Chapter 3 Lesson #1 (4-1)

Classroom Copy

Objective: Understand how to interpret and graph relationships.

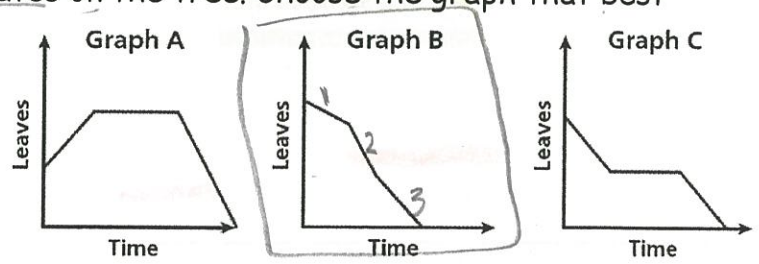
Relating Graphs to Situations:

Key words:

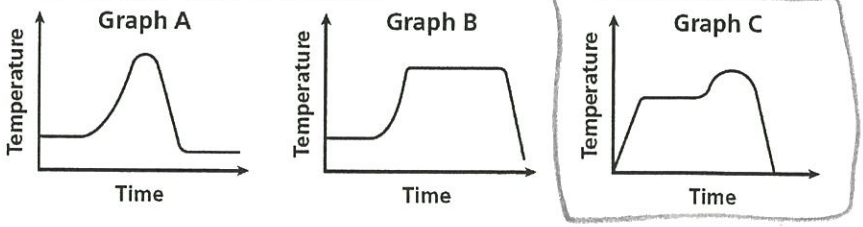
1. Increasing ↗ on graph
2. Decreasing ↘ on graph
3. Constant → on graph

Examples:

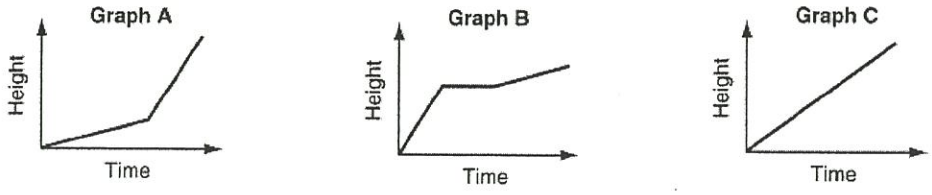
1. Each day several leaves fall from a tree. One day a gust of wind blows off many leaves. Eventually, there are no more leaves on the tree. Choose the graph that best represents the situation. (1) (2) (3)



2. The air temperature increased steadily for several hours and then remained constant. At the end of the day, the temperature increased slightly before dropping sharply. Choose the graph that best represents this situation. 1 2 3 4



#3-5, choose the graph that best represents each situation.



3. A tomato plant grows taller at a steady pace. C

4. A tomato plant grows quickly at first, remains a constant height during a dry spell, then grows at a steady pace. B

5. A tomato plant grows at a slow pace, then grows rapidly with more sun and water. A

Two main types of graphs:

Continuous Graphs - solid line (includes all values)

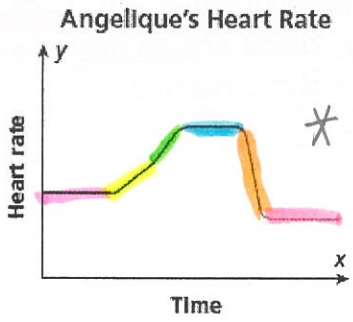
Discrete Graphs - dotted graph (distict points; specific values)

Example:

Angela's heart rate is being monitored while she exercises on a treadmill. While walking, her heart rate remains the same. As she increases her pace, her heart rate rises at a steady rate. When she begins to run, her heart rate rises more rapidly and then remains high while she runs. As she decreases her pace, her heart rate slows down and returns to normal rate.

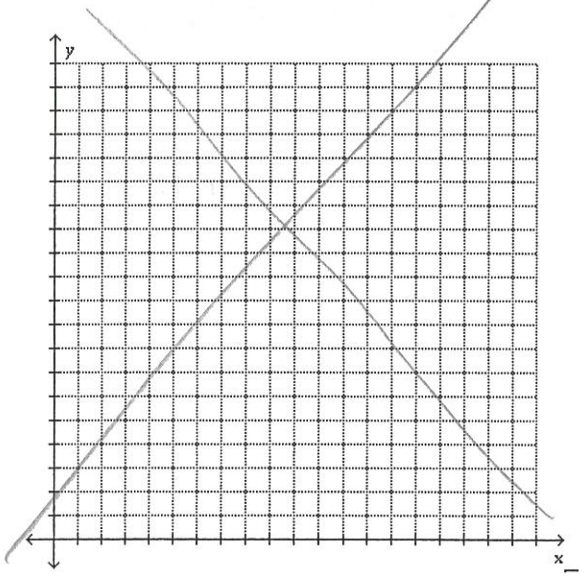
- remains the same,
- rises at a steady rate,
- increases more rapidly (steeper than previous segment),
- remains high,
- slows down,
- and then returns to her normal rate.

The graph is continuous.

