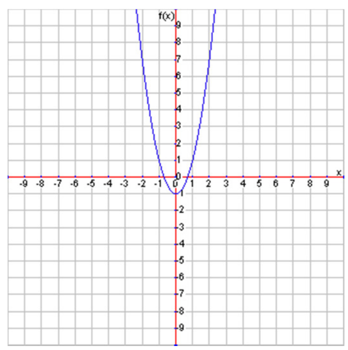
3. $y = \sqrt{x + 9}$

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



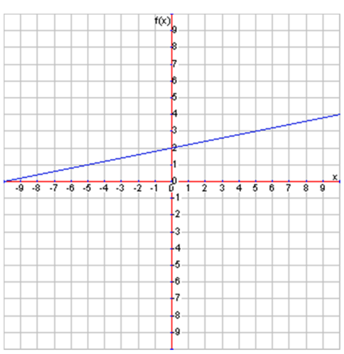
4. $y = 2x^2 - 1$

x	-2	-1	0	1	2
y	7	1	-1	1	7



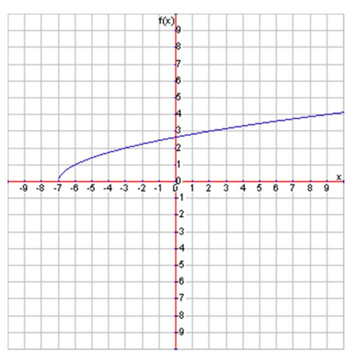
5. $y = \frac{1}{5}x + 2$

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



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

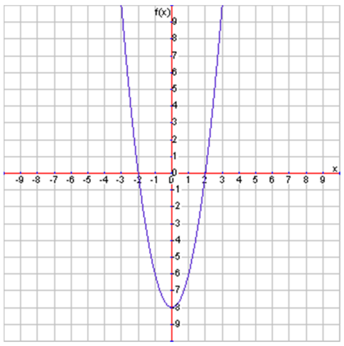
x	-7	-6	-3	2	9
y	0	1	2	3	4



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

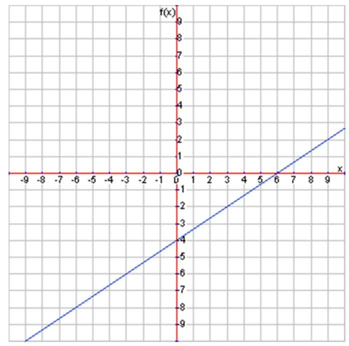
7. $y = 2x^2 - 8$

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



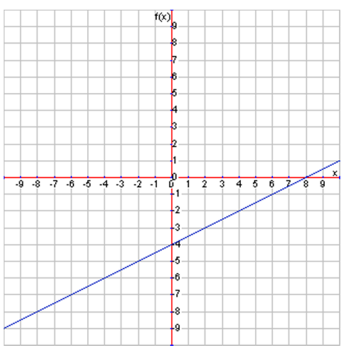
8. $y = \frac{2}{3}x - 4$

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



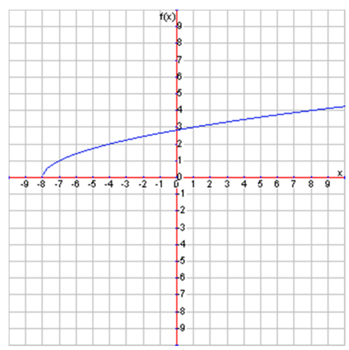
9. $y = \frac{1}{2}x - 4$

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



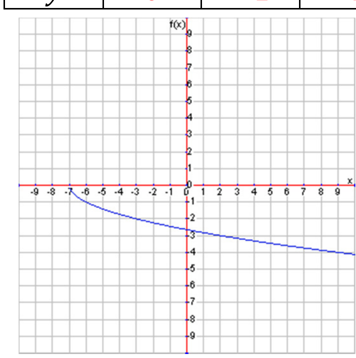
10. $y = \sqrt{x + 8}$

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



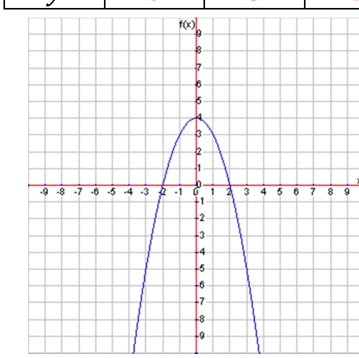
11. $y = -\sqrt{x + 7}$

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.

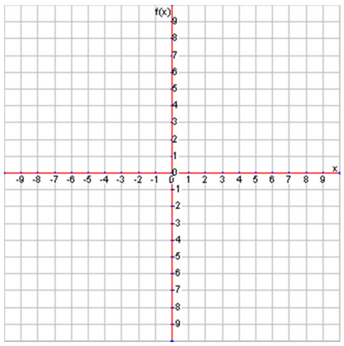
19. For problems 2, 5, 8, 9, explain similarities and differences in the graph of each function.
Answers will vary. Sample: They each are a line but they are tilted different.

