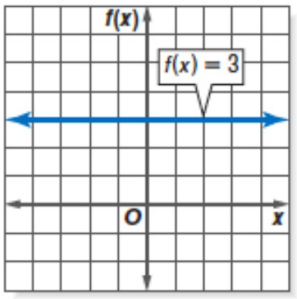
Graphing Special Functions

Example 1 Constant Function

Graph $f(x) = 3$.

For every value of x, $f(x) = 3$. The graph is a horizontal line.

$f(x) = 3$	
x	$f(x)$
-2	3
-0.5	3
0	3
$\frac{1}{3}$	3

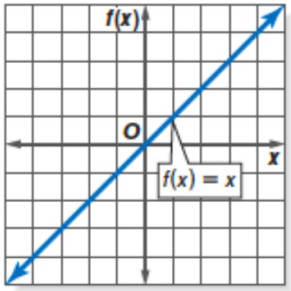


Example 2 Identity Function

Another special case of slope-intercept form is $m = 1$, $b = 0$. This is the function $f(x) = x$. The graph is the line through the origin with slope 1.

Since the function does not change the input value, $f(x) = x$ is called the **identity function**.

$f(x) = x$	
x	$f(x)$
-2	-2
-0.5	-0.5
0	0
$\frac{1}{3}$	$\frac{1}{3}$



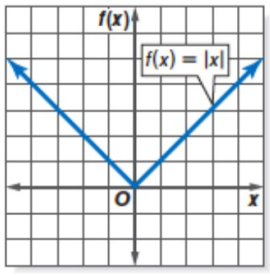
Example 3 Absolute Value Functions

Another special function is the absolute value function.

f(x) = |x|.

$f(x) = \lvert x \rvert$	
x	$f(x)$
-3	3
-2	2
-1	1
0	0
1	1
2	2
3	3

Vertex



Graph f(x) = |x| + 1

- Find the vertex

1. set the the expression inside the absolute value signs equal to zero.

x = 0

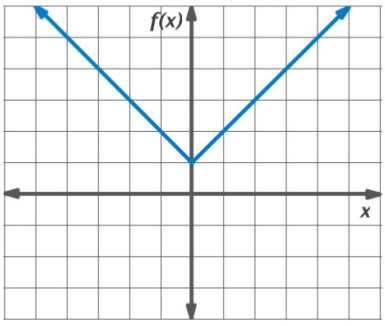
2. now find f(0)

f(0) = |0| + 1

= 1

(0, 1)

x	$\lvert x \rvert + 1$
-2	3
-1	2
0	1
1	2
2	3



-Find several other ordered pairs for the function. Make sure to choose x values less than and greater than the x coordinate of the vertex.

For each equation below, identify the coordinates of the vertex of the graph.

1) f(x) = |2x|

2) g(x)= |2x + 4|

3) f(a) = -|a - 5|

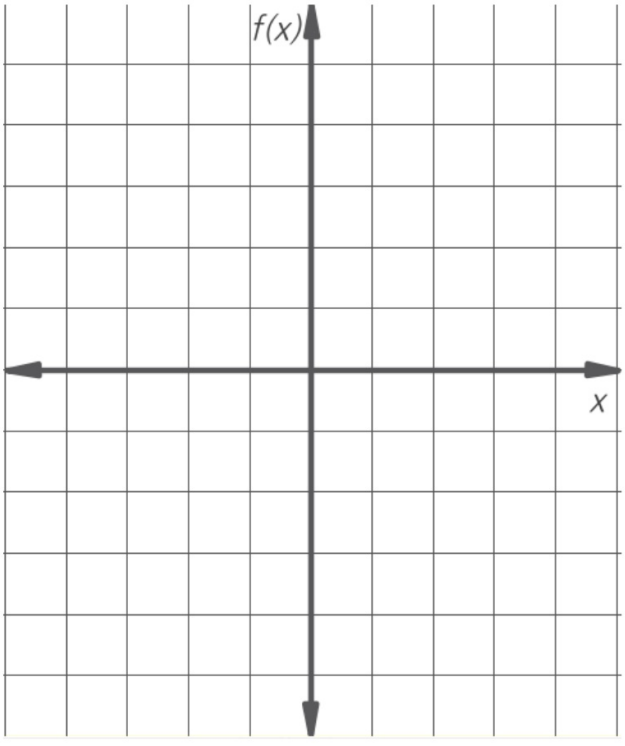
4) f(x) = |x + 2| - 3

For each function, fill in the table then graph.

