

Piecewise Functions

Vocabulary

piecewise function -

points of discontinuity -

step function -

extrema -

average rate of change -

Evaluating Piecewise Functions

Example 1:

Evaluate the function when $x = 3$.

$$g(x) = \begin{cases} x+1, & \text{if } x \leq 2 \\ 4x-1, & \text{if } x > 2 \end{cases}$$

Example 2:

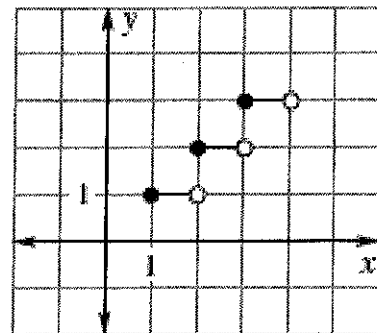
Evaluate the function when $x = -4$ and $x = 2$.

$$f(x) = \begin{cases} 3x-2, & \text{if } x \leq 0 \\ \frac{1}{4}x+1, & \text{if } x > 0 \end{cases}$$

Step Functions

Example 3:

Write the step functions as a piecewise function.

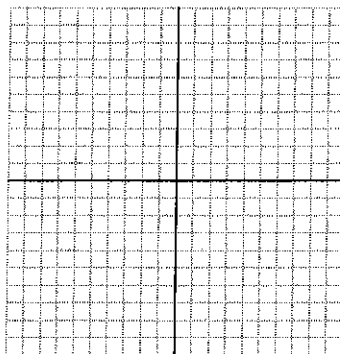


Graphing Piecewise Functions

Example 4:

Graph the function.

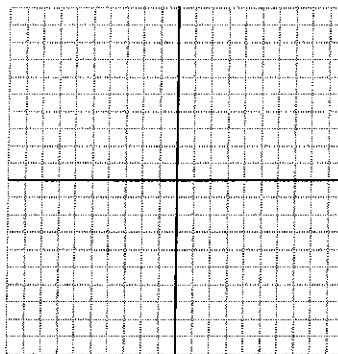
$$g(x) = \begin{cases} x+1, & \text{if } x \leq 2 \\ 4x-1, & \text{if } x > 2 \end{cases}$$



Example 5:

Graph the function.

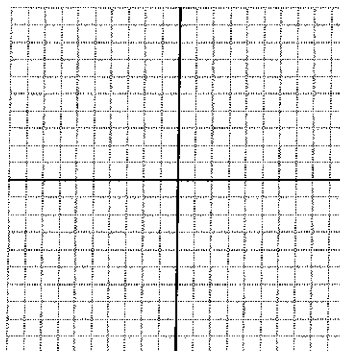
$$f(x) = \begin{cases} \frac{1}{2}x+1, & \text{if } x < 0 \\ x-1, & \text{if } 0 \leq x < 2 \\ x, & \text{if } x \geq 2 \end{cases}$$



Example 6:

Graph the function.

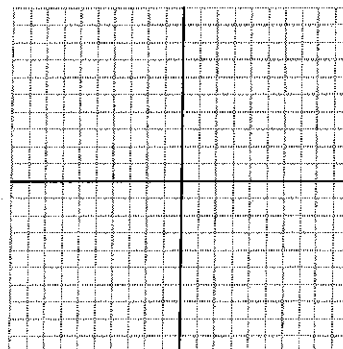
$$h(x) = \begin{cases} (x+1)^2, & \text{if } x < 1 \\ 2x+3, & \text{if } x \geq 1 \end{cases}$$



Absolute Value Functions as Piecewise Functions

Example 7:

Write the function $f(x) = 3|x+1| - 2$ as a piecewise function.



AC Math 2

Notes: Piecewise Functions

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

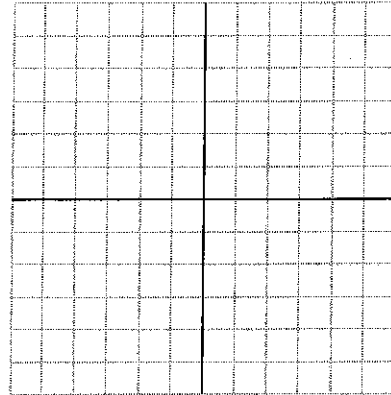
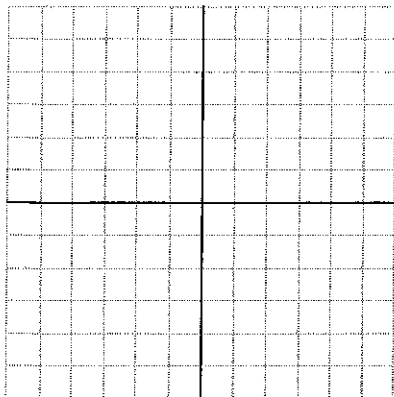
Evaluate $f(x)$ when (a) $x = 0$, (b) $x = 2$, (c) $x = 4$.

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

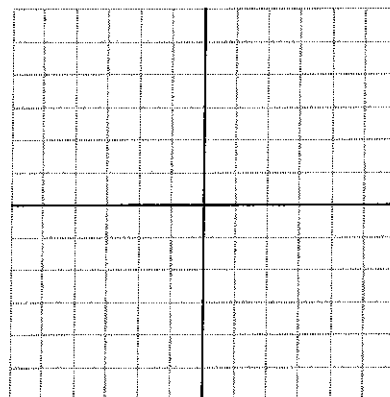
Evaluate $f(x)$ when (a) $x = -3$, (b) $x = -1$, (c) $x = 5$.

