Algebra 2
Chapter 2

Linear Relations and Functions

Section 2.1 Relations and Functions

PART 1: Relations and Functions

Relation:

Function:

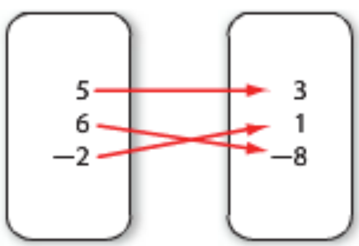
Domain:

Range:

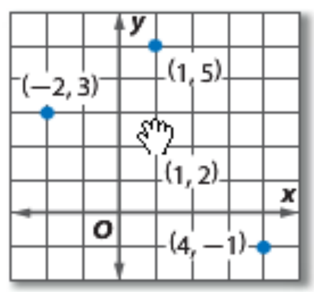
One-to-One Function:

Example 1: State the domain and range of each relation. Then determine whether each relation is a function. If it is a function, determine if it is *one-to-one*.

1.



2.



3.

x	y
−2	−4
1	−4
4	−2
8	6

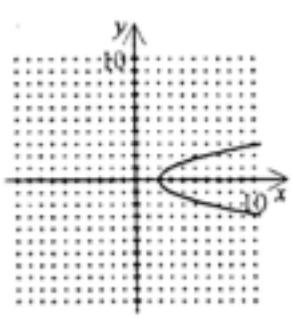
Discrete Relation:

Continuous Relation:

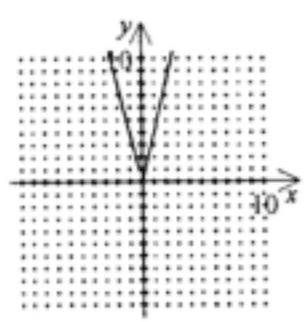
Key Concept: Vertical Line Test

Example 2: Use the vertical line test to determine if the following are functions.

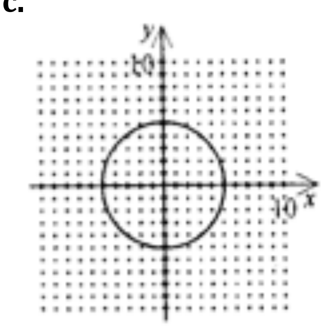
a.



b.



c.



Part 2: Equations of Relations and Functions

Independent Variable:

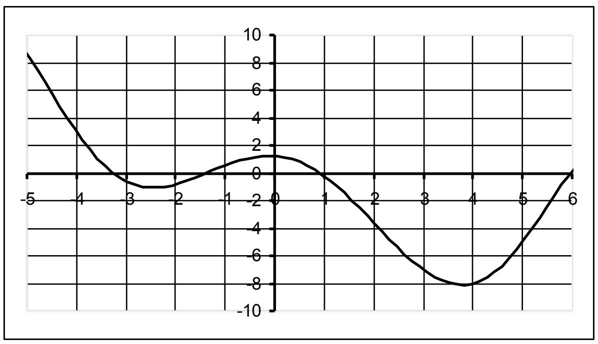
Dependent Variable:

Function Notation:

Example 3: Given $f(x) = 3x^2 + 4$, find each value.

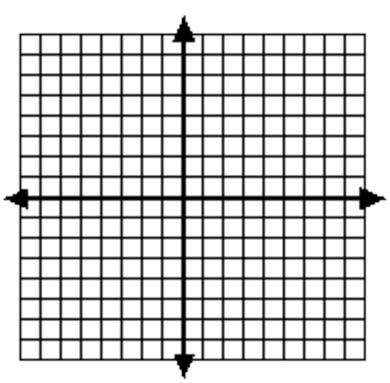
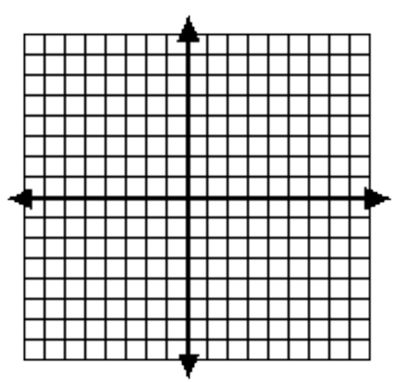
a. $f(6)$	b. $f(\ 5)$	c. $f(7a)$

Example 4: Use the graph below to answer the following:



a. What is $f(2)$?	b. Find x so that $f(x) = 3$.	c. Is $f(1) > f(5)$?

Example 5: Graph each equation and determine the domain and range. Determine whether the equation is a function. If it is a function, determine if it is *one-to-one*. Then state whether it is *discrete* or *continuous*.

a. $y = -4x - 2$ 	b. $y = 2x^2$ 

Section 2.2 Linear Relations and Functions

PART 1: Linear Relations and Functions

Linear Relation:

Linear Equation:

Linear Function:

Example 1: State whether each function is a linear function. Explain.

a. $f(x)=\frac{x+12}{5}$	**b.** $f(x)=\frac{7-x}{x}$	**c.** $f(x)=3x^2-4$	**d.** $f(x)=-8x-21$

Example 2: You want to make sure that you have enough music for a car trip. If each CD is an average of 45 minutes long, the linear function *m(x) = .75x* could be used to find out how many CDs you need.

a. How many hours of music are there on 4 CDs?	**b.** If the trip you are taking is 6 hours, how many CDs should you bring?

PART 2: Standard Form

Standard Form of a Linear Equation:

Example 3: Write each equation in standard form. Identify A, B, and C.

a. $3x = -2y - 1$	**b.** $-6y = 4x - 24$

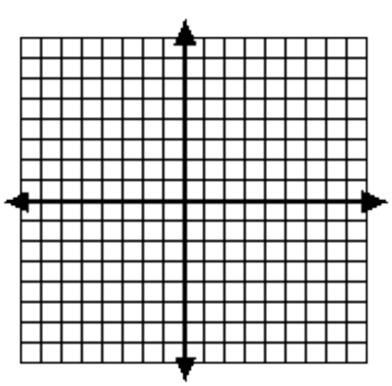
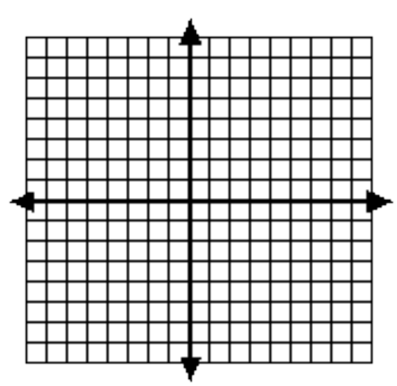
***x*-intercept:**

***y*-intercept:**

To find the *x*-intercept, make ____

To find the *y*-intercept, make ____

Example 4: Find the *x*-intercept and the *y*-intercept of the graph of each equation. Then graph the equation using the intercepts.

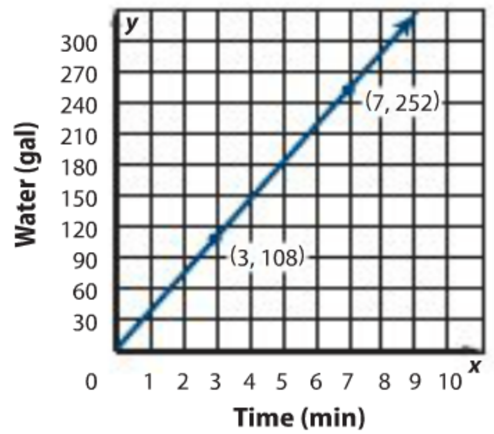
a. y = 5x + 12 **x - intercept:**____________________ **y - intercept:**____________________ 	**b.** 2x + 3y = 12 **x - intercept:**____________________ **y - intercept:**____________________ 

Section 2.3 Rate of Change and Slope

Rate of Change:

Rate of Change = ________________

Example 1: The graph below shows the number of gallons in a swimming pool as it is being filled. At what rate is the pool being filled?



Example 2: Find the rate of change for each set of data.

a.

Time (min)	2	4	6	8	10
Distance (ft)	12	24	36	48	60

b.

Time (sec)	5	10	15	20	25
Volume (cm^3)	16	32	48	64	80

Slope = ________________ **=** ________________

Example 3: Find the slope that passes through the points.

a. (1, -3) and (3, 5)

b. (-8, 11 and (24, -9)

Example 4: Find the slope of each line.

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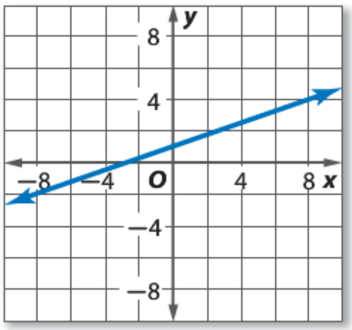
a.



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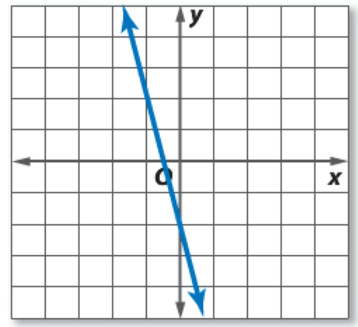
b.



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Example 5: Determine the rate of change for each equation. Solve for y and find slope.

$10x + 5y = 25$	$\frac{1}{4}y = 2x - 3$

Section 2.4 Writing Linear Equations

PART 1: Forms of Equations

Slope-Intercept Form:

To write an equation starting in **slope-intercept form**:

1. Find the slope of the line.
2. Select a point from the line.
3. Plug in slope (m) and the values of (x) and (y) from the point into $y = mx + b$.
4. Solve for b.
5. Rewrite the equation using m and b, in the slope-intercept equation $y = mx + b$.

Example 1: Write an equation in slope-intercept form for the line described.

a. slope $\frac{4}{3}$, passes through (0, 4)	**b.** passes through (0, -6) and (-4, 10)

Point-Slope Form:

To write an equation using **point-slope form:** $y - y_1 = m(x - x_1)$

1. Find the slope of the line.
2. Select a point from the line.
3. Plug in slope for (m) and the value of (x) in for x_1 and the value of (y) in for y_1 in the point-slope equation $y - y_1 = m(x - x_1)$
5. Rewrite the equation using the form requested in the problem.

Example 2: Use point-slope form to write an equation in slope-intercept form for the line described.

a. slope $\frac{1}{2}$; passes through (6, 5)	**b.** passes through (-2, -1); $m = -3$

PART 2: Parallel and Perpendicular Lines and Standard Form

Parallel Lines:

Perpendicular Lines:

Example 3: Write an equation in slope-intercept form for the line described.

a. passes through (-9, -3); perpendicular to $y=-\frac{5}{3}x-8$
b. passes through (4, -10) and parallel to $y=\frac{7}{2}x-3$

Standard form of a linear equation:

Example 4: Write each linear equation in standard form.

a. y = 2x + 3	**b.** $y=-\frac{3}{2}x+4$

Section 2.5 Scatter Plots and Lines of Regression

PART 1: Scatter Plots and Prediction Equations

Scatter Plot:

Positive Correlation	**Negative Correlation**	**No Correlation**

To Find a Line of Best Fit or ______________________line:

1.

2.

3.

Example 1:

Year born, *x* (years since 1900)	20	30	40	50	60	70	80	90
Expected years of life, *y*	54	59	63	68	70	71	74	75

a. Make a scatter plot, draw a line of best fit and describe the correlation.	**b.** Write a predication equation.
c. If you were born in 1957, how long would you expect to live?	**d.** How accurate does your prediction appear to be?

PART 2: Regression Line

Regression Line:

Correlation Coefficient, *r* :

Example 2: The table at the below shows the percent of sales that were made in music stores in the United States for the period 1999-2008. Use a graphing calculator to make a scatter plot of the data. Find and graph a line of regression. Then use the function to predict the percent of sales made in a music store in 2018.

1. Enter data in your calculator.
2. Find the Line of Regression:
3. Prediction for 2018:

Music Store Sales	
Year	Sales (percent)
1999	44.5
2000	42.4
2001	42.5
2002	36.8
2003	33.2
2004	32.5
2005	39.4
2006	35.4
2007	31.1
2008	30.0

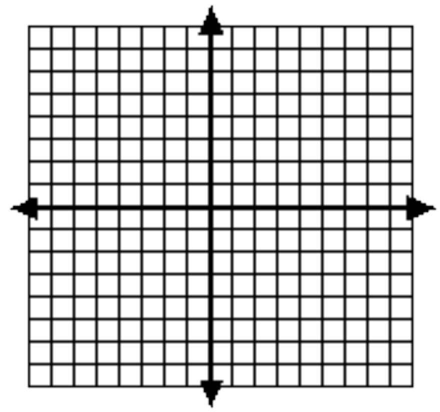
Section 2.6 Special Functions

PART 1: Piecewise-Defined Functions

Piecewise-Defined Function:

Example 1:

$$f(x)=\begin{cases} x+3 & \text{if } x<-1 \\ -2x-4 & \text{if } x\geq -1 \end{cases}$$



Domain:

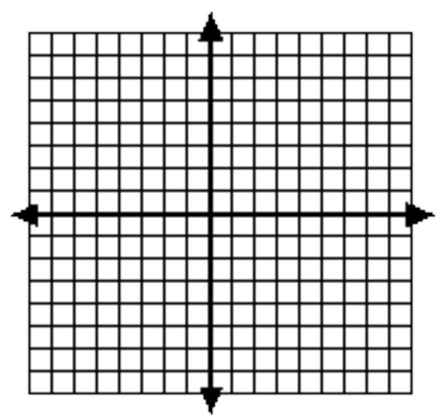
Range:

Evaluate:

$f(-5)$	$f(-1)$	$f(3)$

Example 2:

$$f(x)=\begin{cases} -3 & \text{if } x\leq -4 \\ x & \text{if } -4<x<2 \\ -x+6 & \text{if } x\geq 2 \end{cases}$$



Domain:

Range:

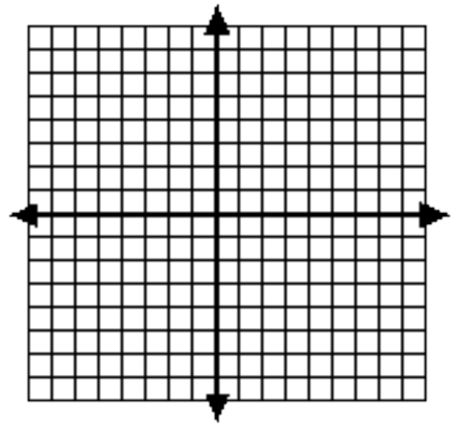
Evaluate:

$f(-5)$	$f(2)$	$f(8)$

PART 2: Absolute Value Functions

Absolute Value Function:

Example 3: $f(x) = |\ x - 2\ |$



Section 2.7 Parent Functions and Transformations

PART 1: Parent Graphs

Parent Functions:

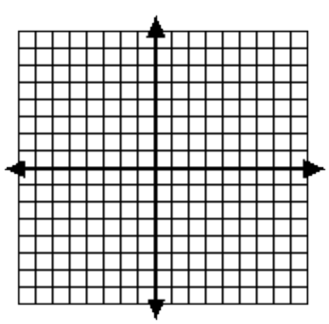
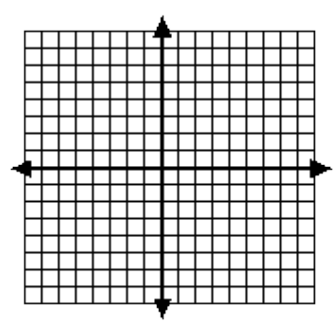
Constant Function	Identity Function
Absolute Value Function	**Quadratic Function**

PART 2: Transformations

Translation:

- $f(x) \pm k$,
- $f(x \pm h)$,

Example 1:

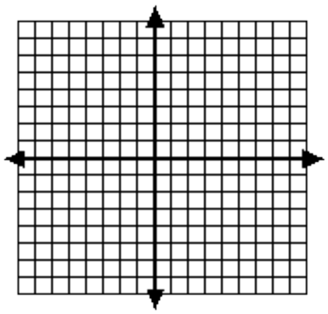
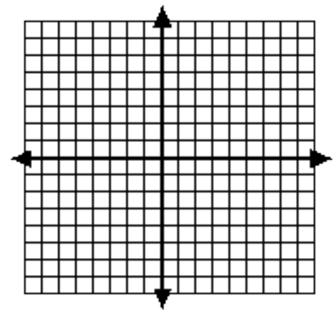
a. $y = a\lvert x-h \rvert + k$ 	**b.** $y = x^2 - 4$ 

Reflection:

- when parent function is multiplied by -1, the result *–f(x),*

- when only the variable is multiplied by -1, the result *f(-x),*

Example 2:

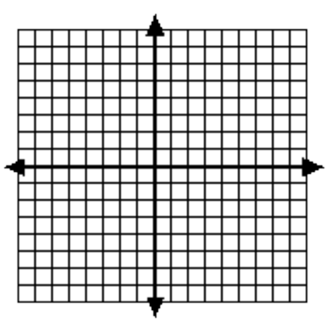
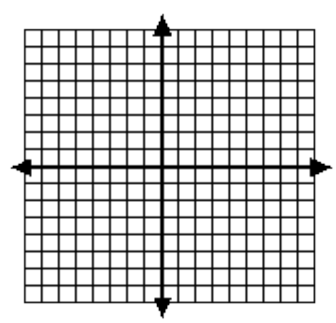
a. $y = -\lvert x \rvert$ 	**b.** $y = -x$ 

Dilation :

- When a nonlinear parent function is multiplied by a nonzero number,

- Coefficients greater than 1 cause the graph to be ______________________________, and coefficients between 0 and 1 cause the graph to be ________________________________.

Example 3:

a. $y = 2x^2$ 	**b.** $y = \left\lvert \frac{1}{3}x \right\rvert$ 

Section 2.8 Graphing Linear and Absolute Value Inequalities

PART 1: Graph Linear Inequalities

Linear Inequality:

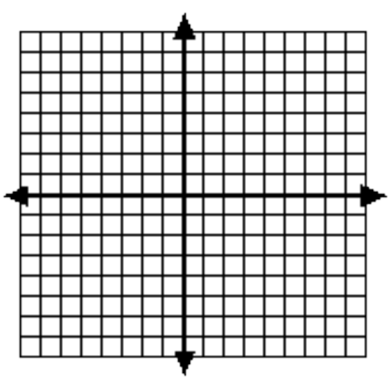
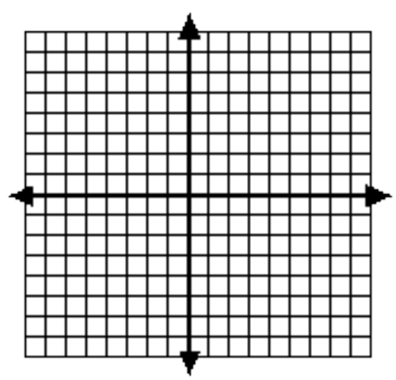
To Graph a Linear Inequality:

1.

2.

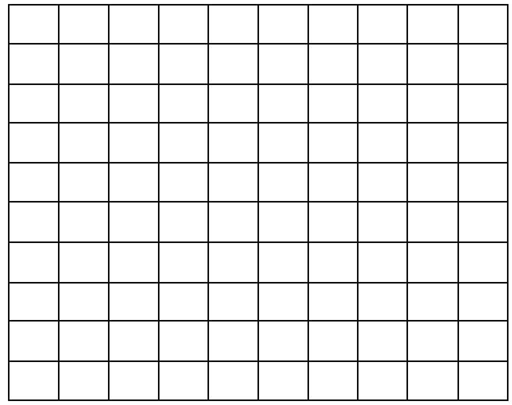
3.

Example 1: Graph the following linear inequalities.

$y < \frac{1}{2}x - 3$ 	$\frac{1}{2}x - y \geq 3$ 

Example 2:

Manual has $15 to spend at the county fair. The fair costs $5 for admission, $0.75 for each ride ticket, and $0.25 for each game ticket. Write an inequality and draw a graph that represent the number of ride tickets and game tickets that Manual can buy.

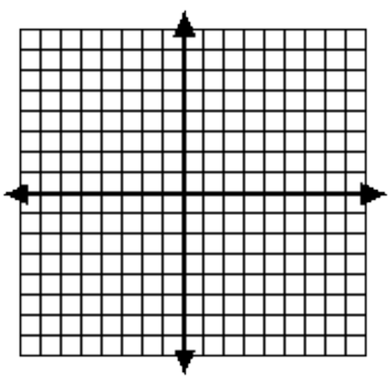


PART 2: Graph Absolute Value Inequalities

Write in the form of $y = a|x-h|+k$, before graphing an absolute value function

Example 3: Graph the following linear inequalities.

$y \quad |x+2|$



$y \quad 5 > |x|$