1) f(x) = |3x|

x	|3x|

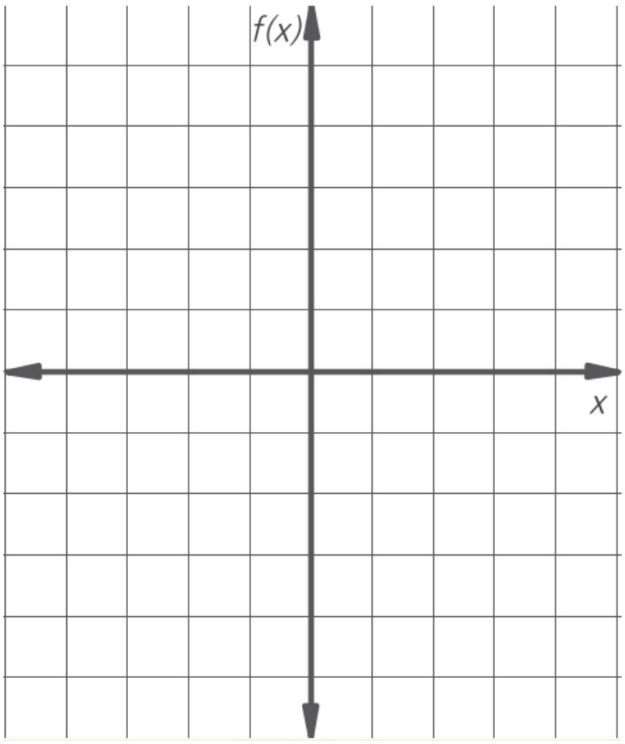
(vertex)



2) $f(x) = |2x| + 3$

x	$\|2x\| + 3$

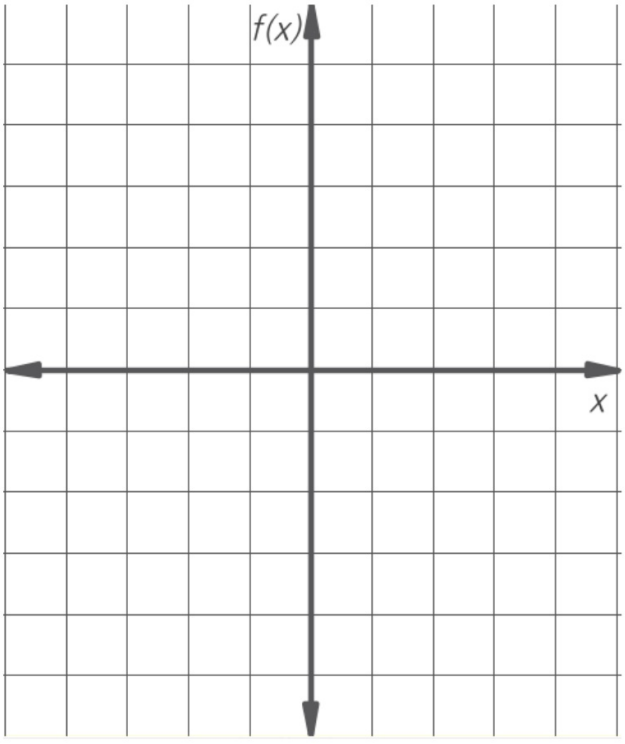
(vertex)



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

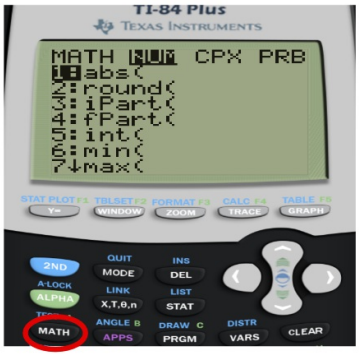
x	$-\left\|\frac{1}{2}x - 2\right\| + 1$

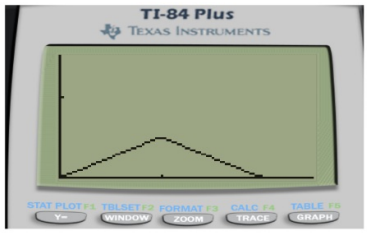
(vertex)