3. Graph: $f(x) = \begin{cases} \frac{1}{2}x + \frac{3}{2}, & \text{if } x < 1 \\ -x + 3, & \text{if } x \geq 1 \end{cases}$

4. Graph this function: $f(x) = \begin{cases} \frac{2}{3}x + \frac{2}{3}, & \text{if } x < 2 \\ -x + 1, & \text{if } x \geq 2 \end{cases}$



5. $f(x) = \begin{cases} 2x-1, & \text{if } x \leq 1 \\ 3x+1, & \text{if } x > 1 \end{cases}$

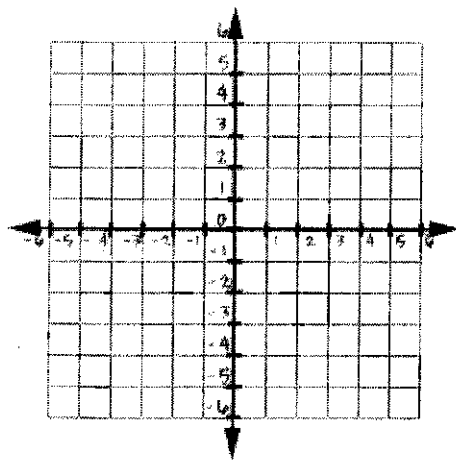


AC Math 2

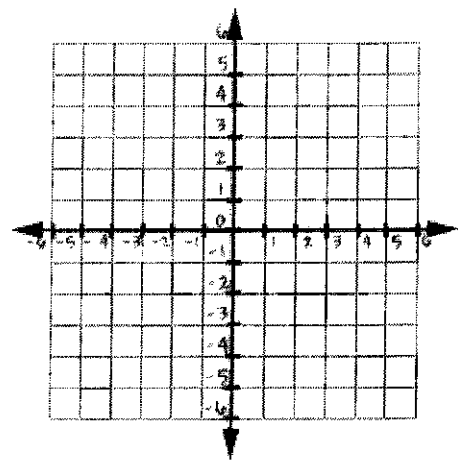
Notes: Piecewise Functions

Step Functions:

4. Graph this function: $f(x) = \begin{cases} 1, & \text{if } 0 \leq x < 1 \\ 2, & \text{if } 1 \leq x < 2 \\ 3, & \text{if } 2 \leq x < 3 \\ 4, & \text{if } 3 \leq x < 4 \end{cases}$



5. Graph this function: $f(x) = \begin{cases} 1, & \text{if } -4 \leq x < -3 \\ 2, & \text{if } -3 \leq x < -2 \\ 3, & \text{if } -2 \leq x < -1 \\ 4, & \text{if } -1 \leq x < 0 \end{cases}$



Accelerated Math 2
 Piecewise Functions Worksheet 2

Name _____

Evaluate $f(x) = \begin{cases} 3x-1, & x \leq 4 \\ 2x+7, & x > 4 \end{cases}$ for the given value of x .

1. $x=10$

3. $x=4$

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

4. $x=-2$

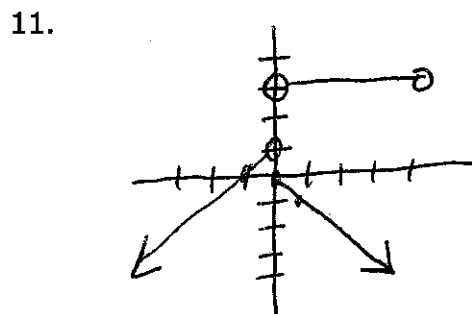
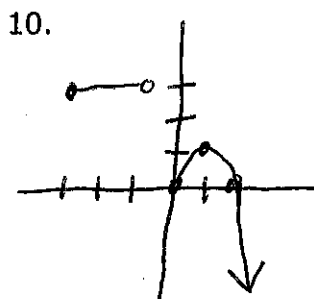
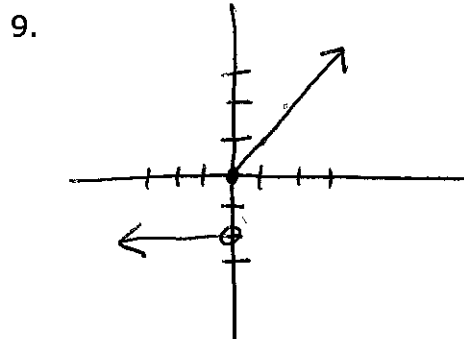
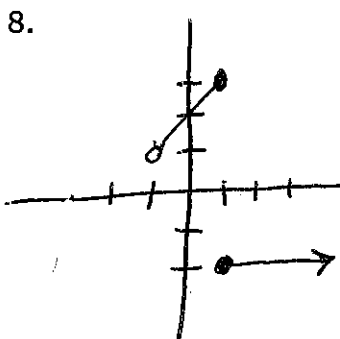
Graph the function.

5. $f(x) = \begin{cases} 2x+1, & x < 1 \\ -x+4, & x \geq 1 \end{cases}$

6. $f(x) = \begin{cases} 4, & 0 \leq x < 2 \\ 5, & 2 \leq x < 4 \\ 6, & 4 \leq x < 6 \end{cases}$

7. $f(x) = \begin{cases} x+6, & x \leq -3 \\ -\frac{2}{3}x-3, & x > -3 \end{cases}$

Write equations for the piecewise functions whose graphs are shown.

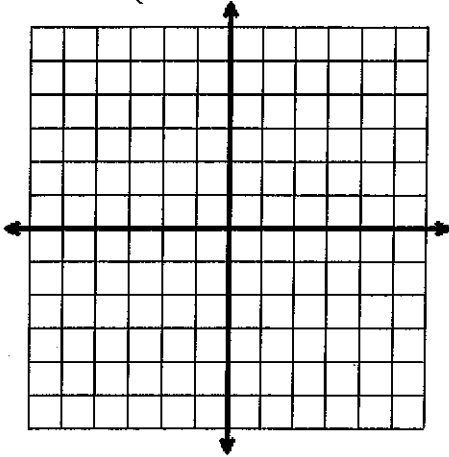


Accelerated Math 2
 Piecewise Functions Worksheet

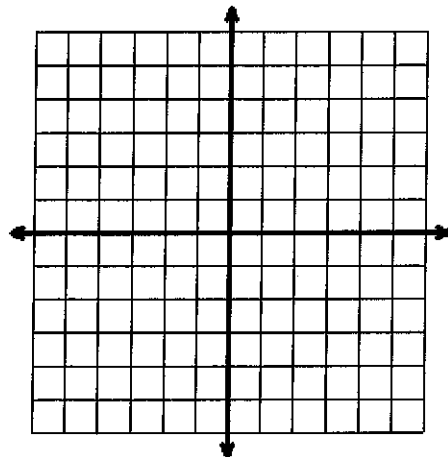
Name _____

For each of the following functions: (a) graph, (b) state the domain, (c) state the range, (d) Is it continuous? If not, what is(are) the point(s) of discontinuity?