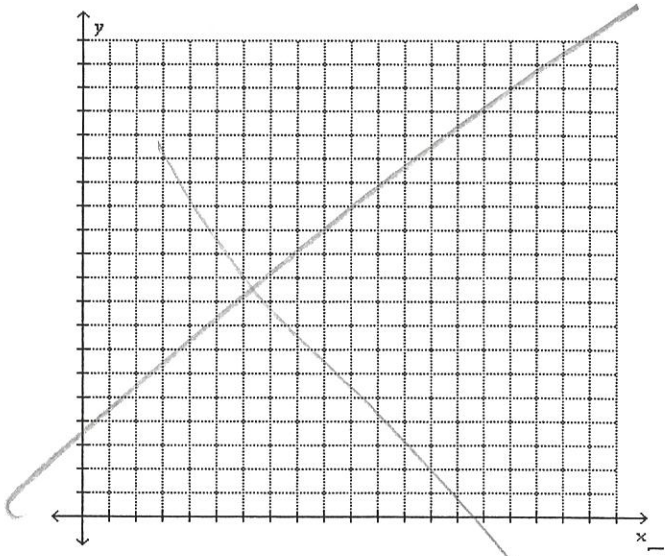


* continuous graph

6. Joulies Example



Without Joulies



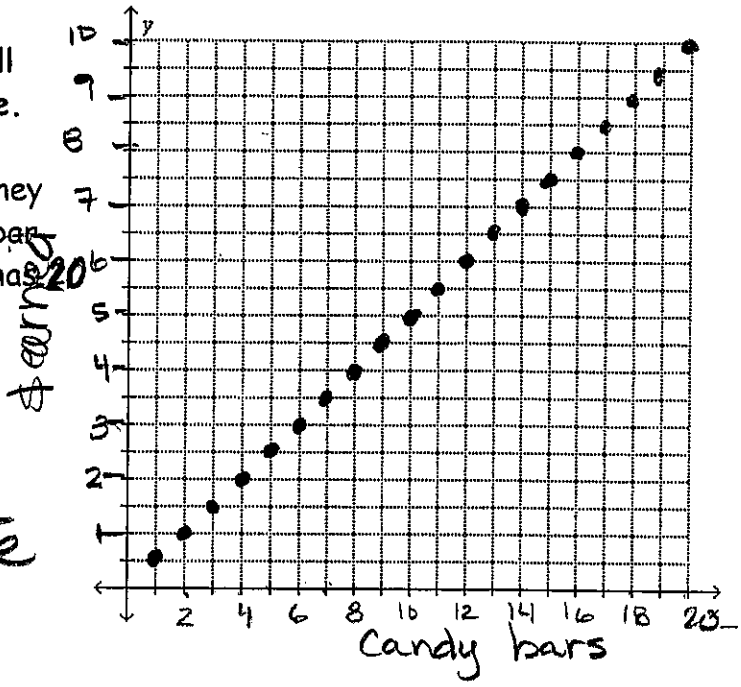
With Joulies

#7-9, sketch a graph of the situation. Tell whether the graph is continuous or discrete.

7. Jenny is selling candy bars to raise money for the school dance. For each candy bar she sells, the school gets $0.50. She has 20 candy bars she needs to sell.

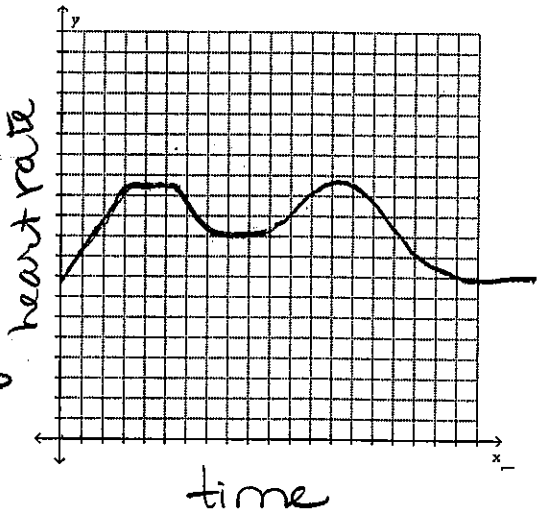
(1, .50)
(2, 1)
(3, 1.50)

Discrete



8. Tim's heart rate is being monitored while he exercises on a treadmill. He jumps on the treadmill and starts running. After a few minutes, he has to slow down to a walk and then after he walks for a few minutes, he feels good enough to jog until he stops.

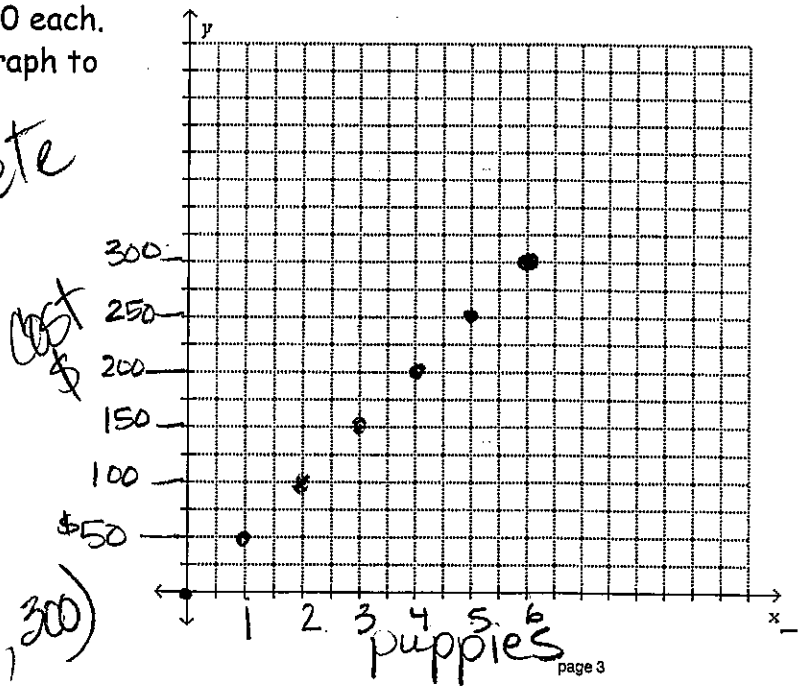
continuous



9. A pet store is selling puppies for $50 each. It has 6 puppies to sell. Sketch a graph to describe this situation.

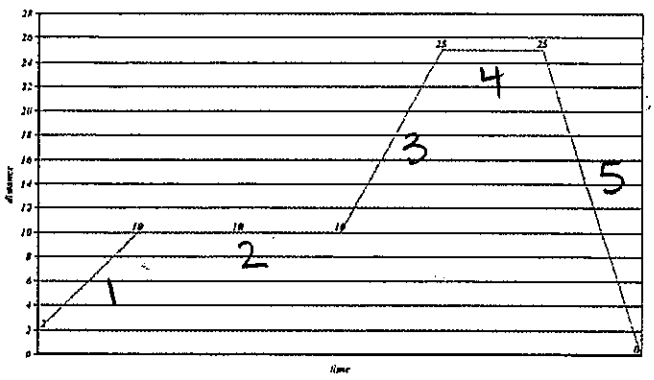
(0, 0)
(1, 50)
(2, 100)
(3, 150)
(4, 200)
(5, 250)
(6, 300)

Discrete



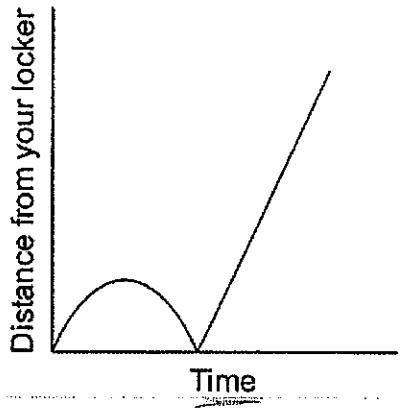
#10 & 11, write a story for each graph.

10.



Makenzie starts on her bike from her neighbor's house and bikes steadily to the corner. She waits for the traffic light before pedaling more quickly than before. She stays at another corner for a few minutes before high tailing back home.

11.



Susie leaves her locker and turns back to get her math book. To avoid being late, she hurries to class.

Chapter 3 Lesson #2 (4-2)

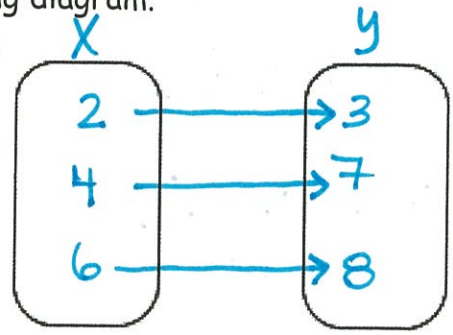
Objective: Understand relations, functions, domain, and range.

Relation - set of numbers represented by ordered pairs.

Examples:

1. Express {(2,3), (4,7), (6,8)} as a table and a mapping diagram.

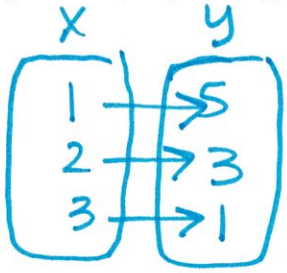
x	2	4	6
y	3	7	8



2. **(a)** Express the following set as a table or mapping diagram. {(1,5), (2,3), (3,1)}

x	y
1	5
2	3
3	1

x	1	2	3
y	5	3	1



(b) Describe what these numbers mean if they are represent info from a track meet.

1st place = 5pt

2nd place = 3pt

3rd place = 1pt

Vocabulary:

Domain - independent variable

"x" values; "input"

Range - dependent variable

"y" values; "output"

3. Give the domain & range of the set of numbers {(6, -4), (0, 1), (8, 2), (-3, -4)}.

D: {6, 0, 8, -3} R: {-4, 1, 2, -4}

* do not have to repeat values.

for each input there is only 1 output
"x cannot repeat with a different y value"

Function - a relation where each domain is paired with one range.

Example:	Is a function	Is **NOT** a function
	{(4,9), (-3,10), (7, 0)}	{(1,2), (4,5), (1,10)}

#4-12, state the domain & range. Tell whether or not it's a function.

4. {(7,-1), (6,0), (9,-7), (7, -3), (15,0)}

D: {7, 6, 9, 7, 15}

R: {-1, 0, -7, -3, 0}

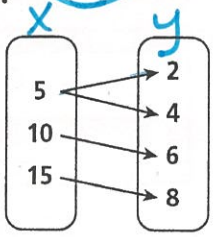
NOT a function

5.

Students	# of buses needed
75	2
68	2
125	3

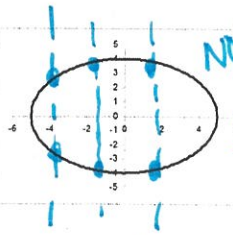
yes

6. NO



Vertical Line test - way/method to determine if a graph is a function.

the vertical line can only cross (touch) the graph once to pass the test → it is a function



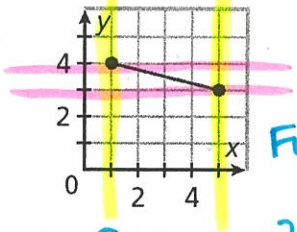
Not a function

7.

D: {0 ≤ x ≤ 3} Function

R: {0 ≤ y ≤ 3}

8.

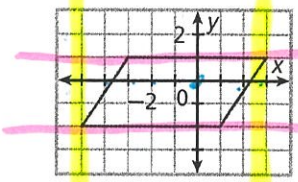


Function

D: {1 ≤ x ≤ 5}

R: {3 ≤ y ≤ 4}

9.

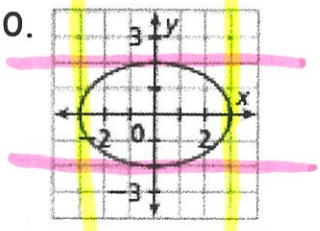


Not a function

D: {-5 ≤ x ≤ 3}

R: {-2 ≤ y ≤ 1}

10.

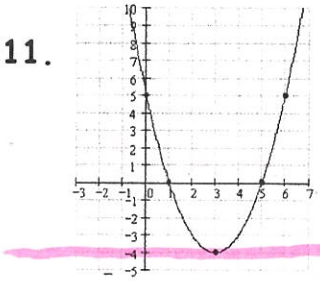


D: {-3 ≤ x ≤ 3}

R: {-2 ≤ y ≤ 2}

Not a function

11.

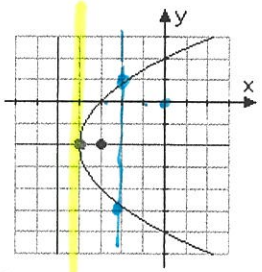


D: {all real #s}

R: {y ≥ -4}

Function

12.



D: {x ≥ -4}

R: {all real #s}

Not a function

Chapter 3 Lesson #3 (4-3)

Objective: Understand function notation, domain and range story problems.

Function Notation - another way to write y = . (kind of a short hand way)

Ex: $y = 2x + 1$ is the same as $f(x) = 2x + 1$ function rule rule

"f of x"

Examples: In # 1-4 evaluate each function.

1. For $f(x) = 5x$, find $f(6)$.

$f(6) = 5 \cdot 6$

$f(6) = 30$

2. For $g(t) = 2.30t + 10$, find $g(-5)$.

$g(-5) = 2.3(-5) + 10$

$g(-5) = -1.5$

3. For $h(x) = \frac{1}{2}x^2 - 3$, find $h(-8)$.

$h(-8) = \frac{1}{2}(-8)^2 - 3$

$h(-8) = 29$

4. For $m(n) = 5n^2 - 4$, find $m(-6)$.

$m(-6) = 5(-6)^2 - 4$

$m(-6) = 176$

5. Mindy has already sold \$20 worth of tickets to the school play. She has 4 tickets left to sell at \$2.50 per ticket.

f(x)

(a) Write a function rule to describe how much money Mindy can collect from selling tickets.

$f(x) = 2.5x + 20$

(b) What is a reasonable domain for the function?

$\{0, 1, 2, 3, 4\}$

(c) What is a reasonable range for the function?

$\{20, 22.5, 25, 27.5, 30\}$

6. Bobby is ordering a pizza from DJs. The pizza is $5.50 plus $.75 per topping. DJ's has six different topping choices.

(a) Write a function rule to describe how much money Bobby could spend at DJ's Pizza Place.

$f(x) = .75x + 5.5$

(b) What is a reasonable domain for the function?

$\{0, 1, 2, 3, 4, 5, 6\}$

(c) What is a reasonable range for the function?

$\{5.5, 6.25, 7, 7.75, 8.5, 9.25, 10\}$

7. Tickets to Michigan's Adventure are $25 per person and parking is $10 per car. A family of up to 5 is planning a day at Michigan's adventure.

(a) Write a function rule to describe how much money this family could spend at Michigan's Adventure.

$f(x) = 25x + 10$

(b) What is a reasonable domain for the function?

$\{1, 2, 3, 4, 5\}$

(c) What is a reasonable range for the function?

$\{35, 60, 85, 110, 135\}$

8. FedEx charges $12 plus $5 per item in the order, up to a maximum of 5 items.

(a) Write a rule that describes this situation.

$f(x) = 5x + 12$

(b) Give a reasonable domain.

$\{1, 2, 3, 4, 5\}$

(c) Give a reasonable range.

$\{17, 22, 27, 32, 37\}$

Chapter 3 Lesson #4 (4-3)

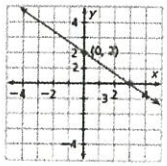
Objective: Determine if an equation or set of data is linear, and write an equation from a set of data.

A **linear function** is a function whose graph is a non-vertical line. — constant rate of change

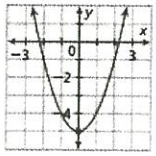
Key: $y = mx + b$ or $f(x) = mx + b$ — x is to the 1st power

A **nonlinear function** does not have a constant rate of change.

Example: Linear



nonlinear x^2



#1-4, determine whether the equation is linear or nonlinear.

1. $y = 5 - x^2$ — nonlinear
2. y = 2x - 7 — linear
3. $x + y = 4$ — linear
4. $y = \frac{1}{x}$ — nonlinear

Determining if a function is linear from a set of data:

Example: Linear — constant rate of slope

x	0	2	4	6
y	-8	2	12	22

+2 +2 +2 ; +10 +10 +10

nonlinear

x	0	2	4	6
y	-7	-3	9	29

+2 +2+2 ; +4 +12 +20

Key concept: Look for a pattern.

Ex: Write an equation using two different variable to show the relationship.

{2, 4, 6, 8, 10, ...}

+2 +2 +2 +2

$y = 2x$ $y = \frac{1}{2}x$ $y = \frac{1}{2}$

In #5-14, determine if the following is linear or nonlinear. If it's linear, write an equation using two different variables to show this relationship.

5. {(4,9), (5,10), (6,11)}

+1 +1

$y = 1x + 5$ $y = x + 5$

6. {(0,0), (1,1), (2,4), (3,9)}

+1 +3 +5

nonlinear

7.

x	0	1	2	3
y	1	3	5	7

+2 +2 +2

$y = 2x + 1$

8. {(1,3), (2,6), (3,9), (4,12)}

+3 +3 +3

$y = 3x$

9.

x	y
0	0
1	1
4	2
9	3
16	4

10. {(1,2), (2,1), (3,0), (4,-1)}

11. {(-2,-9),(-1,-7),(0,-5)}

12.

x	1	5	10	17
y	0	2	3	4

13.

x	1	2	3	4
y	1	8	27	64

14. {(2,22), (3,32), (4,42), (5,52)}

#15 & 16, predict the 100th term.

15.

x	5	6	7	8
y	20	24	28	32

+4 +4 +4

$y = 4x$

$y = 4(100)$

$y = 400$

(100, 400)

16.

x	y
1	35
2	37
3	39
4	41

+2 +2 +2

$y = 2x + 33$

(100, 233)

Chapter 3 Lesson #5 (4-5)

Objective: Understand scatterplots, correlations, and linear regression lines.

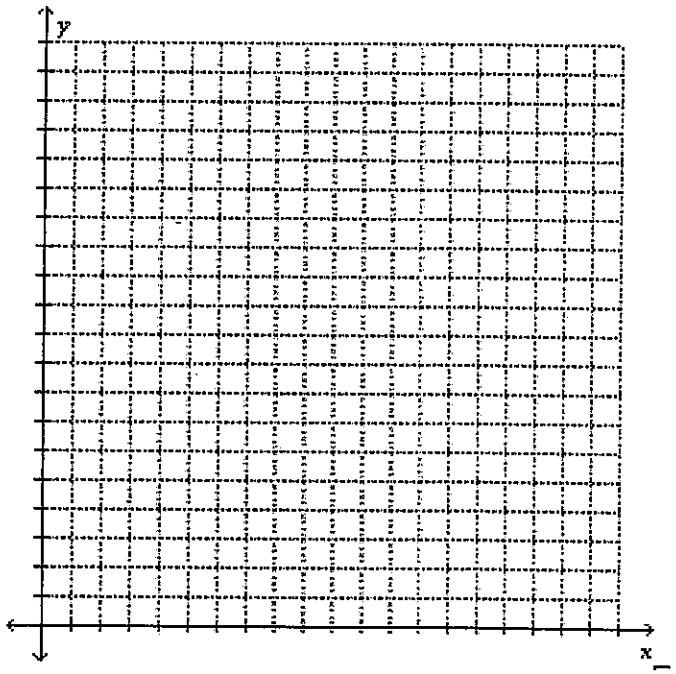
Scatter Plots - graph with individual points that shows a relationship between two sets of data.

- Note: really the same thing as a discrete graph.

Examples: In # 1 & 2, create a scatter plot for the given data.

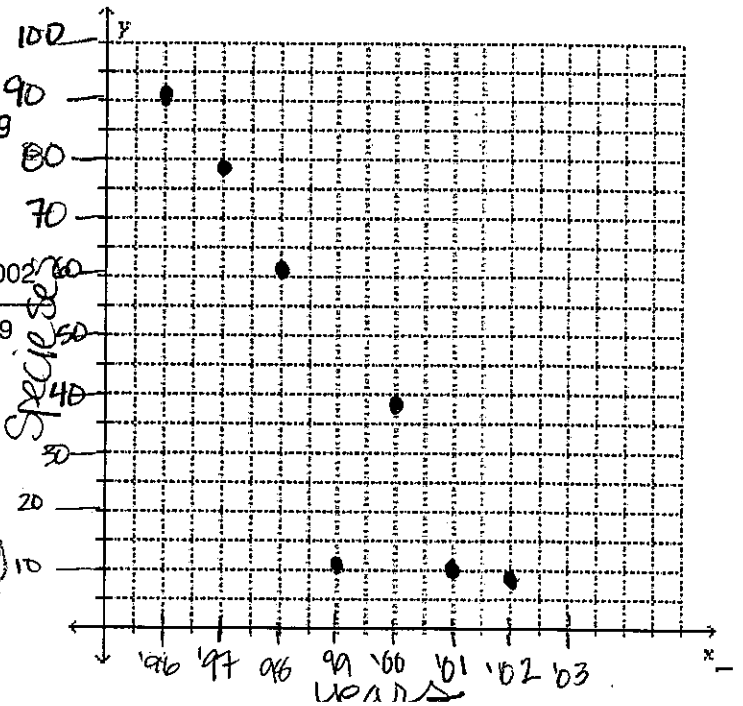
1. The table shows the number of points scored by a high school football team in the first four games of a season. Graph a scatter plot using the given data.

Game	1	2	3	4
Score	6	21	46	34



2. The table below shows the number of species added to the list of endangered and threatened species in the U.S. during the given years. Graph a scatter plot using the given data.

Year	1996	1997	1998	1999	2000	2001	2002
Species	91	79	62	11	39	10	9



As the years progress, the number of species added to the endangered list decreases.

Correlation - describes the relationship between the two data sets.

4 Types of Correlation:

(1) **Positive** - both sets of data go up.

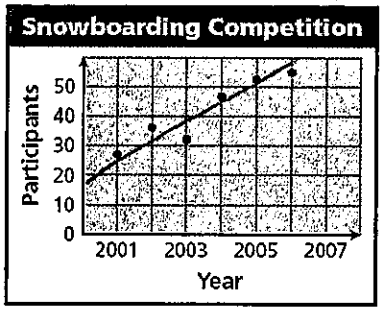
(2) **Negative** - one set of data increases as the other set decreases.

(3) **Constant** - data is in a horizontal line.

(4) **No Correlation** - there is no relationship (pts are all over).

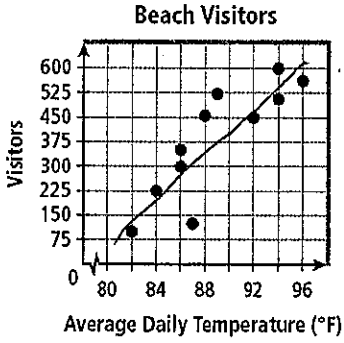
Examples: In #3 & 4, describe the type of correlation from the scatter plot.

3.



positive

4.



positive

In # 5-7, describe the type of correlation you would expect to see in the data.

5. The number of empty seats in a classroom and the number of students seated in the class.

negative

6. The number of pets a person owns and the number of books that a person read last year.

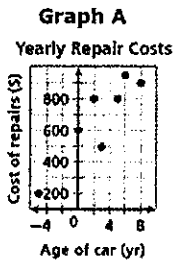
no correlation

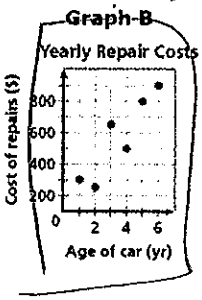
7. The monthly rainfall and the depth of water in a reservoir.

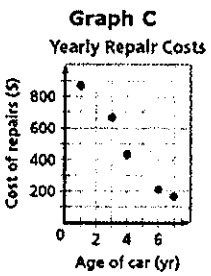
positive

In #8 & 9, match the scatter plot to the situation.

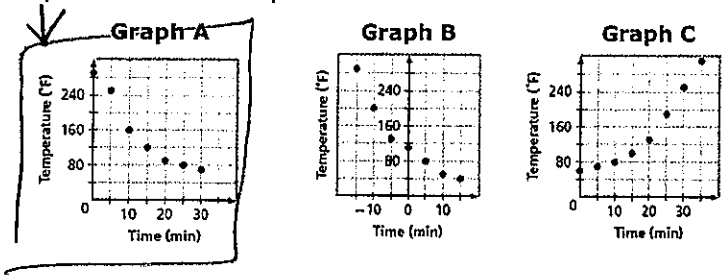
8. Relationship between the age of a car and the amount of money spent each year on repairs.







9. Relationship between the number of minutes since a pie has been taken out of the oven and the temperature of the pie.



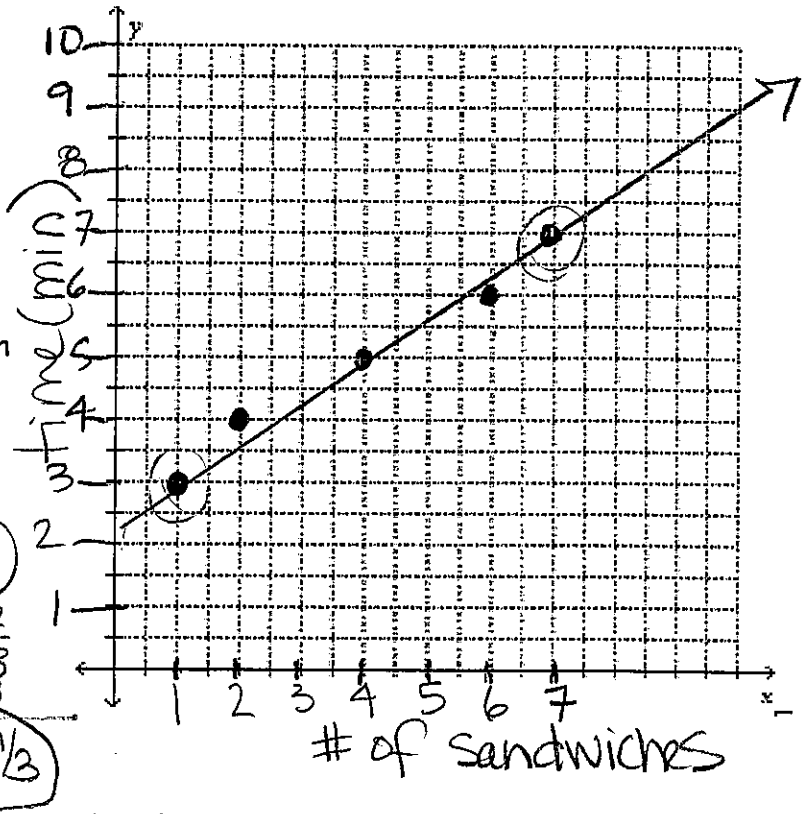
Trend Line (or line of best fit) - line that shows the correlation in the set of data.

- The line through the middle of the data set.

10. Neal kept track of the number of minutes it took him to assemble sandwiches at his restaurant. The information is in the table below

Number of sandwiches	1	2	4	6	7
Minutes	3	4	5	6	7

A. Graph a scatter plot & draw a trend line.



B. Find two points on the graph and write a linear equation.

(1,3) (7,7)

$\frac{7-3}{7-1} = \frac{4}{6} = \frac{2}{3}$ $y-3=\frac{2}{3}(x-1)$

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

$+3 \quad +3$

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

C. Based on your linear equation, predict the amount of time it will take Neal to assemble 12 sandwiches.

$y=\frac{2}{3}(12)+2\frac{1}{3}$

$y=8+2\frac{1}{3}$

$\approx 10\frac{1}{3}$ min

Trend Lines with your calculator.

How to use the graphing calculator to help make a prediction (or write an equation):

(1) STAT → Edit

(2) Type in data into L_1 & L_2

(3) Can graph if you want to: 2nd y = , then turn stat plot on

or

(4) Get equation of line: STAT → Calc → LinReg

- This will give you the equation of the line through the data.

11. The table shows the price of a stock over an 8-month period. Use your calculator to find a linear regression line. Write the equation for the linear regression line and use it to predict what the price of one share of stock will be in the twelfth month.

L1	Month	1	2	3	4	5	6	7	8
L2	Price ($)	32	35	37	41	46	50	54	59

$y = 3.90x + 26.68$

$y = 3.9(12) + 26.68$

$= \$73.48$

12. The table shows the dosage of a particular medicine as related to the person's weight. Use your calculator to find a linear regression line. Predict the dosage for a person weighing 240 pounds and 275 pounds.

Weight (lb)	90	100	110	125	140	155	170	180	200
Dosage (mg)	20	25	30	35	40	53	60	66	75

$y = .51x - 26.79$

13. Monster Mash Prediction:

240 lbs = $y = .51(240) - 26.79$

(240, 95.61) = 95.61 mg

275 lbs = $y = .51(275) - 26.79$

(275, 113.46) = 113.46 mg

Chapter 3 Lesson #6 (Not in textbook)

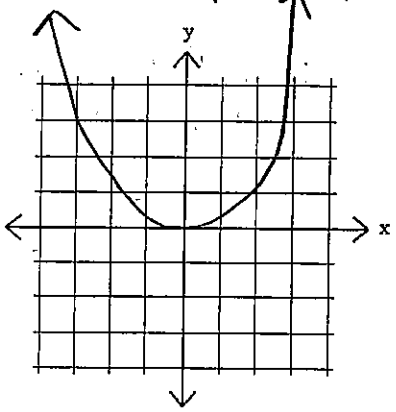
Objective: Exploring different functions.

Using your graphing calculator or an on-line graphing calculator, explore what the various functions look like.

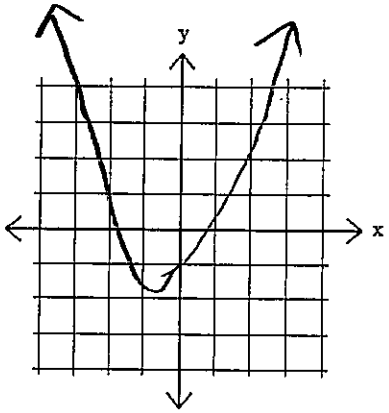
- Type the function listed into your graphing calculator or go to https://www.desmos.com/calculator.
- Sketch a graph of the function.

1. $y = x^2$

What's my name? Quadratic

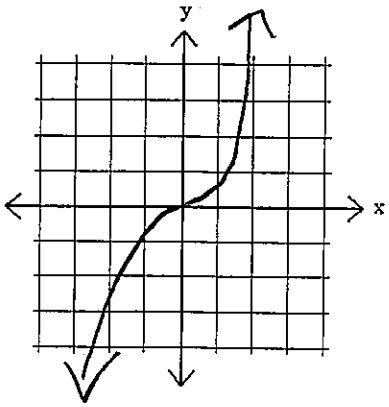


2. $y = x^2 + x - 3$



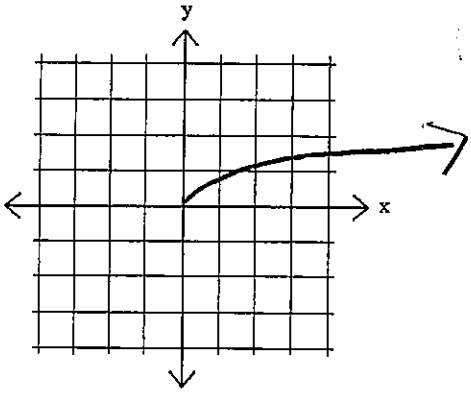
3. $y = x^3$

What's my name? Cubic

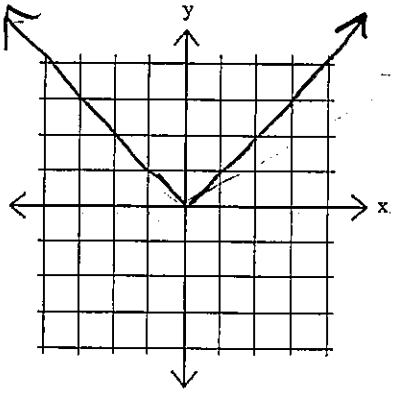


4. $y = \sqrt{x}$

Square root

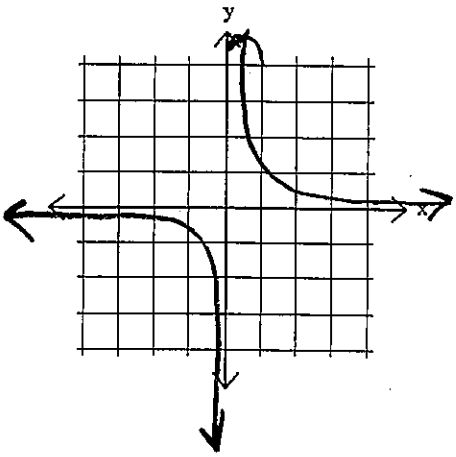


5. $y = |x|$ absolute value

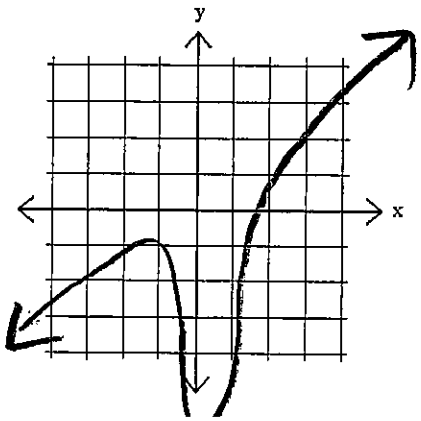


6. $y = \frac{1}{x}$ inverse variation

What's my name?



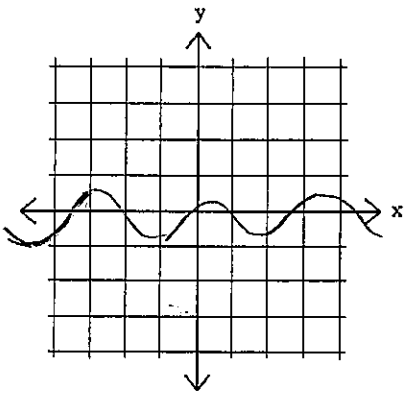
7. $y = x - \left(\frac{1}{x}\right)^2$



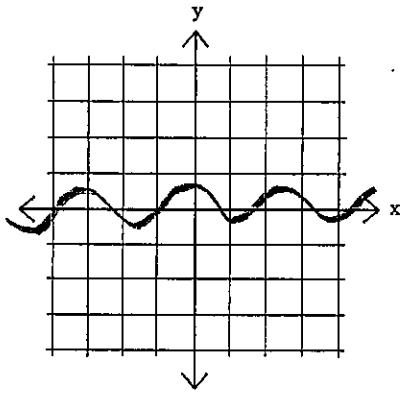
Trig Functions:

* If your using a graphing calculator, on your calculator, go to MODE. Choose Radian. You must do this or you won't be able to see the graph.

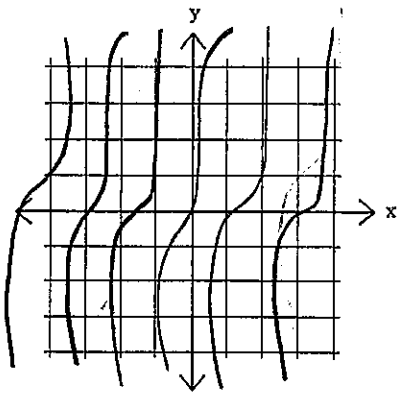
8. $y = \sin x$



9. $y = \cos x$

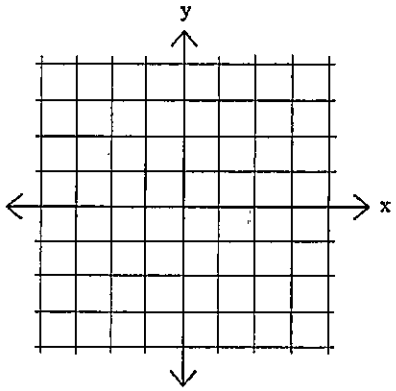


10. $y = \tan x$

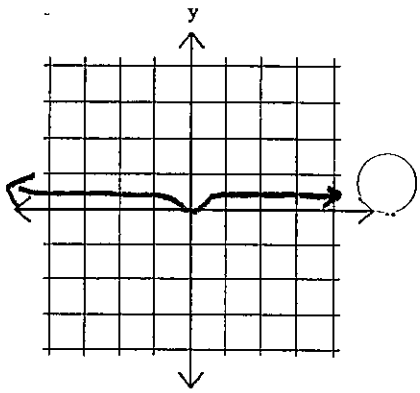


11. Graphing Calc. or on-line

$y = \tan^{-1}(x)$ or y = arctan (x)



12. $y = x \bullet \sin\left(\frac{1}{x}\right)$



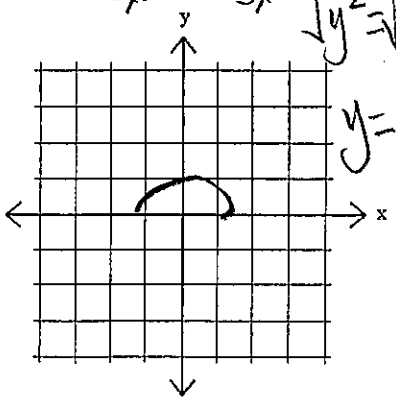
Must use on-line tool.

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

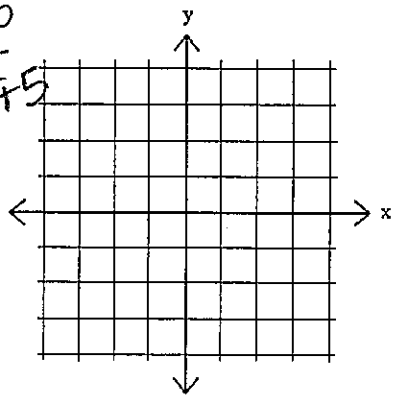
$-x^2 \quad -x^2$

$\sqrt{y^2} = \sqrt{-x^2+5}$

$y = \sqrt{-x^2+5}$



14. y = x - floor (x)



15. $x^2 + \left(y - \sqrt{x^2}\right)^2 = 1$