A rainstorm begins as a drizzle, builds up to a heavy rain, and then drops back to a drizzle. The rate r (in inches per hour) at wich it rains is given by the function $r = -0.5|t - 1| + 0.5$ where t is the time (in hours)

a. Using a graphing calculator, graph the function.





window is set at: x min - 0 x max - 2.5
y min - 0 y max - 1.5

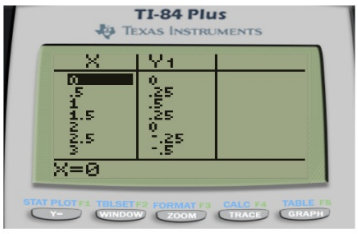


table set : Δ Tbl - 0.5

b. How many hours does it rain?

c. When does it rain the most?

d. At what rate is it raining after 1 hour 15 min?

Example 4 Greatest Integer and Step Functions

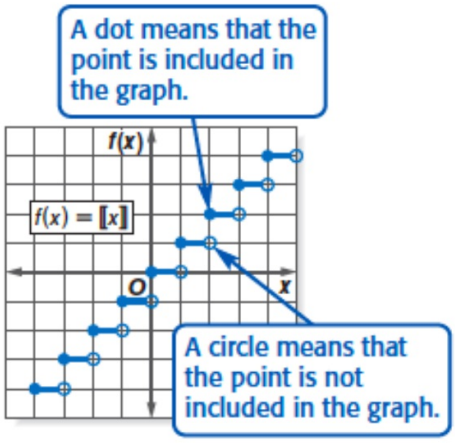
The greatest integer function, written $f(x) = [[x]]$, is not linear. It consist of line segements or rays.

The symbol **[[x]]** means the ***greatest integer less than or equal to x.***

Examples: **a) [[7.4]] = 7** **b) [[-1.5]] = -2** **c) [[10.9]] = 10**

$f(x) = [[x]]$	
x	$f(x)$
$-3 \le x < -2$	-3
$-2 \le x < -1$	-2
$-1 \le x < 0$	-1
$0 \le x < 1$	0
$1 \le x < 2$	1
$2 \le x < 3$	2
$3 \le x < 4$	3

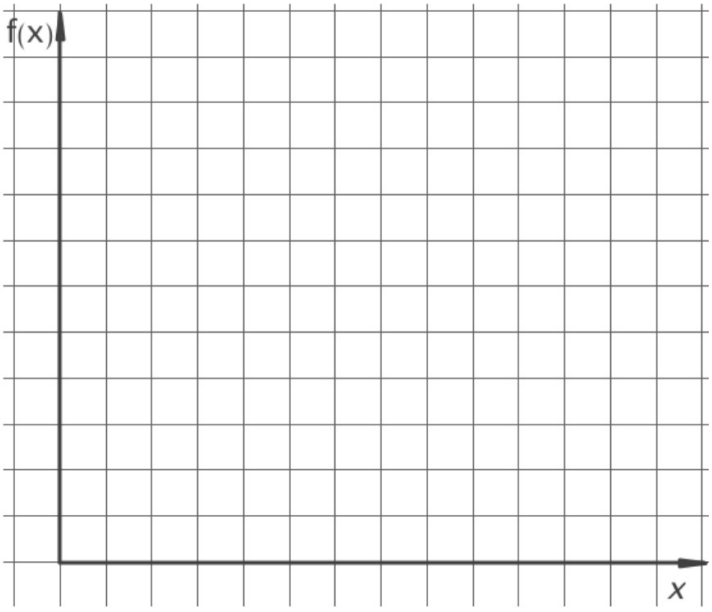
$3 \le x < 4$ means any decimal value between 3 and 4.



Labor costs at the Fix-It Auto Repair Shop are $60 per hour or any fraction thereof. Fill in the table and then graph the relationship between the number of hours and labor cost.

If the time spent on labor is greater than or equal to 0 hours but less than 1 hour, then the labor cost is $60. If the time is greater than or equal to 1 hour but less than 2 hours then the labor cost is $120 and so on.