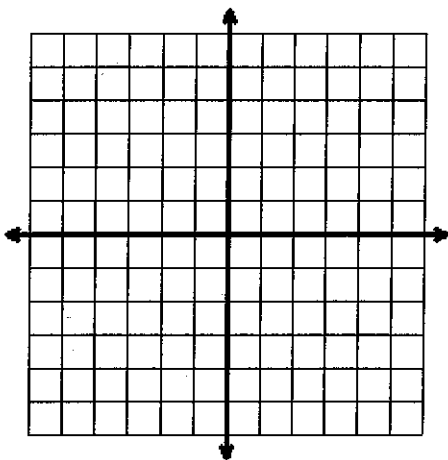
$$1. f(x) = \begin{cases} x-1, & x < -1 \\ 3, & 0 < x < 2 \\ x+2, & x \geq 4 \end{cases}$$



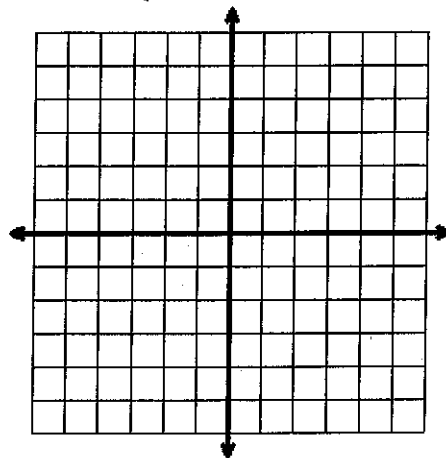
$$2. f(x) = \begin{cases} x^2, & x < 0 \\ |x|, & x > 0 \end{cases}$$



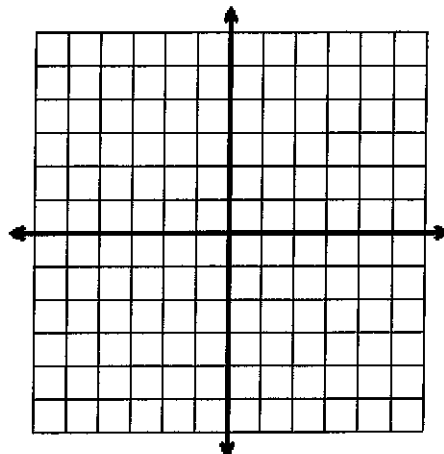
$$3. f(x) = \begin{cases} \sqrt{x-1}, & x \geq 1 \\ x-1, & x \leq -1 \end{cases}$$



$$4. f(x) = \begin{cases} x, & x \leq -4 \\ -4, & -4 < x < 1 \\ 2x-3, & x \geq 1 \end{cases}$$



$$5. f(x) = \begin{cases} |x|, & x \leq 0 \\ 3, & 0 < x < 2 \\ x^2, & x > 2 \end{cases}$$



Solving Absolute Value Equations Notes

<p>1. $x+2 =6$ $x+2 =6$</p>	<p>2. $2 x+7 -6=12$ $2 x+7 -6=12$</p>
<p>3. $x-1 +2=5$ $x-1 +2=5$</p>	<p>4. $-2 x+6 =18$ $-2 x+6 =18$</p>
<p>5. $4x-8 =x+2$ $4x-8 =x+2$</p>	<p>6. Decide whether the number is a solution to the equation.</p> <p>$2x-5 =9; -2$ $2x-5 =9; -2$</p> <p>$2x-5 =9; 2$</p>

Advanced Algebra
Absolute Value Equations

Name _____

Rules:

1. Isolate bars
2. Check for special cases
3. Solve by setting up 2 cases
4. Check: Some answers may be extraneous.

1. $|2x + 3| = 4$

2. $|x - 3| = 3x + 5$

3. $|4 - 3x| - 9 = 3$

4. $|10x + 2| - 18 = -12$

5. $|2x + 8| + 2 = 1$

6. $|x + 4| - 1 = 6x$

7. $\frac{1}{3}|3x + 6| - 2 = 2$

8. $|4 + x| = 1 - 2x$

Absolute Value Equations

Solve each equation.

1) $|6m| = 42$

2) $|-6x| = 30$

3) $|k - 10| = 3$

4) $\left|\frac{x}{7}\right| = 3$

5) $|7 + p| = 7$

6) $|-3p| = 15$

7) $7|n| = 56$

8) $\frac{|m|}{5} = 3$

9) $-3|p| = -12$

10) $|m| + 2 = 11$

11) $|n| + 1 = 2$

12) $\frac{|x|}{7} = 5$

13) $\frac{|a - 5|}{8} = 5$

14) $4|n + 8| = 56$

15) $|7m| + 3 = 73$

16) $\left|\frac{x}{7}\right| - 8 = -7$

17) $\frac{|-9 + v|}{8} = 3$

18) $-10|v + 2| = -70$

Solve the following :

1. $|x-3|+2=5$

2. $2|x+1|-4=1$

3. $-3|x-4|+1=-2$

4. $\frac{1}{2}|x|+3=6$

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

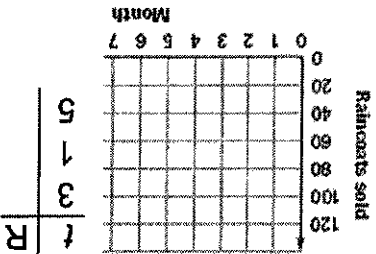
6. $-\frac{1}{3}|x-2|-3=-5$

7. $|x-6|=-3$

8. $2|x-4|=8$

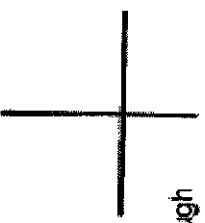
Example 3 Applications of Absolute Value

A raincoat retailer has modeled the number of raincoats sold from Jan. through May by the function $R = -30(t - 3) + 80$. Assume that $t=1$ is January. What is the maximum number of raincoats sold in one month? In what month is the maximum reached?



Graphs

The parent graph of an absolute value function is

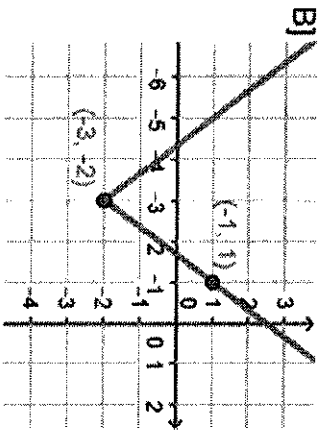
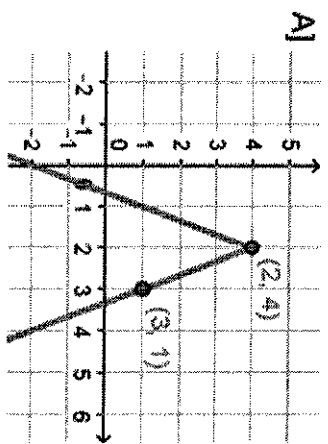


with vertex at

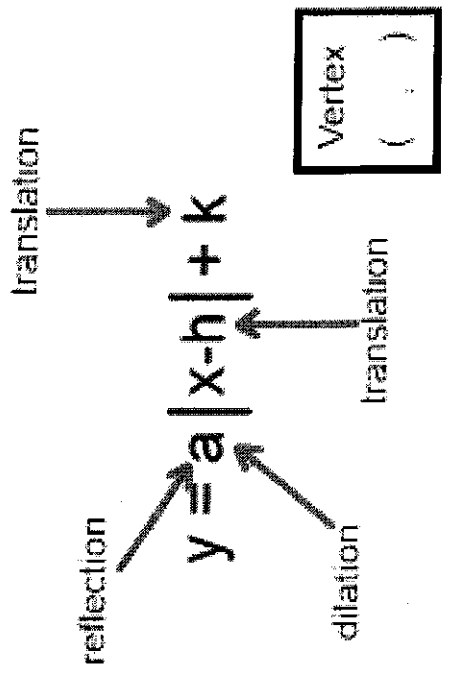
and passes through

Absolute Value

Example 2 Write an absolute value equation

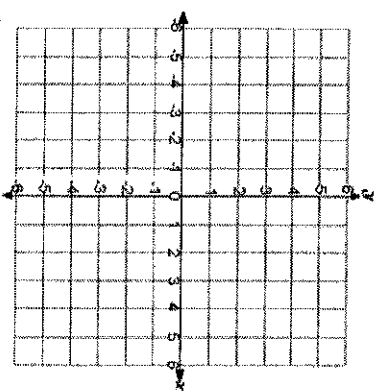


Transformations



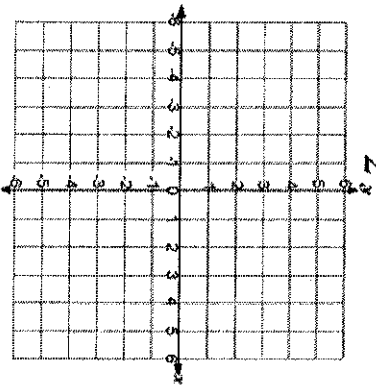
Example 1 Graph and describe an absolute value function.

A) $y = 3|x - 2| - 4$



Vertex:
Opens:
Slope:

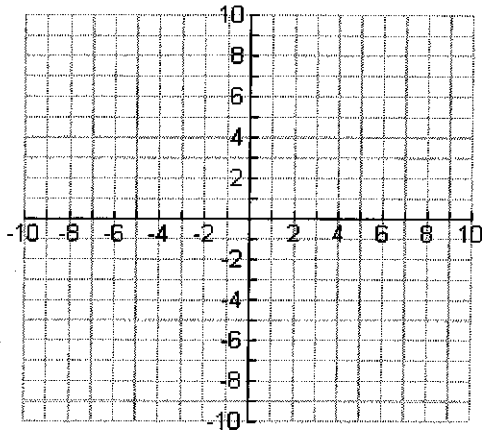
B) $y = -\frac{1}{2}|x + 3| + 2$



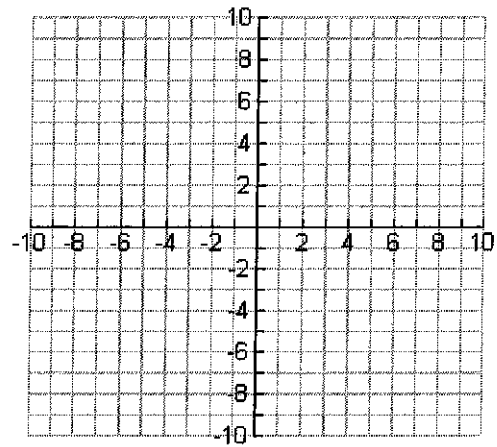
Vertex:
Opens:
Slope:

Solve the following absolute value equations by graphing.

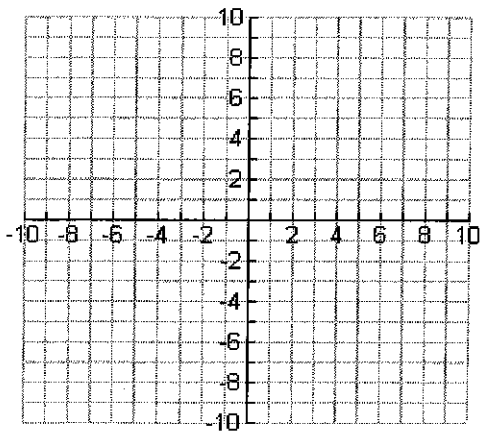
1. $|x+2|+3=5$



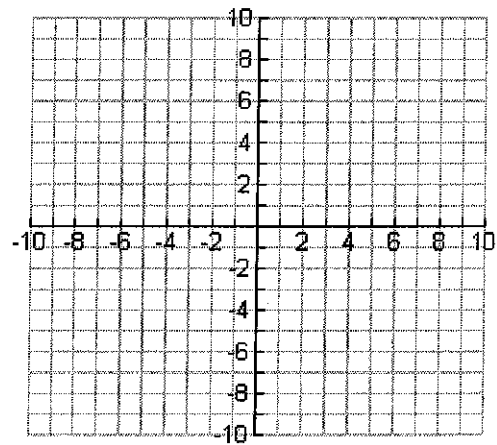
2. $3|x-1|-5=1$



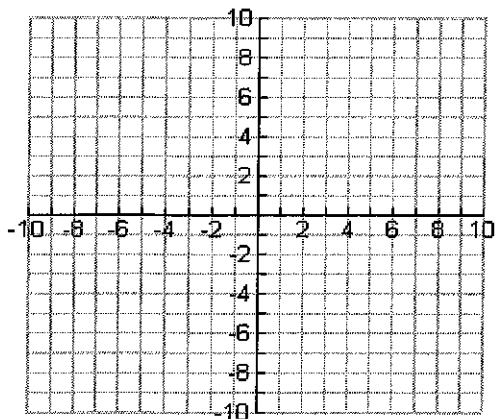
3. $-2|x+1|+3=-2$



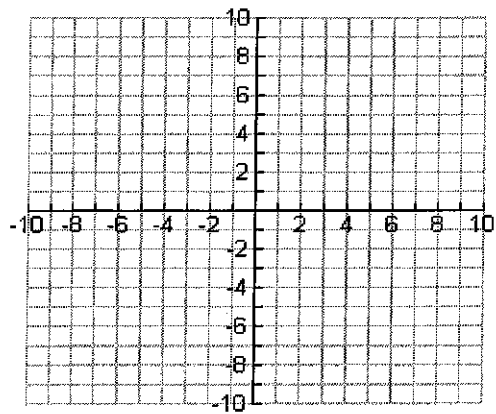
4. $\frac{1}{2}|x+2|-4=0$



5. $2|x-1|+2=7$



6. $-|x+6|+1=-3$



Name:

Period:

Date:

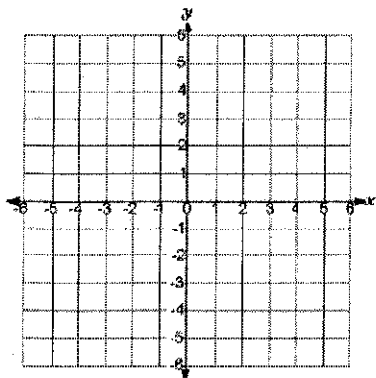
Practice Worksheet: Absolute Value Graphs

Identify the vertex. Determine if the graph opens up or down (circle one). Determine if the graph is narrower, wider, or the same width (circle one) as the parent graph.

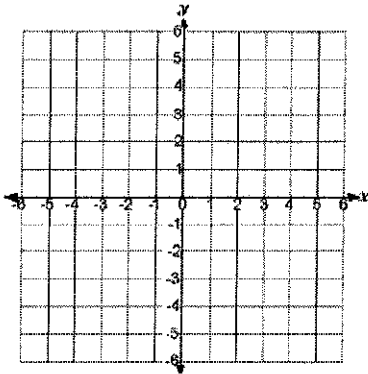
1] $y = - x + 1 $ Vertex: (____, ____) Opens: UP / DOWN NARROWER / WIDER / SAME	2] $y = 7 x - 3 - 4$ Vertex: (____, ____) Opens: UP / DOWN NARROWER / WIDER / SAME	3] $y = -\frac{2}{3} x - 1 $ Vertex: (____, ____) Opens: UP / DOWN NARROWER / WIDER / SAME
4] $y = \frac{5}{2} x + 9 - 1$ Vertex: (____, ____) Opens: UP / DOWN NARROWER / WIDER / SAME	5] $y = \frac{3}{4} x + 3 - 6$ Vertex: (____, ____) Opens: UP / DOWN NARROWER / WIDER / SAME	6] $y = - x + 5$ Vertex: (____, ____) Opens: UP / DOWN NARROWER / WIDER / SAME

Graph the function.

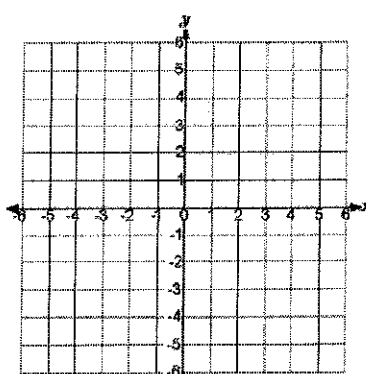
7] $y = 3|x - 3|$



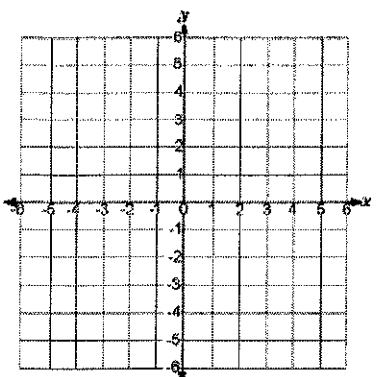
8] $y = -|x| + 4$



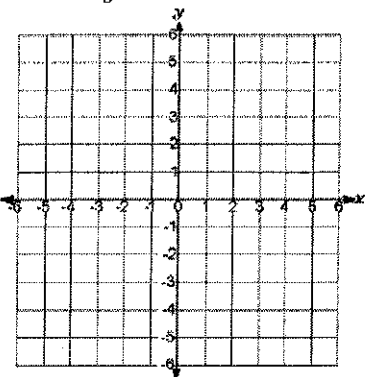
9] $y = -|x + 3| + 5$



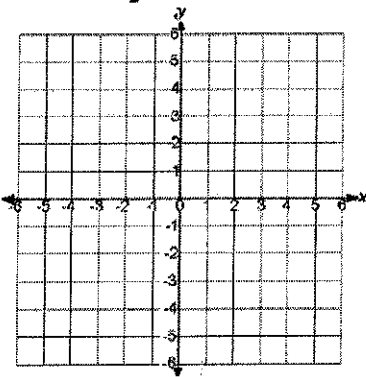
10] $y = 2|x + 1| - 1$



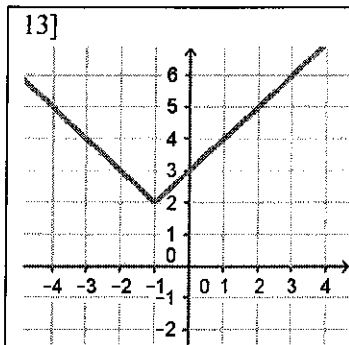
11] $y = \frac{4}{3}|x + 2| - 5$



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

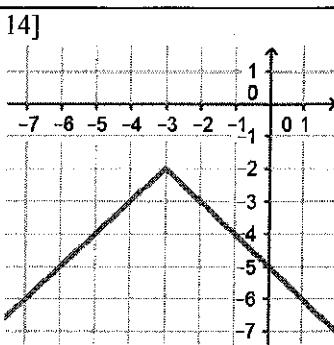


Write the equation of the graph. Then give its range.



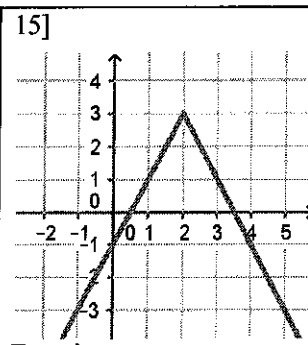
Equation:

Range:



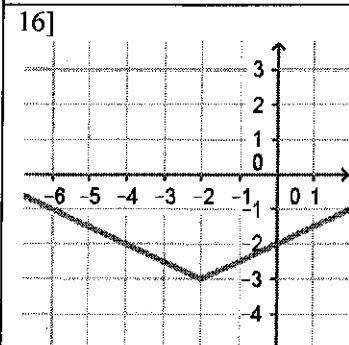
Equation:

Range:



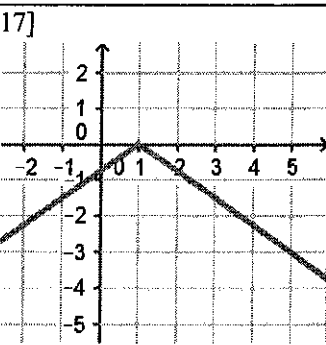
Equation:

Range:



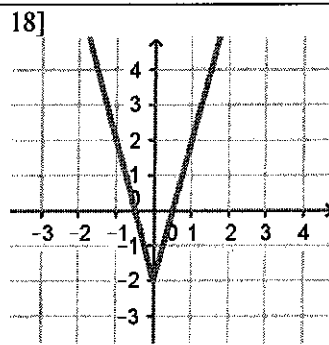
Equation:

Range:



Equation:

Range:



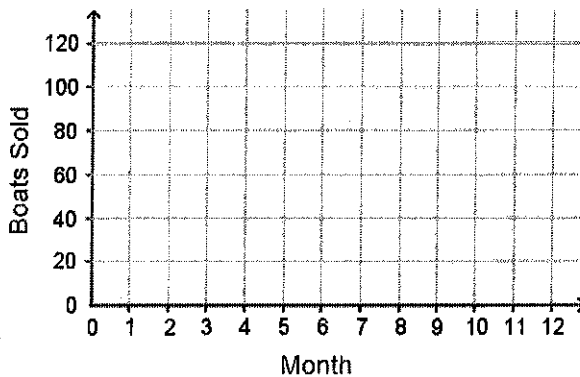
Equation:

Range:

19] The number of boats B a boat dealer sells in each month of the year from March to December can be modeled by the function $B = -15|t - 5| + 120$ where t is the time in months and $t = 1$ represents January.

A] Complete the table of values and then graph the function.

Time (months)	Boats Sold
3	
5	
7	
9	
11	
12	



B] What is the maximum number of sales in one month? In what month is the maximum reached?

C] What is the minimum number of sales in one month? In what month is the minimum reached?

LESSON
2.7

Practice

For use with pages 121–129

For the function (a) tell whether the graph *opens up or down*, (b) identify the vertex, and (c) tell whether the function is *wider, narrower, or the same width* as the graph of $y = |x|$.

1. $y = -|x + 1|$

2. $f(x) = 7|x - 3| - 4$

3. $y = -4|x + 2| + 2$

4. $f(x) = 2|x + 2| + 8$

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

6. $f(x) = -|x| - 5$

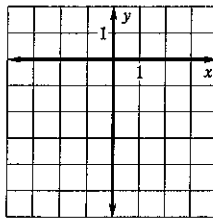
7. $y = \frac{5}{2}|x + 9| - 1$

8. $f(x) = \frac{7}{8}|x + 3| - 9$

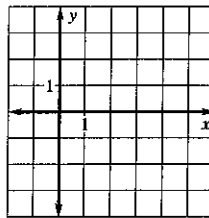
9. $y = -\frac{7}{5}|x - 1| + 1$

Graph the function.

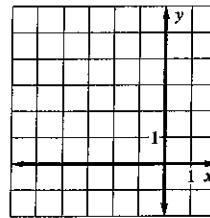
10. $y = |x| - 3$



11. $f(x) = |x - 3|$



12. $y = |x + 2| + 1$



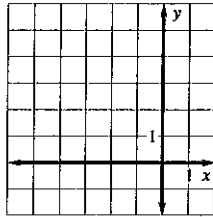
Copyright © by McDougal Littell, a division of Houghton Mifflin Company.

Name _____

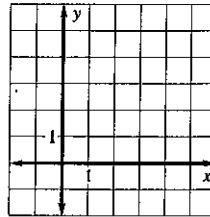
Date _____

LESSON 2.7 **Practice** *continued*
For use with pages 121-129

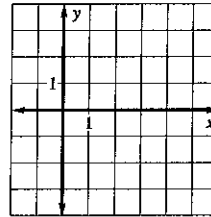
13. $y = 2|x + 1| - 1$



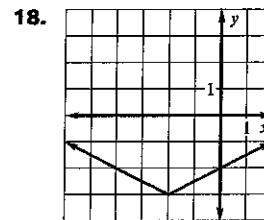
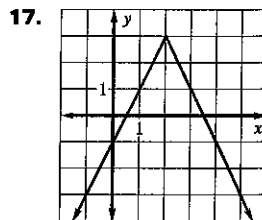
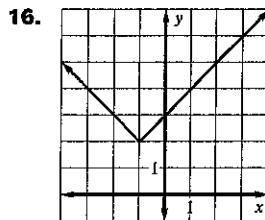
14. $f(x) = \frac{1}{2}|x - 3| + 2$



15. $y = -\frac{3}{2}|x - 4| + 2$

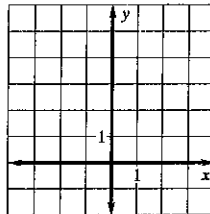


Write an equation of the graph shown.

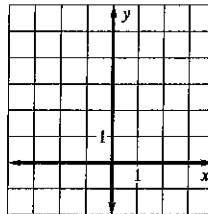


Let $f(x) = x + 2$. Sketch $f(x)$ and then sketch the function y given by the transformation to $f(x)$.

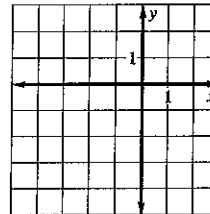
19. $y = f(x) + 1$



20. $y = f(x - 2)$



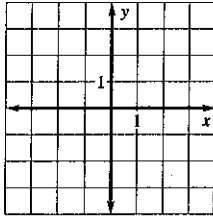
21. $y = -2f(x)$



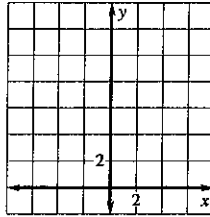
LESSON
2.7

Practice *continued*
For use with pages 121–129

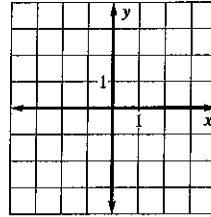
22. $y = \frac{1}{4}f(x)$



23. $y = 3f(x + 2) - 1$



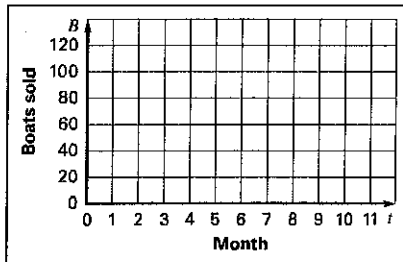
24. $y = -f(x - 1) + 3$



In Exercises 25–27, use the following information.

Speedboats The number of boats B a boat dealer sells in each month of the year can be modeled by the function $B = -15|t - 5| + 120$ where t is the time in months and $t = 1$ represents January.

25. Graph the function for $0 \leq t \leq 12$.



26. What is the maximum number of sales in one month? In what month is the maximum reached?

27. What is the minimum number of sales in one month? In what month is the minimum reached?

Graphing Absolute Value Inequalities NOTES

Honors Algebra II

Reminders:

< and > = open circles

≤ and ≥ = closed circles

Example 1:

$$|3x - 4| \leq 8$$

Example 2:

$$|-2x + 11| > 5$$

Example 3:

$$3|9x + 5| + 1 > 16$$

Try these on your own:




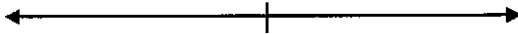
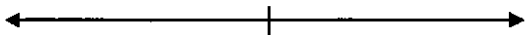

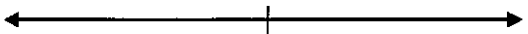

1) $|2x - 4| > 6$








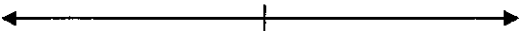
2) $\left| \frac{1}{2}x + 5 \right| - 6 \leq 5$

3) $|-3x + 7| + 3 \leq 2$

Solving Absolute Value Equations and Inequalities

Solve, and then represent your answers graphically.

1. $ 8x-3 > 21$ 	2. $ y-2 \leq 7$ 
3. $ 5x+8 < 23$ 	4. $ 9-2x = 5$
5. $ x = 4$ 	6. $ \frac{1}{2}y-3 \geq 3$ 
7. $ y+9 \leq -2$ 	8. $ y+\frac{1}{3} > \frac{4}{3}$ 
9. $ -4x+3 > 13$ 	10. $ m+5 +9 \leq 16$ 

<p>11. $10y - 1.3 = 4.7$</p>	<p>12. $9 - 4x \geq 15$</p> 
<p>13. $x + 9 > 17$</p> 	<p>14. $\left \frac{3}{4} + x \right = \frac{1}{4}$</p>
<p>15. $9 - y > -11$</p> 	<p>16. $t - 7 + 3 \geq 4$</p> 
<p>17. $\left \frac{3}{7}y \right > \frac{3}{7}$</p> 	<p>18. $3 - x = \frac{1}{4}$</p>
<p>19. $5x + 2 \leq 3$</p> 	<p>20. $8 - 3y < 35$</p> 
<p>21. $1 - \left \frac{1}{4}x + 8 \right > \frac{3}{4}$</p> 	<p>22. $2 2x - 7 + 11 = 25$</p>

- 1) Use same rules as the equations.
- 2) Test to see where to shade.
- 3) Put answers in interval notation.

1. $\left| \frac{2x+3}{-5} \right| < 3$

2. $-2|4x+1| \geq -4$

3. $2|4x+1| < -4$

4. $2|3-x|-11 > -7$

5. $-3|3-x|+6 \geq 15$

6. $5-2|x+2| > 3$

7. $6 \leq |x-2|$

8. $|x-2| < 2x-7$

Practice Quiz for solving Absolute Value equations and inequalities




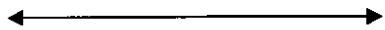
Solve. Graph your answers on a number line if the problem is an inequality.

Name: _____

a) $ 3x-6 < 12$	b) $-2 x+1 +7=15$	c) $ x-7 -2 \geq 4$
d) $ x-7 -2 > -6$	e) $-3 x+1 +7=23$	f) $2 x-6 -7 < 14$
g) $4 x-1 =12$	h) $\left \frac{2}{3}x-6\right =1$	i) $ 2x-17 +7 > 6$
j) $\frac{1}{2} x+5 < 8$	k) $\frac{3}{2} x-6 +3 \geq 6$	l) $\left \frac{4}{5}x+13\right \leq -19$

Absolute Value/ Piecewise Review

Solve the following equation or inequality. Represent your answers graphically for the inequalities.

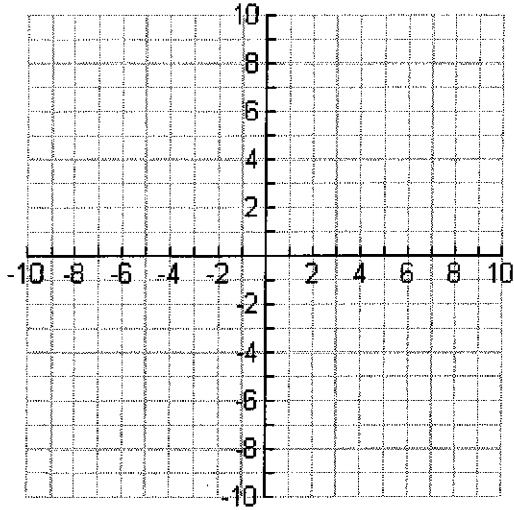
1. $ x+7 =5$	2. $2 -2x+5 +3=17$	3. $ x+3 \leq 6$ 
4. $ 2x+2 =8$	5. $2 3x-7 +6=4$	6. $\frac{1}{2} 6x-2 +4=6$
7. $3 5x-5 +2\geq 10$ 	8. $2 3x-1 +8<4$ 	9. $ x-12 +4>9$ 

10-11)

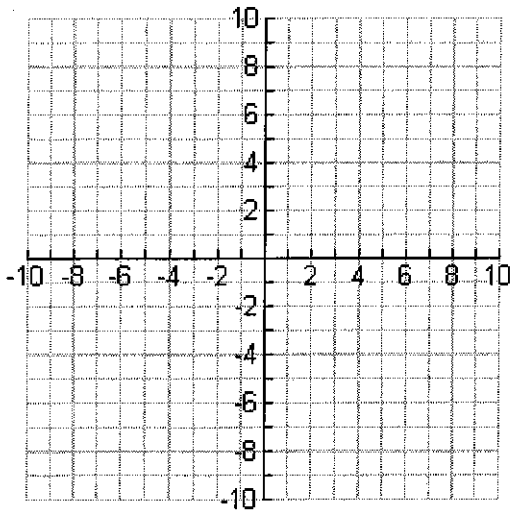
Solve the following absolute value functions by graphing.

10) $-1 = -2|x+1| + 3$

Solutions: _____



11) $\frac{1}{2}|x-2| - 4 = -2$

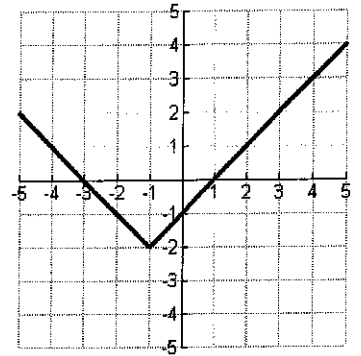


Solutions: _____

12-13)

Write the absolute value graph function as a piecewise function.

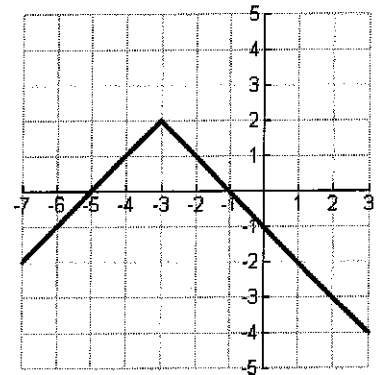
12. $y = |x+1| - 2$



Piecewise:

$f(x) =$

13. $y = -|x+3| + 2$



Piecewise function:

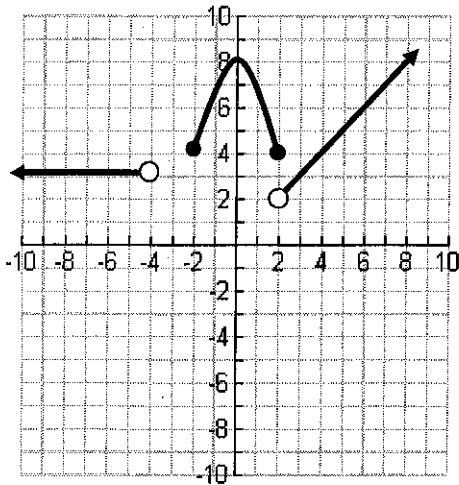
$f(x) =$

14-15. Write the following absolute value functions as a piecewise function.

14) $f(x) = |2x - 4| + 1$

15) $h(x) = -|x+4| + 2$

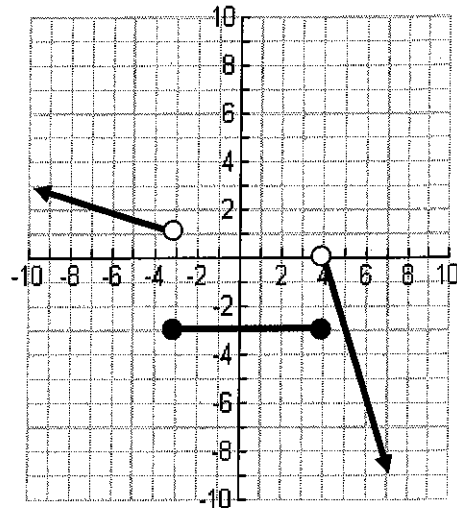
22.



Identify the characteristic of the following piecewise function:

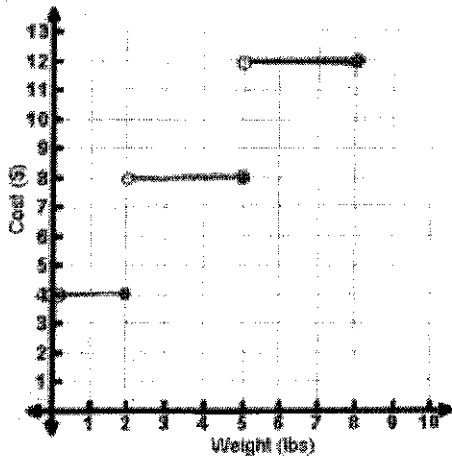
Domain: _____
 Range: _____
 Min/Max: _____
 Interval of Increase: _____
 Interval of decrease: _____
 Points of discontinuity: _____
 Intervals over which the function is constant: _____

23.



Domain: _____
 Range: _____
 Min/Max: _____
 Interval of Increase: _____
 Interval of decrease: _____
 Points of discontinuity: _____
 Intervals over which the function is constant: _____

24. Write the following as a step function



$F(x) =$

Domain: _____
 Range: _____

How much would it cost to ship something that weighed 4.75 lbs?

25. You get paid to pick up recycling materials along the side of the road every day. You are given a bag each day to collect plastic bottles and aluminum cans in. If you collect 3 pounds or less than 3 pounds, you earn \$8. If you collect between 3 and 5 pounds, you get \$12 and if you collect 5 pounds or more than 5 pounds, you get \$16. Write a piecewise function and a graph that models your income.

$f(x) =$