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.***

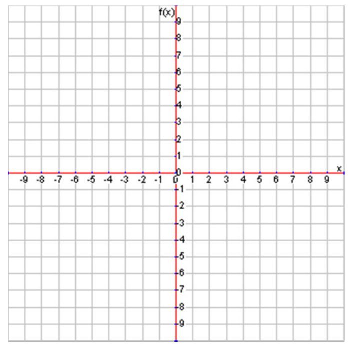
1. $y = x^2 - 2x$ non-linear

x					
y					



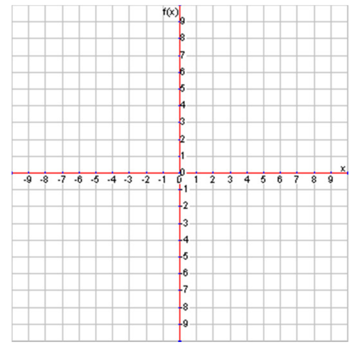
2. $y = \frac{1}{3}x - 2$ linear

x					
y					



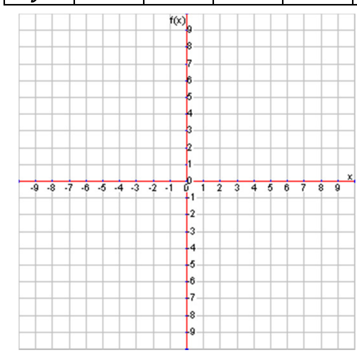
3. $y = -2x + 2$ linear

x					
y					



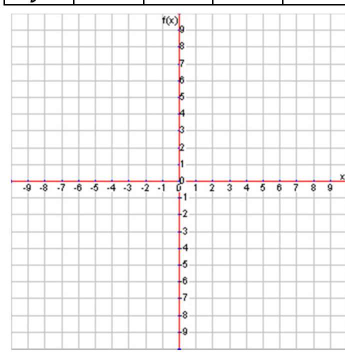
4. $y = x^2 + 3$ non-linear

x					
y					



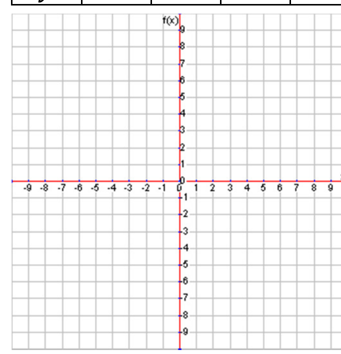
5. $5x + 3y = 0$ linear

x					
y					



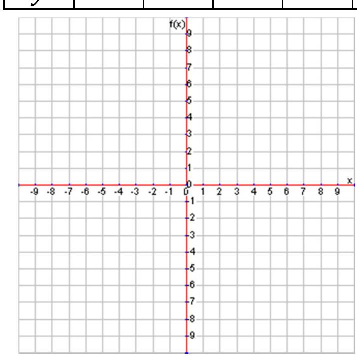
6. $y - 4x = -5$ linear

x					
y					



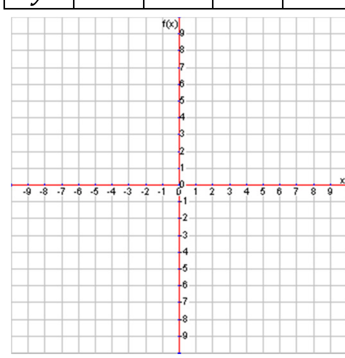
7. $y = \sqrt{x + 9}$ non-linear

x					
y					



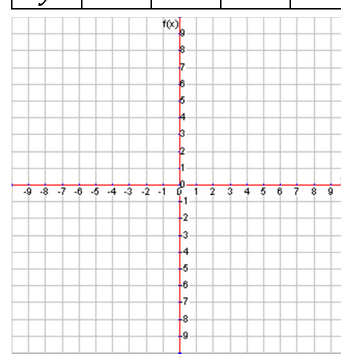
8. $y = 3^x - 2$ non-linear

x					
y					



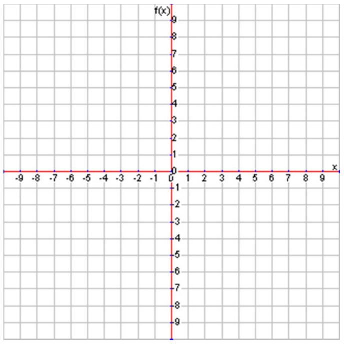
9. $y = x^3 - x^2$ non-linear

x					
y					



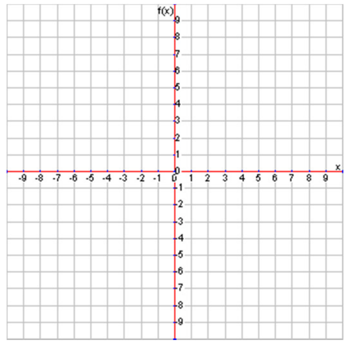
10. $y = x^3 - 7x$ non-linear

x					
y					



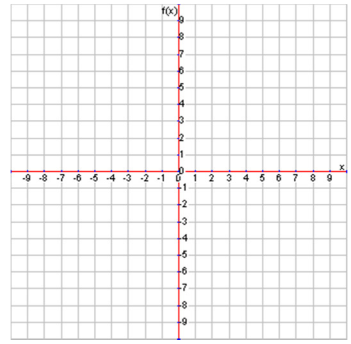
11. $y = 2^x + 3$ non-linear

x					
y					



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

x					
y					

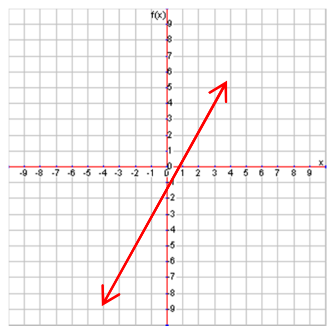


13. Give an example of a linear function in equation form.
Answers will vary. Sample: $y = 2x + 1$

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:

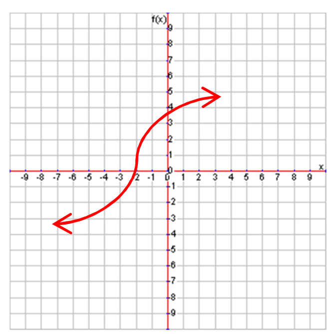


16. Give an example of a non-linear function in equation form.
Answers will vary. Sample: $y = x^2$

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

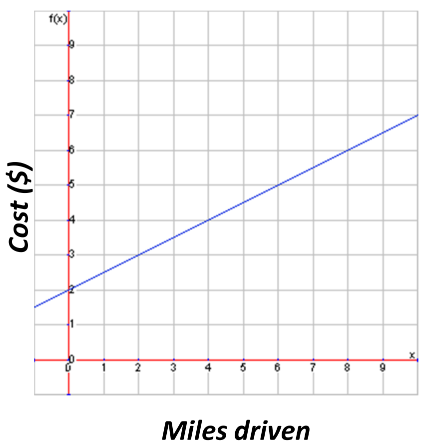
Initial Value: 2

Independent Variable: t

Dependent Variable: d

Contextual Description of Rate of Change	Contextual Description of Initial Value
The rocket travels 5 meters per second,	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:



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	Contextual Description of Initial Value
The taxi charges one dollar per two miles traveled.	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	Contextual Description of Initial Value
Planet Wiener makes $2.25 for every hotdog sold.	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__________

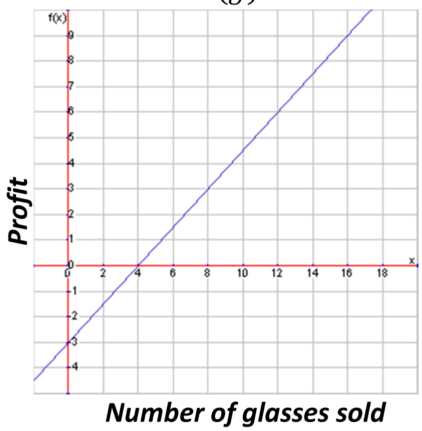
Initial Value:______20___________

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:



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

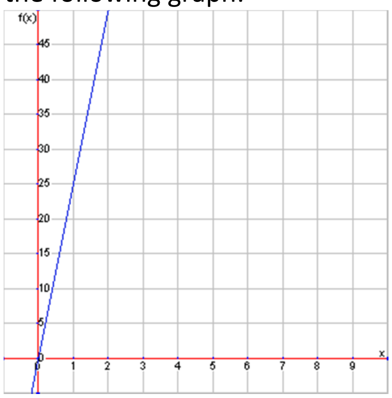
It costs $104 each night

Contextual Description of Initial Value

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:

Cost



Days

Rate of Change:___25_________

Initial Value:____0___________

Independent Variable:__d____

Dependent Variable:__c_______

EQ of Line:__$c = 25d$___

Contextual Description of Rate of Change

It costs $25 per day to attend the sports clinic.

Contextual Description of Initial Value

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_______

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

Contextual Description of Rate of Change

It costs $40 per night.

Contextual Description of Initial Value

There is a $10 bathing fee.

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:___ $-\frac{1}{25}$ ___

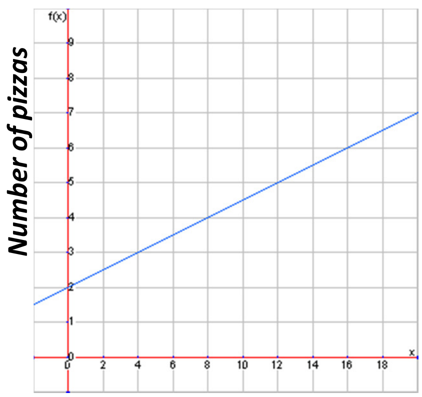
Initial Value:___12___

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 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__________