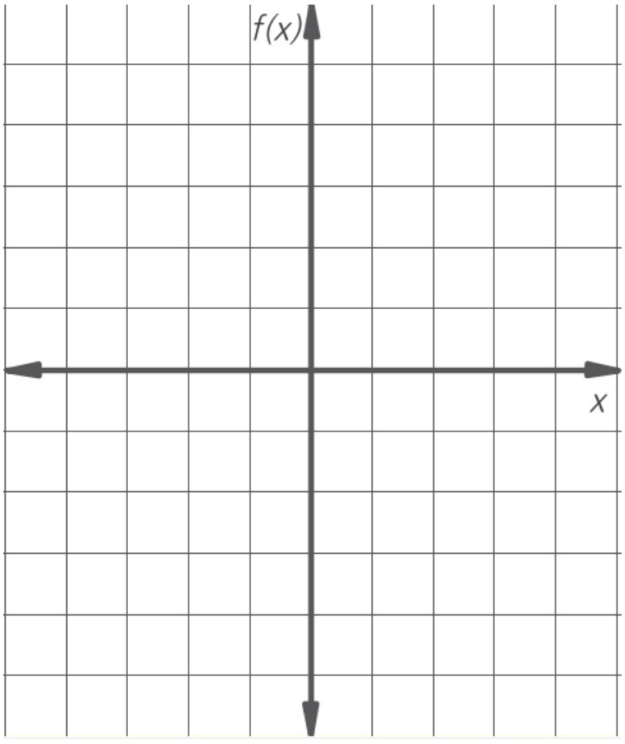
x	f(x)



For the function, fill in the table then graph.

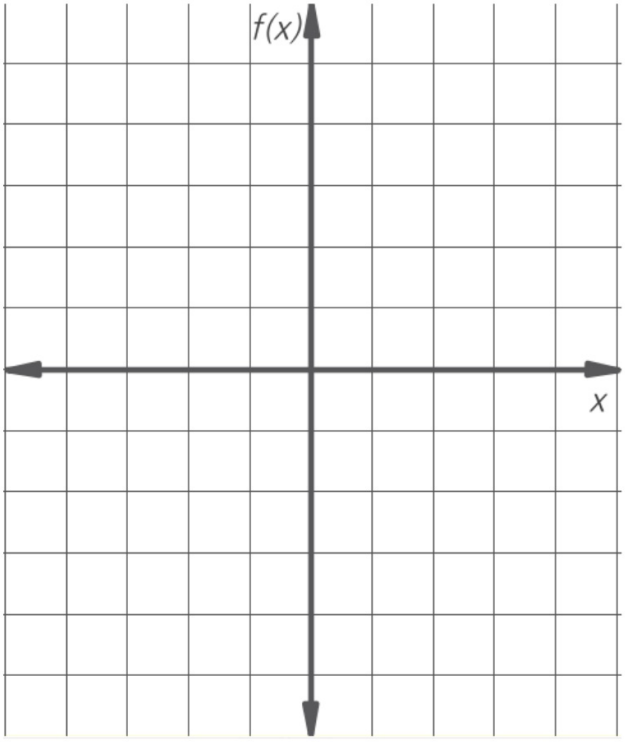
1) f(x) = -[[x]]

x	[[x]]	(x, f(x))
0		
0.1		
0.2		
0.3		
0.4		
0.5		
0.6		
0.7		
0.8		
0.9		
1		
1.1		



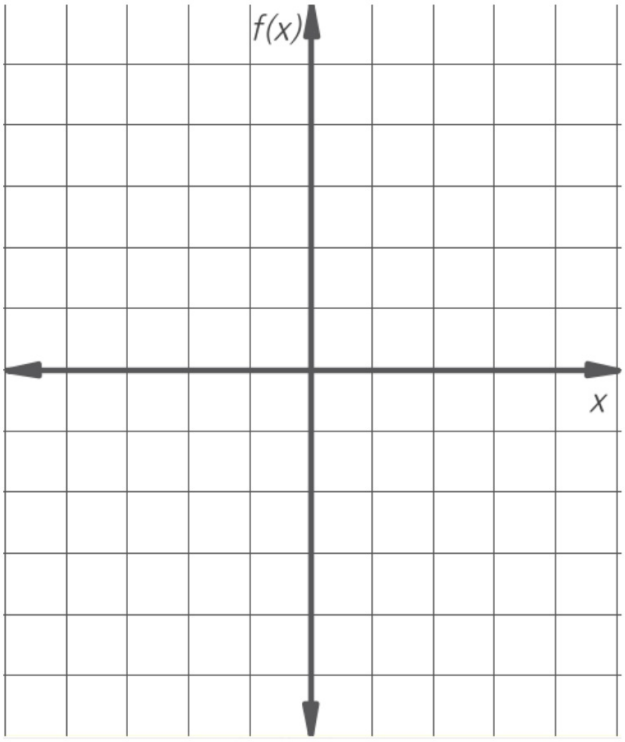
2) f(x) = [[x + 2]]

x	x+2	[[x+2]]
0		
0.1		
0.2		
0.3		
0.4		
0.5		
0.6		
0.7		
0.8		
0.9		
1		
1.1		



3) f(x) = [[2x]]

x	2x	[[2x]]
0		
0.1		
0.2		
0.3		
0.4		
0.5		
0.6		
0.7		
0.8		
0.9		
1		
1.1		

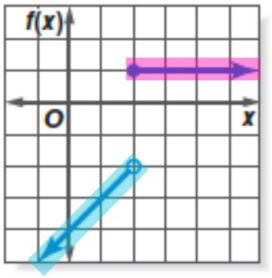


Example 5 Piecewise Function

Graph $f(x) = \begin{cases} x - 4 \text{ if } x < 2 \\ 1 \text{ if } x \geq 2 \end{cases}$. **Identify the domain and range.**

Step 1 Graph the linear function $f(x) = x - 4$ for $x < 2$. Since 2 does not satisfy this inequality, stop with an open circle at $(2, -2)$.

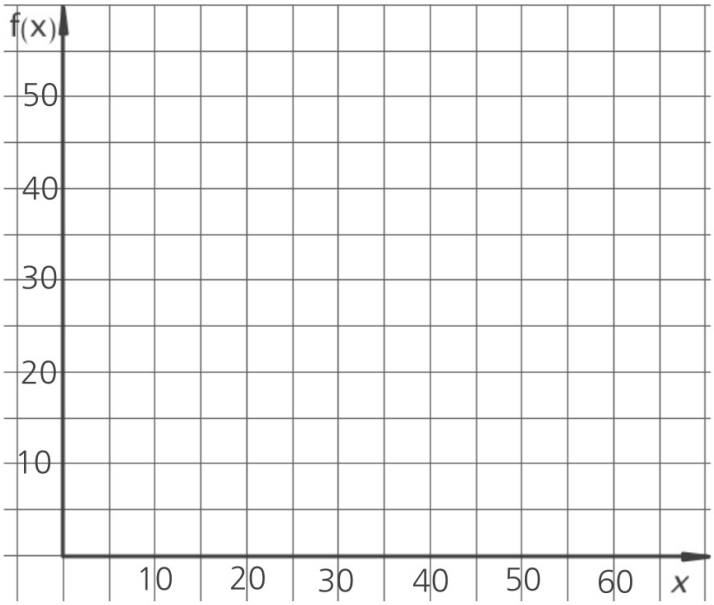
Step 2 Graph the constant function $f(x) = 1$ for $x \geq 2$. Since 2 does satisfy this inequality, begin with a closed circle at (2, 1) and draw a horizontal ray to the right.



The function is defined for all values of x, so the domain is all real numbers. The values that are y-coordinates of points on the graph are 1 and all real numbers less than -2, so the range is $\{y \mid y < -2 \text{ or } y = 1\}$.

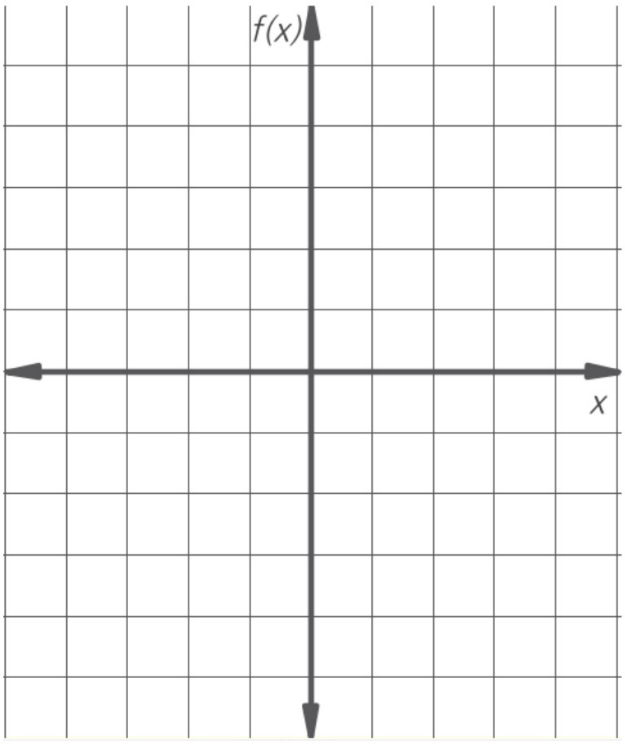
Your favorite dog groomer charges according to your dog's weight. If your dog is 15 pounds and under, the groomer charges $35. If your dog is between 15 and 40 pounds, she charges $40. If your dog is over 40 pounds, she charges $40, plus an additional $2 for each pound.