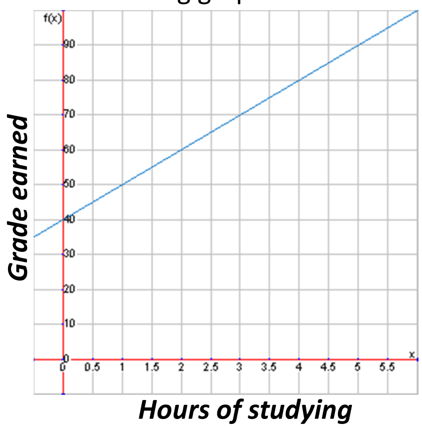
Initial Value:____1050___________

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

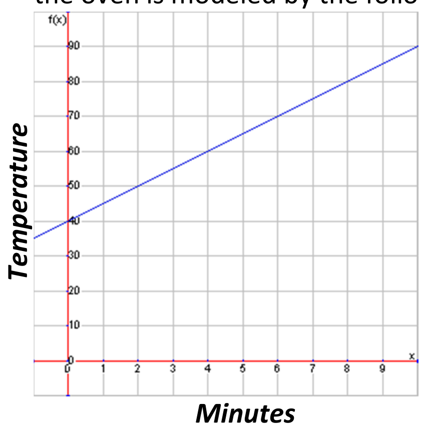
Initial Value: 0

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: $t = 5m + 40$

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

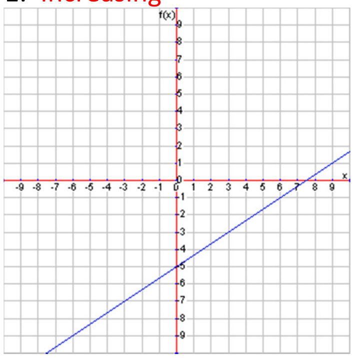
EQ of Line: $l = 3s + 2$

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

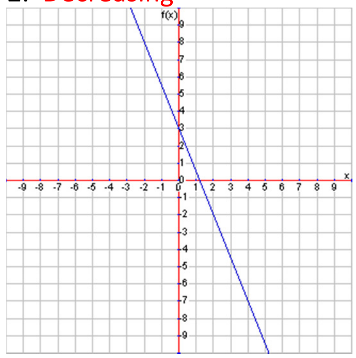
Lesson 3.5

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

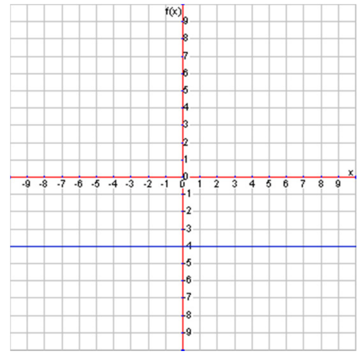
1. Increasing



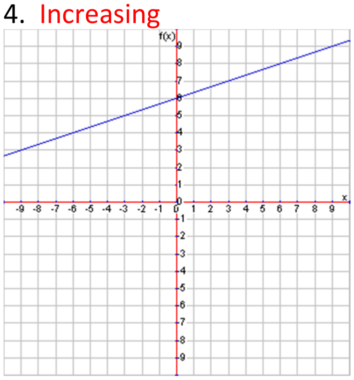
2. Decreasing



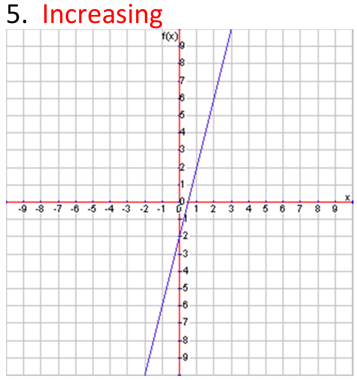
3. Constant



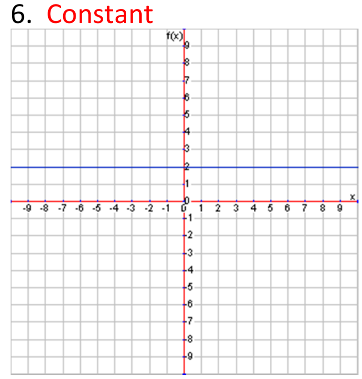
4. Increasing



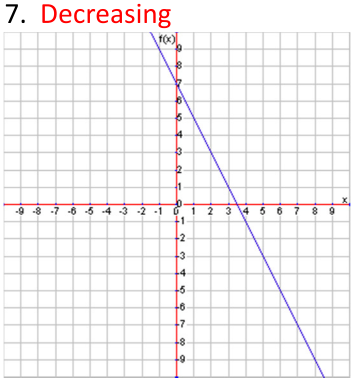
5. Increasing



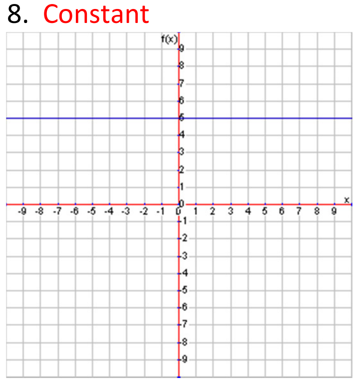
6. Constant



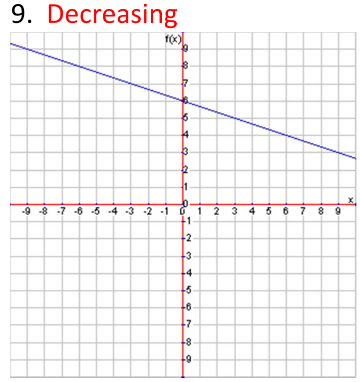
7. Decreasing



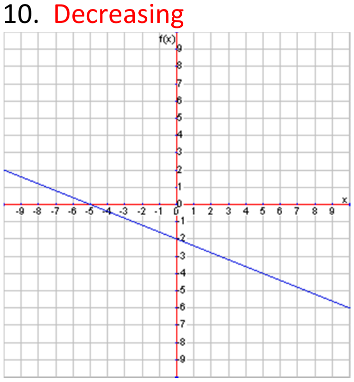
8. Constant



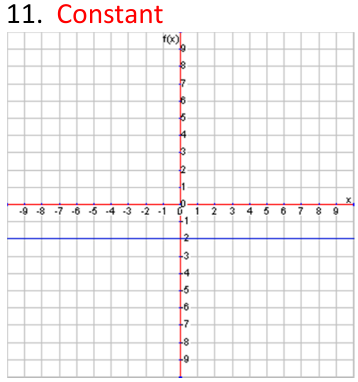
9. Decreasing



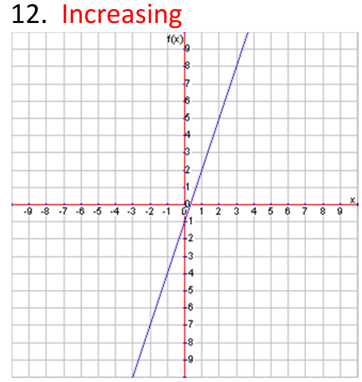
10. Decreasing



11. Constant

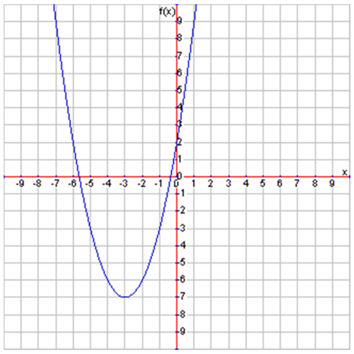


12. Increasing



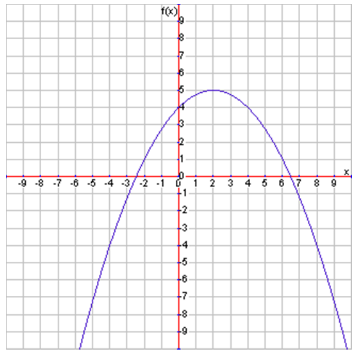
For each non-linear graph tell where it is increasing and decreasing and identify any maximum, minimum, local maximum, or local minimum.

13.



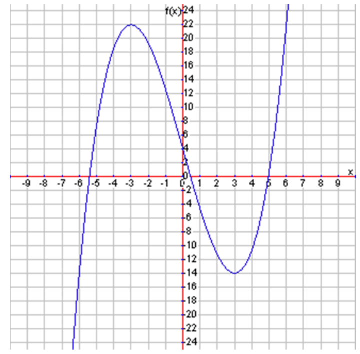
Increasing: $x > -3$
Decreasing: $x < -3$
Minimum: $y = -7$

14.



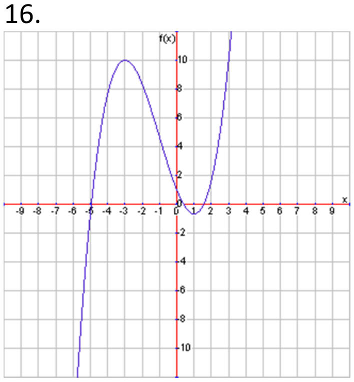
Increasing: $x < 2$
Decreasing: $x > 2$
Maximum: $y = 5$

15.



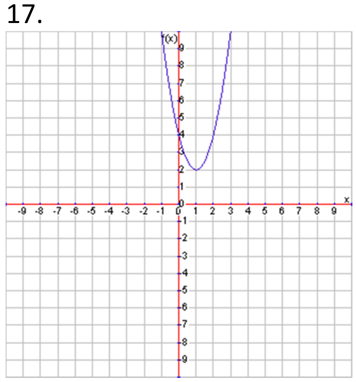
Increasing: $x < -3 \; or \; x > 3$
Decreasing: $-3 < x < 3$
Local Maximum: $y = 22$
Local Minimum: $y = -14$

16.



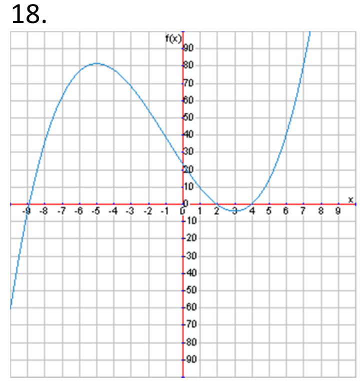
Increasing: $x < -3 \; or \; x > 1$
Decreasing: $-3 < x < 1$
Local Maximum: $y = 10$
Local Minimum: $y \approx -0.5$

17.



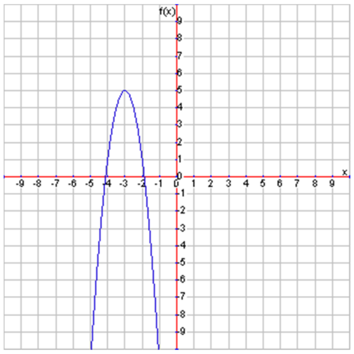
Increasing: $x > 1$
Decreasing: $x < 1$
Minimum: $y = 2$

18.



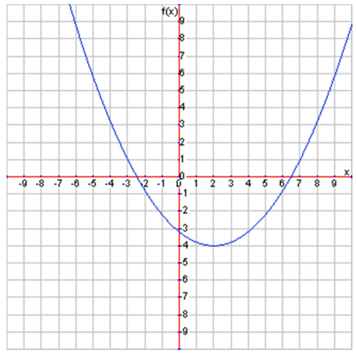
Increasing: $x < -5 \; or \; x > 3$
Decreasing: $-5 < x < 3$
Local Maximum: $y \approx 82$
Local Minimum: $y \approx -5$

19.



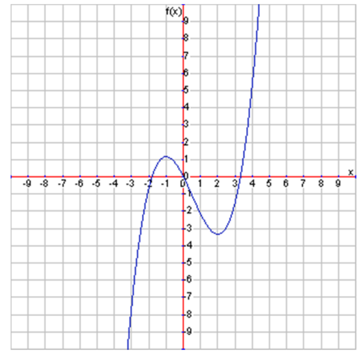
Increasing: $x < -3$
Decreasing: $x > -3$
Maximum: $y = 5$

20.



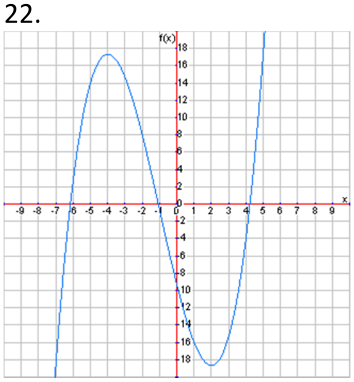
Increasing: $x > 2$
Decreasing: $x < 2$
Minimum: $y = -4$

21.



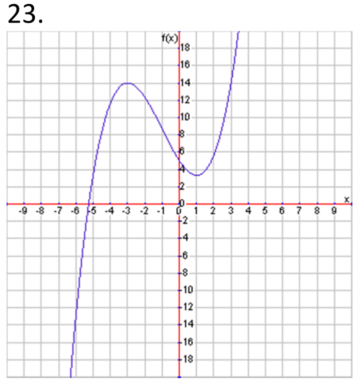
Increasing: $x < -1 \; or \; x > 2$
Decreasing: $-1 < x < 2$
Local Maximum: $y \approx 1.1$
Local Minimum: $y \approx -3.3$

22.



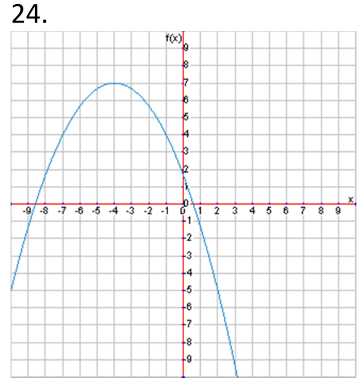
Increasing: $x < -4 \; and \; x > 2$
Decreasing: $-4 < x < 2$
Local Maximum: $y \approx 17$
Local Minimum: $y \approx -18.5$

23.



Increasing: $x < -3 \; or \; x > 1$
Decreasing: $-3 < x < 1$
Local Maximum: $y = 14$
Local Minimum: $y \approx 3.5$

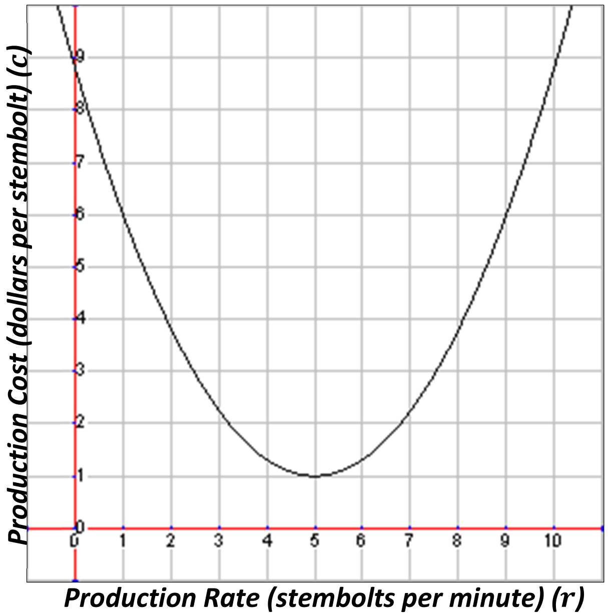
24.



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

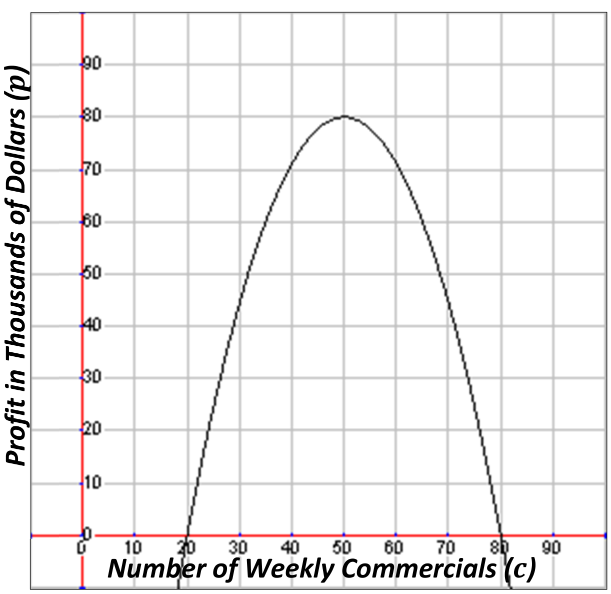
Lesson 3.6

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.



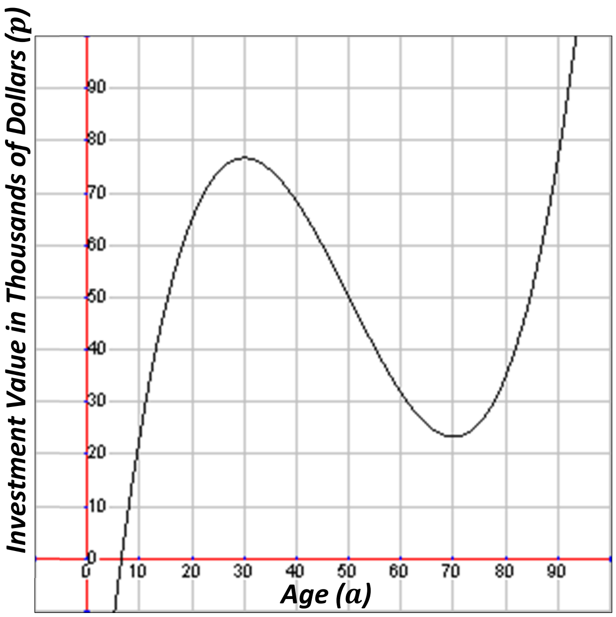
1. If the possible inputs for this function are between one and nine, what does that mean in the context of this problem?
The factory can produce between 1 and 9 stembolts per minute.
2. Within those inputs, what are all the different costs per stembolt that the company could have?
1 to 6 dollars per 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

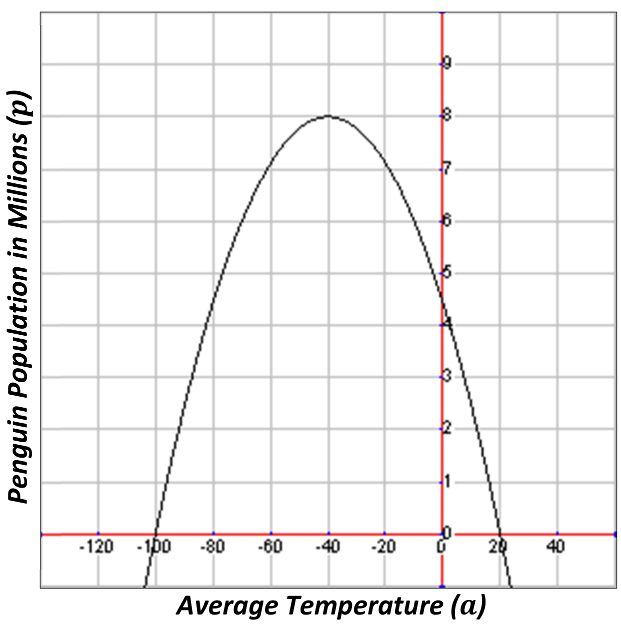
17. Between what ages was his investment growing in value?
Between 20 and 30 and then between 70 and 80.

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

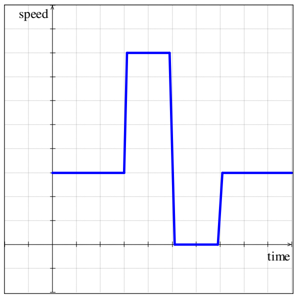
24. What is the highest population of the penguins?
8 million

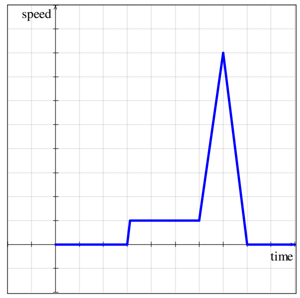
25. Between what temperatures does the population grow?
Between −100 and −40 degrees.

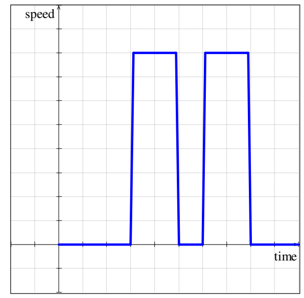
26. Between what temperatures does the population shrink?
Between −40 and 20 degrees.

Lesson 3.7

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

A. 

B. 

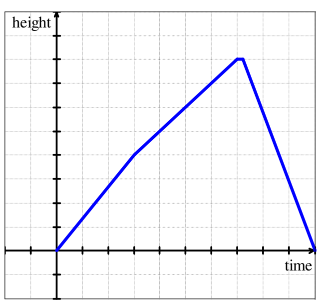
C. 

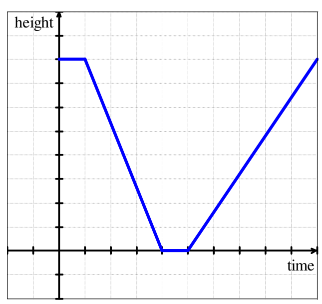
1. A squirrel chews on an acorn for a little while before hearing a car coming down the street. It then runs quickly to the base of a nearby tree where it sits for a second listening again for the car. Still hearing the car, the squirrel climbs up the tree quickly and sits very still on a high branch.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

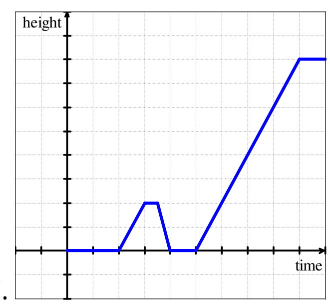
2. A possum is slowly walking through a backyard when a noise scares it causing it to hurry to a hiding place. It waits at the hiding place for a little while to make sure it's safe and then continues its slow walk through the backyard. *Graph A*

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. 

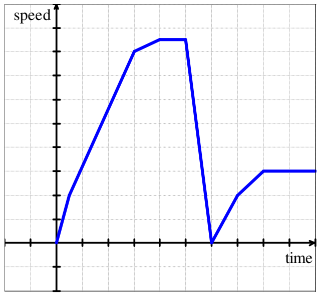
F. 

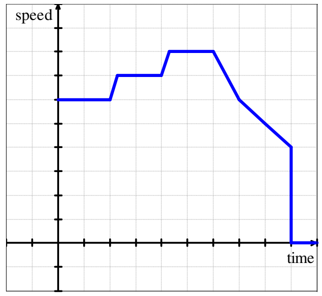
4. Sean starts to bike up a long steep hill. Half way up, he gets off his bike to walk the rest of the hill. When he makes it to the top, he races down the other side until he makes it to the bottom. *Graph D*

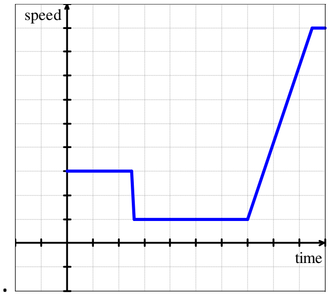
5. Micah is racing down a flat road. He comes to a small hill and charges up as fast as he can. Coming down the other side, Micah gains speed for the big hill ahead. Micah climbs the hill to the top, and hops off his bike to stretch. *Graph F*

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.

G. 

H. 

I. 

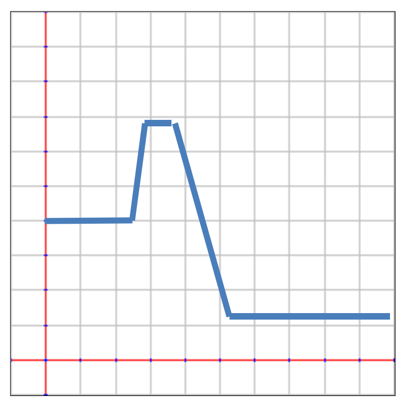
7. Sean starts to bike up a long steep hill. Half way up, he gets off his bike to walk the rest of the hill. When he makes it to the top, he races down the other side until he makes it to the bottom. *Graph I*

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*

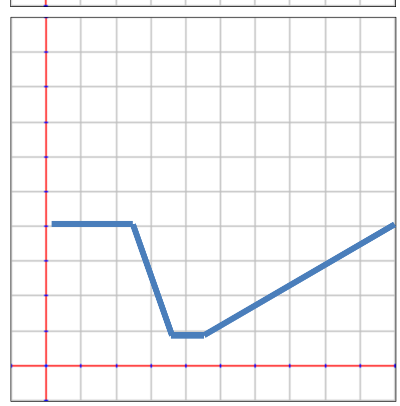
9. Jerika hops on her bike as she comes out of her garage which sits at the top of a large hill. She coasts down the hill and starts pedaling as the road flattens. She realizes she forgot something, so she turns around and rides back up to her house. *Graph G*

Sketch a graph modeling a function for the following situations.

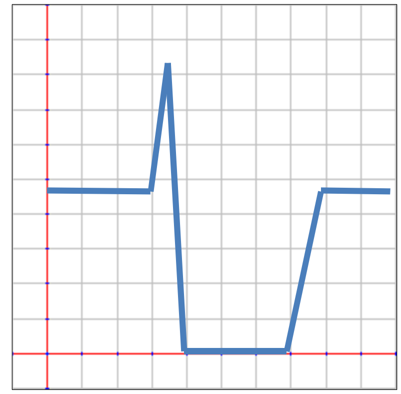
10. A runner starts off her day running at an average speed down her street. At the end of a street is a slight hill going down so she runs even faster down the hill. At the bottom of the hill she has to go back up to the level of her street and has to slow way down. Sketch a graph of a function of runner's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



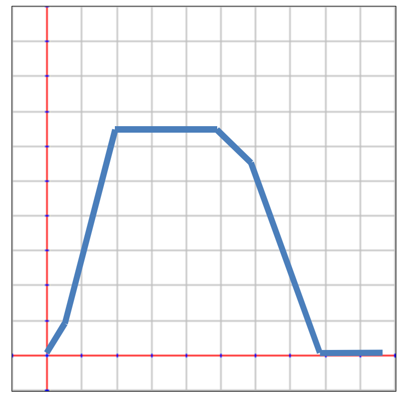
11. A runner starts off her day running at an average speed down her street. At the end of a street is a big hill going down, so she runs very fast down the hill. At the bottom of the hill she runs on flat ground at an average speed for a while before going back up another hill where she slows way down.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



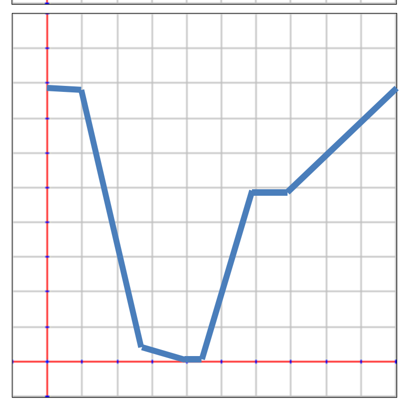
12. A fish swims casually with her friends. All of a sudden, she hears a boat, so she darts down toward the bottom of the ocean and hides motionlessly behind the coral. She remains still until she hears the boat pass. When the coast is clear, she goes back to swimming with her friends. Sketch a graph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



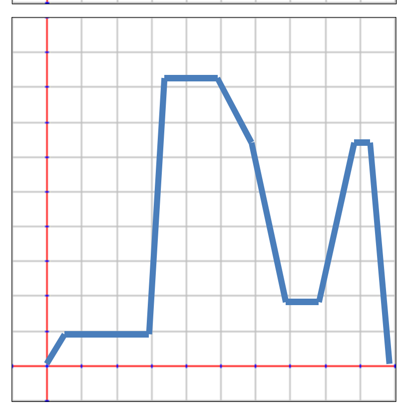
13. My dad drove me to school this morning. We started off by pulling out of the driveway and getting on the ramp for the interstate. It wasn't long before my dad saw a police car, so he slowed down. The police car pulled us over, so we sat on the side of the road until the cop finished talking to my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



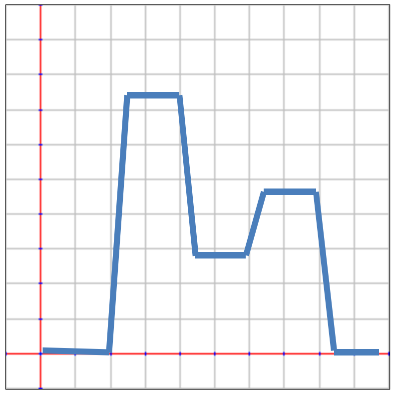
14. Rashid starts on the top of a snow-covered hill. He sleds down and coasts on flat ground for a few feet. Tickled with excitement, Rashid runs up the hill for another invigorating race. About half way up the hill, he recognizes a friend of his has fallen off his sled. Rashid stops to help his friend 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*



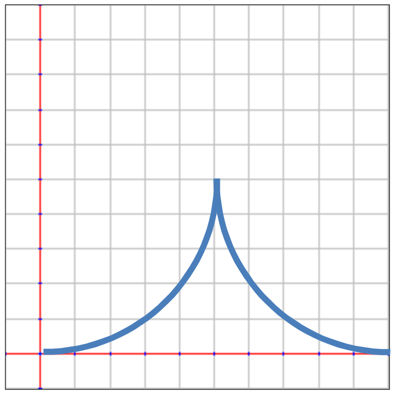
15. Roller coaster cars start out by slowly going up a hill. When all of the cars reach the top of the hill, the cars speed down the other side. Next, the cars are pulled up another, but smaller, hill. Racing down the other side, the cars race through a tunnel and come to a screeching halt where passengers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



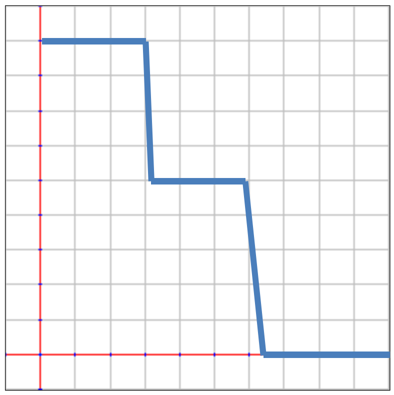
16. A dog is sitting on his owner's lap. When the owner throws the ball, the dog sprints after the ball and catches it mid-air. The dog trots back and plops back on the owner's lap. The owner throws the ball again; tired, the dog jogs over to the ball and lies down next to it. Sketch a graph of a function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



Review Unit 3: Functions KEY

No calculator necessary. Please do not use a calculator.

Unit 3 Goals

- *Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (8.F.1)*
- *Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationships or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or table of values. (8.F.4)*
- *Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationships or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or table of values. (8.F.4)*
- *Describe qualitatively the functional relationship between two quantities by analyzing a graph. Sketch a graph that exhibits the qualitative features of a function that has been described verbally. (8.F.5)*

You may not use a calculator.

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

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

x	-8	-6	0	6	8
y	± 6	± 8	± 10	± 8	± 6

Not a function, more than one output for each input

2. $y = \frac{1}{2}x^2 - 6$

x	-4	-2	0	2	4
y	2	-4	-6	-4	2

Function, one output for each input

Evaluate the given function using the given value as inputs.

3. $k = \frac{1}{2}j - 8$

$j = 8$

$k = -4$

4. $y = x^2 + 6$

$x = 4$

$y = 22$

5. $a = b - 47$

$b = 100$

$a = 53$

6. $g = -4h + 10$

$h = 3$

$g = -2$

Answer the following question in complete sentences.

7. Give a definition of a function in your own words.

Answers will vary. Sample: A rule where every input only produces one output.

8. Determine if the following describes a true function or not. Explain why or why not.

Input: Number of candy bars purchased, Output: The amount of money spent

Answers will vary. Sample: Function because there is a set price for candy bars at a store.

9. Determine if the following describes a true function or not. Explain why or why not.

Input: Age of a person, Output: The number of hours spent playing video games

Answers will vary. Sample: Not a function because people the same age could play different amounts.

10. Determine if the following describes a true function or not. Explain why or why not.

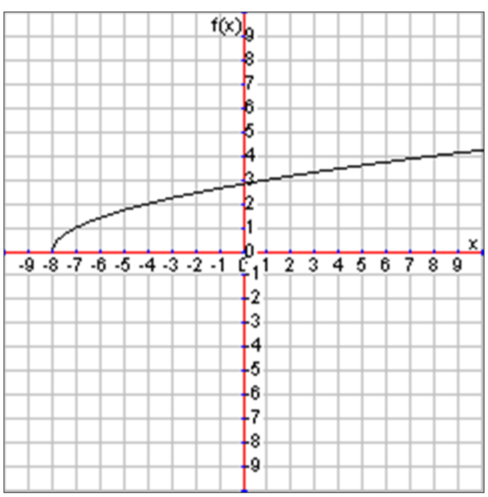
Input: Number of students in a class, Output: Number of birthdays in the class

Answers will vary. Sample: Function because each person has a birthday.

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

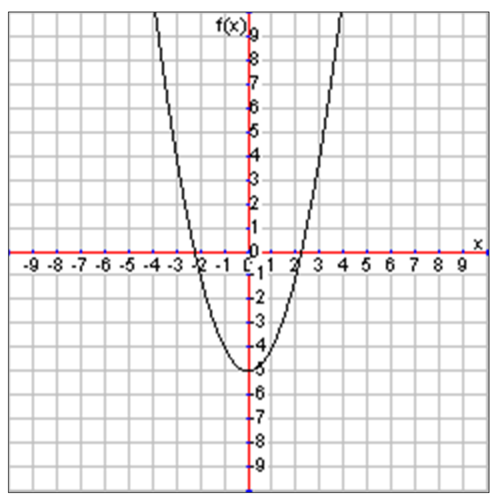
11. $y = \sqrt{x+8}$

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



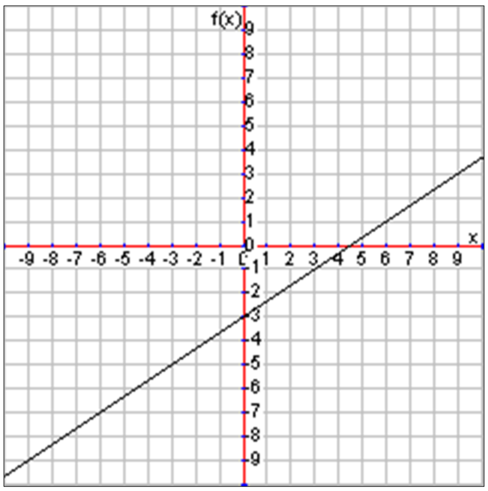
12. $y = x^2 - 5$

x	-2	-1	0	1	2
y	-1	-4	-5	-4	-1



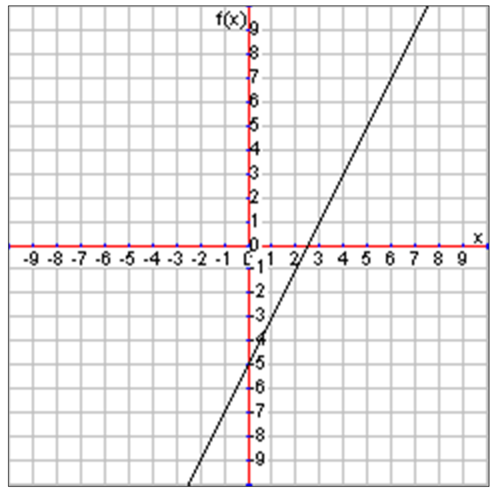
13. $y = \frac{2}{3}x - 3$

x	-6	-3	0	3	6
y	-7	-5	-3	-1	1



14. $y = 2x - 5$

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



Determine whether the following functions are linear or non-linear and explain how you know.

15. $y = 2(x - 4) + 3$

Linear, no exponent

16. $y = 2(x - 4)^2 + 3$

Non-linear, exponent

17. $y = \frac{3}{4}x^4$

Non-linear, exponent

Answer the following questions about different types of functions.

18. Give an example of a linear function in equation form and explain how you know it is linear.
Answers will vary. Sample: $y = 2x + 1$ because it's in slope-intercept form.

19. Give an example of a non-linear function in equation form and explain how you know it is non-linear.
Answers will vary. Sample: $y = x^2$ because it has an exponent on x.

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, give the equation of the line.

20. The amount of money in dollars a mailman gets paid (p) to deliver mail to houses (h) is modeled by the following function: $p = 4h + 125$.

Rate of Change:___4________

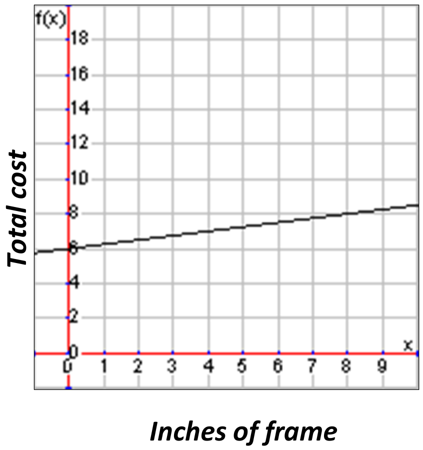
Initial Value:_____125__________

Independent Variable:_h_____

Dependent Variable:_p______

Contextual Description of Rate of Change	Contextual Description of Initial Value
The mailman gets paid \$4 per house.	The mailman gets paid \$125 no matter what.

21. The function relating the cost of framing (c) to how many inches of frame around a picture (i) is shown by the following graph:



Rate of Change:____ $\frac{1}{4}$ ________

Initial Value:_____6__________

Independent Variable:_ i ____

Dependent Variable:_ c _______

EQ of Line:_ $c = \frac{1}{4}i + 6$ _______

Contextual Description of Rate of Change

It costs $1 for every 4 inches of frame.

Contextual Description of Initial Value

There is an initial fee of $6 no matter what.

22. Imagine you saved $4000 to spend winter break visiting your relatives in New York. It costs $1200 for the plane ticket and $300 per night for the hotel. Think of the function that demonstrates the cost (c) based on the number of nights (n) you spend.

Rate of Change:__300_________

Initial Value:___1200______________

Independent Variable:_ n _____

Dependent Variable:__ c _____

EQ of Line:__ $c = 300n + 1200$ __

Contextual Description of Rate of Change

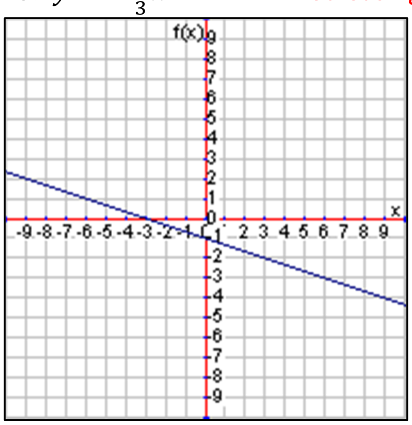
The cost increases by $300 per night.

Contextual Description of Initial Value

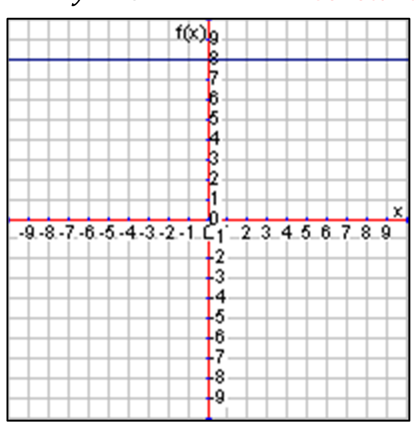
There is an initial cost of $1200 no matter what because of the plane tickets.

Tell whether the following linear functions are increasing, decreasing, or constant.

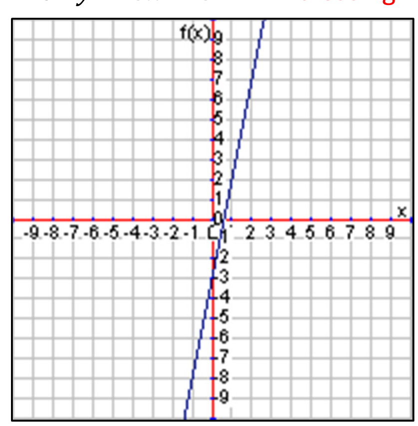
23. $y = -\frac{1}{3}x - 1$ Decreasing



24. $y = 8$ Constant

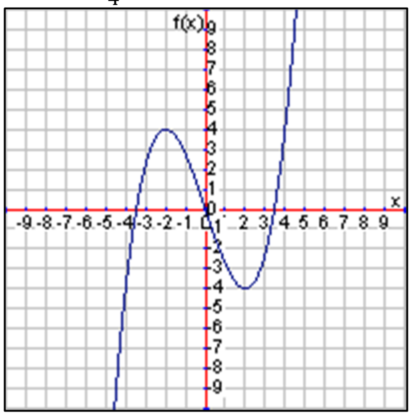


25. $y = 5x - 3$ Increasing



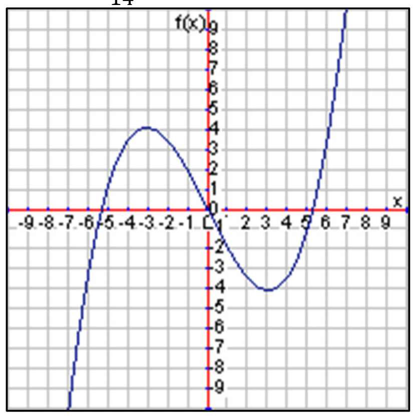
For the following functions tell where they are increasing and where they are decreasing. Then give the max or min of the function.

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



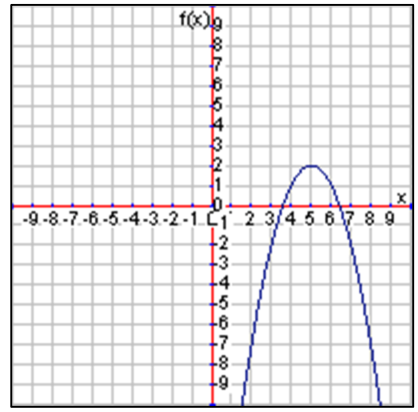
Increasing: $x < -2$ and $x > 2$
Decreasing: $-2 < x < 2$
Local max: $y = 4$
Local min: $y = -4$

27. $y = \frac{1}{14}x^3 - 2x$



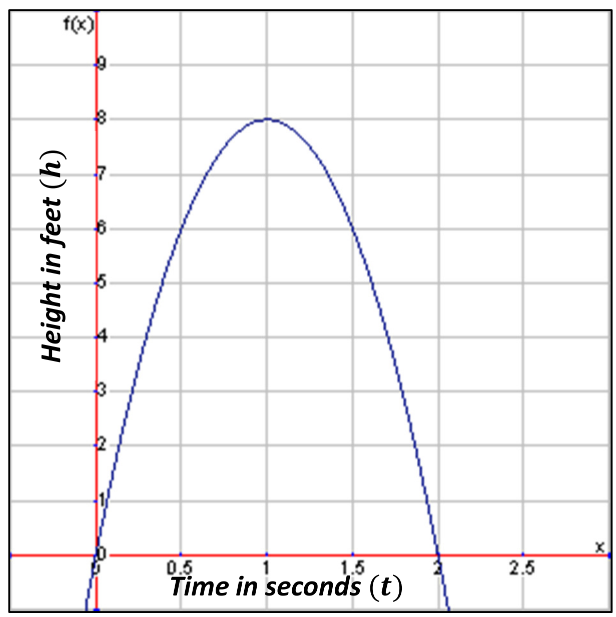
Increasing: $x < -3$ and $x > 3$
Decreasing: $-3 < x < 3$
Local max: $y = 4$
Local min: $y = -4$

28. $y = -(x-5)^2 + 2$



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

Use the following graph showing a function modeling the height (h) of an angry bird that is thrown in terms of time (t) in seconds to answer the questions.



29. What is the maximum height of the angry bird and when does the bird reach its max height?
$8\ ft$ at $1\ sec$

30. What inputs makes sense in this context?
$0\ to\ 2\ seconds$

31. During what times is the bird's height increasing?
Between $0\ and\ 1\ sec$

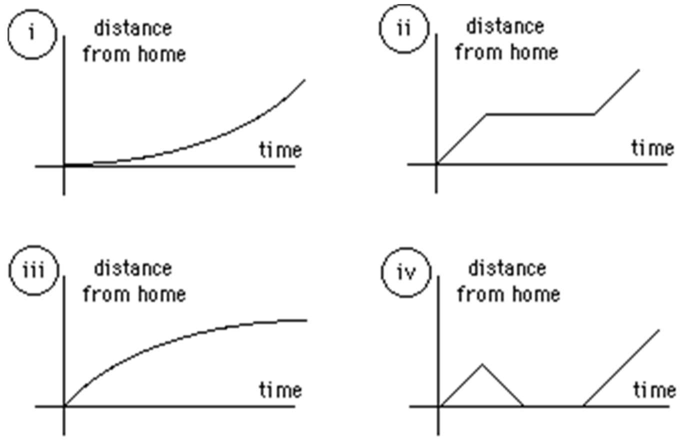
32. During what times is the bird's height decreasing?
Between $1\ and\ 2\ sec$

33. What are all the different heights the bird reaches?
From $0\ to\ 8\ ft$

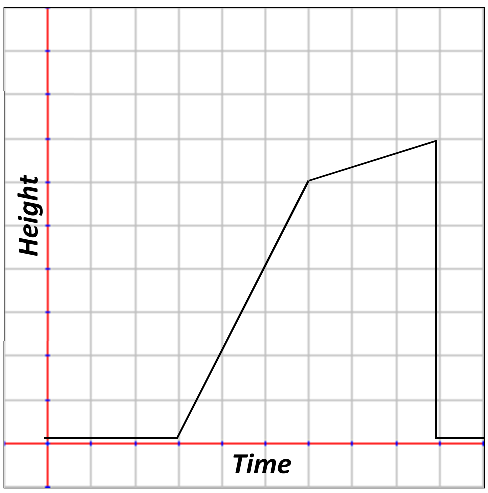
Determine which graph matches the story and explain why.

34. A young boy decided he was fed up with his parents and wanted to join the circus. After gathering his belongings in a hobo-style bag on a stick, he started running away from home very fast. He continually slowed down the longer he ran until he finally stopped about halfway to the circus when he realized he was being irrational.

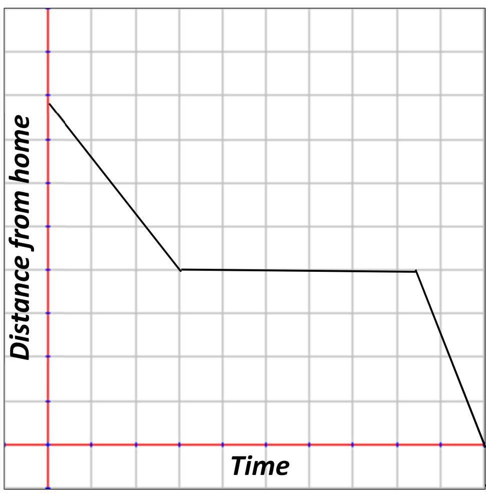
Graph iii



Sketch a graph modeling a function for the following situations.



35. A seed was planted in the early spring. A sprout appeared and grew rapidly in the rainy spring. Growth nearly stopped during the dry and hot summer. In the middle of the summer, a rabbit ate the plant. Sketch a graph of a function of the plant's height in terms of time.



36. A child starts walking home from school. He stops at his friend's house on the way home to play video games. Around dinner time, his mom comes to pick him up and drive him home. Sketch a graph of a function of the child's distance from home in terms of time.