f(x) = { _____ , _____ , _____



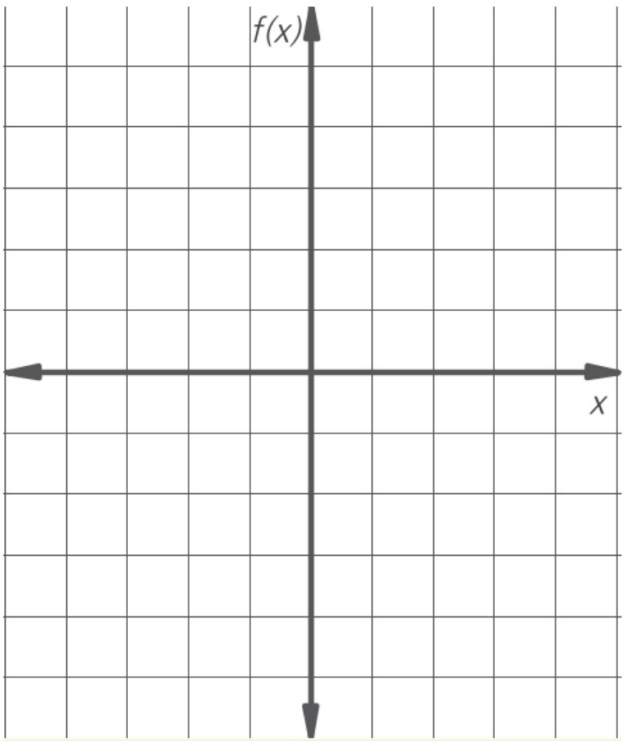
Graph the following piecewise functions. State the domain and range.

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



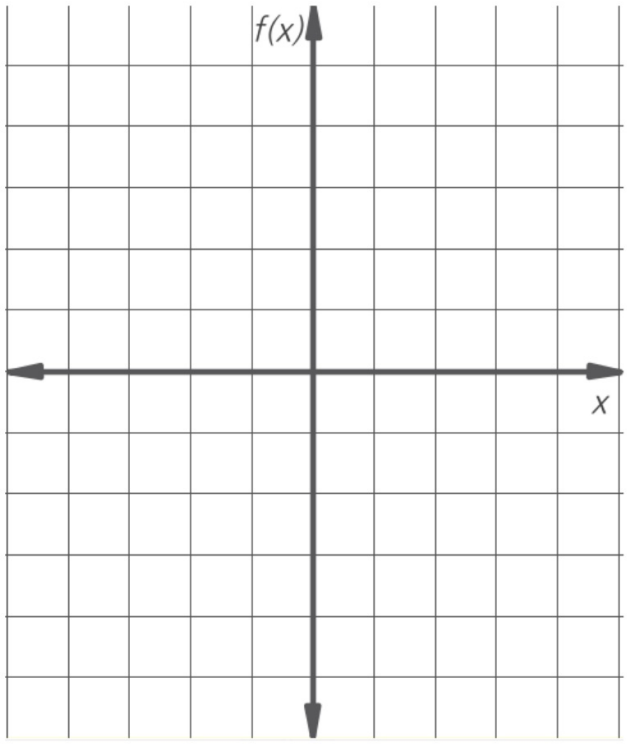
domain:
range:

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



domain:
range:

3) $f(x) = \begin{cases} 2 \text{ if } x < -1 \\ 2x \text{ if } -1 \leq x \leq 1 \\ -x \text{ if } x > 1 \end{cases}$



domain:

range: