1 Solve the equation for x: $7x - (6 - 2x) = 12$.

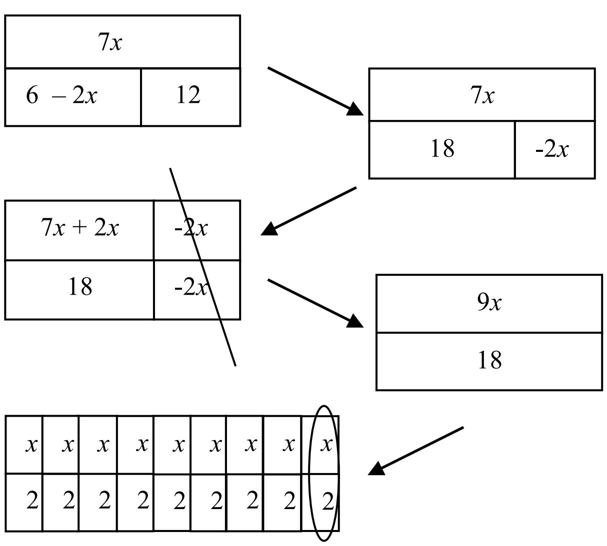
Inverse Operations

$7x - (6 - 2x) = 12$	Given
$7x - 1(6 - 2x) = 12$	Show distributing with "1"
$7x + (-1)[6 + (-2x)] = 12$	Change subtraction to add (-)
$7x + (-1)(6) + (-1)(-2x) = 12$	Distributive property
$7x + (-6) + 2x = 12$	Simplify
$7x + 2x + (-6) = 12$	Commutative property
$9x + (-6) = 12$	Combine like terms
$9x + (-6) + 6 = 12 + 6$	Additive inverse
$9x = 18$	Simplify/Combine like terms
$\frac{9x}{9} = \frac{18}{9}$	Multiplicative inverse
$x = 2$	Simplify

Decomposition

$7x - (6 - 2x) = 12$	Given
$7x - 6 - (-2x) = 12$	Distributive property
$7x - (-2x) - 6 = 12$	Commutative property
$9x - 6 = 12$	Combine like terms
$9x - 6 = 12 + 6 - 6$	Add in zero pairs
$9x - 6 = 12 + 6 - 6$	Simplify
$9x = 18$	Simplify
$9 \bullet x = 9 \bullet 2$	Decompose multiplication
$\therefore x = 2$	

Bar Model



$\therefore x = 2$

A-REI.3

1a′ Solve the equation for c: $-8 = 9c - (c + 24)$.

1b′ Mark Yes or No to indicate which of the following equations are equivalent to

$$2(3x-1)-(3x+2)=-13$$

A)	$6x-2-3x-2=-13$	◯ Yes	◯ No
B)	$6x-2-3x+2=-13$	◯ Yes	◯ No
C)	$6x-3x-4+4=-13+4$	◯ Yes	◯ No
D)	$3x=-13$	◯ Yes	◯ No
E)	$3x=-9$	◯ Yes	◯ No

2 Solve $5(2x+3)-3x=5x+1$ for x.
Justify each step.

To solve equations with variables on both sides, collect the variable terms on one side of the equation and the constant terms on the other side of the equation.

Inverse Operations

$5(2x+3)-3x=5x+1$	
$5(2x)+5(3)-3x=5x+1$	Distributive property
$10x+15-3x=5x+1$	Simplify
$10x-3x+15=5x+1$	Commutative property
$7x+15=5x+1$	Combine like terms
$7x-5x+15=5x-5x+1$	Additive inverse
$2x+15=1$	Combine like terms
$2x+15-15=1-15$	Additive inverse
$2x=-14$	Combine like terms
$\frac{2x}{2}=\frac{-14}{2}$	Multiplicative inverse
$x=-7$	Simplify

A-REI.3

2a′ Solve $2(-2c+7)+10=4c$ for c.
Justify each step.

2b′ Tania's work on a problem is shown below.

Given:	$4x-(9x-1)=-6x$
Step 1:	$4x-9x+1=-6x$
Step 2:	$-5x+1=-6x$
Step 3:	$-5x+6x+1=-6x+6x$
Step 4:	$x+1=0$
Step 5:	$x+1-1=0-1$
Step 6:	$x=-1$

Select True or False for each justification.

A) Step 1 is justified by the distributive property.
◯ True ◯ False

B) Step 2 is justified by the associative property.
◯ True ◯ False

C) Step 3 is justified by the commutative property.
◯ True ◯ False

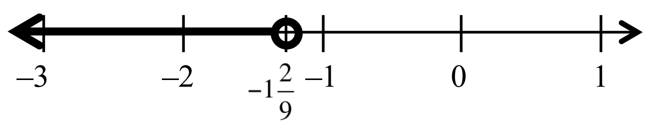
D) Step 4 is justified by the property of additive inverses.
◯ True ◯ False

3 Solve the inequality for x: $2(4x-1) > 17x+9$
Graph the solution(s).

To solve inequalities with variables on both sides, collect the variable terms on one side of the inequality and the constant terms on the other side of the inequality. **Switch the inequality sign when multiplying or dividing by a negative number**

Inverse Operations

$2(4x-1) > 17x+9$	Given
$2(4x)-2(1) > 17x+9$	Distributive Property
$8x-2 > 17x+9$	Simplify
$8x-17x-2 > 17x-17x+9$	Additive inverse
$-9x-2>9$	Simplify/Combine like terms
$-9x-2+2>9+2$	Additive inverse
$-9x>11$	Simplify/Combine like terms
$\frac{-9x}{-9} < \frac{11}{-9}$	Multiplicative inverse
$x < -\frac{11}{9}$	Simplify
$x < -1\frac{2}{9}$	

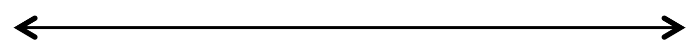


Decomposition

$2(4x-1) > 17x+9$	Given
$(4x-1)+(4x-1) > 17x+9$	Definition of multiplication
$4x+4x-1-1 > 17x+9$	Commutative property
$8x-2 > 17x+9$	Combine like terms
$8x-2 > 8x+9x+9$	Decompose terms
$-2>9x+9$	Simplify
$-2+9-9>9x+9$	Add in zero pairs
$-11>9x$	Simplify
$-11\bullet\frac{1}{9}\bullet 9>9\bullet x$	Decompose multiplication
$-11\bullet\frac{1}{9}>x$	Simplify
$-\frac{11}{9}>x$	Multiply
$x<-\frac{11}{9}$	Rewrite: variable on the left

A-REI.3

3a′ Solve the inequality for a: $-3(a+4) \geq 2(a-6)$
Graph the solution(s).



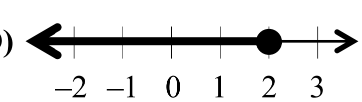
3b′ Mark Yes or No to indicate which of the following represent the solution(s) to

$$6+3n \geq -4(n-5)$$

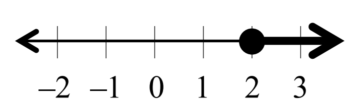
A) $n \geq 2$ ○ Yes ○ No

B) $2 \geq n$ ○ Yes ○ No

C) $n \leq 2$ ○ Yes ○ No

D) 

○ Yes ○ No

E) 

○ Yes ○ No

4 Solve $-4|x+5|-10=-22$

First, isolate the absolute value.
Rewrite the equation in the form $|ax+b|=c$

$-4|x+5|-10=-22$	Given
$-4|x+5|-10+10=-22+10$	Additive inverse
$-4|x+5|=-12$	Combine like terms
$\frac{-4|x+5|}{-4}=\frac{-12}{-4}$	Multiplicative inverse
$|x+5|=3$	Simplify

Do not distribute the –4.

$|ax+b|=c$ is equivalent to the statement
$ax+b=c$ or $ax+b=-c$

$|x+5|=3$

$x+5=3$	or	$x+5=-3$
$x+5-5=3-5$	or	$x+5-5=-3-5$
$x=-2$	or	$x=-8$

A-REI.3

4a′ Solve $3|2x-1|+3=18$

4b′ Mark Yes or No to indicate which of the following represent the solution(s) of

$$6|m|-11=1$$

A) $m=-3$ ◯ Yes ◯ No

B) $m=-2$ ◯ Yes ◯ No

C) $m=0$ ◯ Yes ◯ No

D) $m=2$ ◯ Yes ◯ No

E) $m=3$ ◯ Yes ◯ No

5 Solve the following system of equations. $\begin{cases} 2x+4y=8 \\ x-3y=-1 \end{cases}$

Method 1: Substitution

1. Solve for x in the second equation.

$$x-3y=-1$$
$$x-3y+3y=-1+3y$$
$$x=-1+3y$$

2. Substitute $(-1+3y)$ for x in the first equation and solve for y.

$$2x+4y=8$$
$$2(-1+3y)+4y=8$$
$$-2+6y+4y=8$$
$$-2+10y=8$$
$$-2+2+10y=8+2$$
$$\frac{10y}{10}=\frac{10}{10}$$
$$y=1$$

3. Substitute 1 for y in any equation (here, we chose the second equation) and solve for x.

$$x-3y=-1$$
$$x-3(1)=-1$$
$$x-3+3=-1+3$$
$$x=2$$

The solution for this system is (2, 1).

Method 2: Eliminate x

1. Multiply second equation by –2 to create inverse x-terms.

$$\begin{cases} 2x+4y=8 \\ x-3y=-1 \end{cases} \xrightarrow{\bullet(-2)} \begin{cases} 2x+4y=8 \\ -2x+6y=2 \end{cases}$$

2. Add both equations together and solve for y.

$$\begin{array}{r} 2x+4y=8 \\ +\quad -2x+6y=2 \\ \hline \frac{10y}{10}=\frac{10}{10} \\ y=1 \end{array}$$

3. Substitute 1 for y in any equation (here, we chose the first equation) and solve for x.

$$2x+4y=8$$
$$2x+4(1)=8$$
$$2x+4-4=8-4$$
$$\frac{2x}{2}=\frac{4}{2}$$
$$x=2$$

The solution for this system is (2, 1).

Method 3: Eliminate y

1. Multiply first equation by 3 and second equation by 4 to create inverse y-terms.

$$\begin{cases} 2x+4y=8 \quad \bullet(3) \\ x-3y=-1 \quad \bullet(4) \end{cases} \rightarrow \begin{cases} 6x+12y=24 \\ 4x-12y=-4 \end{cases}$$

2. Add both equations together and solve for x.

$$\begin{array}{r} 6x+12y=24 \\ +\quad 4x-12y=-4 \\ \hline \frac{10x}{10}=\frac{20}{10} \\ x=2 \end{array}$$

3. Substitute 2 for x in any equation (here, we chose the first equation) and solve for y.

$$2x+4y=8$$
$$2(2)+4y=8$$
$$4-4+4y=8-4$$
$$\frac{4y}{4}=\frac{4}{4}$$
$$y=1$$

The solution for this system is (2, 1).

A.REI.6

"You Try" problems for #5 are on the next page.

5a′ Solve this system of equations using any method:

$$\begin{cases} x + y = 13 \\ 6x - 8y = 36 \end{cases}$$

5b′

$$\begin{cases} 8x + y = 31 \\ 3x - 2y = 14 \end{cases}$$

State whether or not each of these statements could be the first step to solve the system above.

A) Add the equations together.	◯ Yes	◯ No
B) Multiply both sides of one equation by 2.	◯ Yes	◯ No
C) Multiply both sides of one equation by 3 and both sides of the other equation by 2.	◯ Yes	◯ No
D) Subtract 8x from both sides of one equation.	◯ Yes	◯ No
E) Subtract 2y from both sides of one equation.	◯ Yes	◯ No
F) Multiply both sides of one equation by –4.	◯ Yes	◯ No
G) Divide both sides of one equation by 2.	◯ Yes	◯ No

5c′ The following are statements about the solution to

$$\begin{cases} 4x + y = -4 \\ x - y = -1 \end{cases}$$

Choose whether each statement is True or False.

A) $x = -1$	◯ True	◯ False
B) $x = 0$	◯ True	◯ False
C) $x = 1$	◯ True	◯ False
D) $y = -1$	◯ True	◯ False
E) $y = 0$	◯ True	◯ False
F) $y = -1$	◯ True	◯ False
G) There is no solution.	◯ True	◯ False

6 A **function** is a relation where each element of the input is associated with a *unique* element of the output.

A function can be represented as a table of ordered pairs where each element of the input (usually x) is associated with only one element of the output [usually y or $f(x)$].

Function

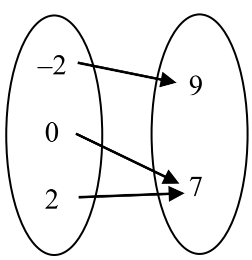
x	$g(x)$
–1	5
0	10
1	15
2	20

Not a function

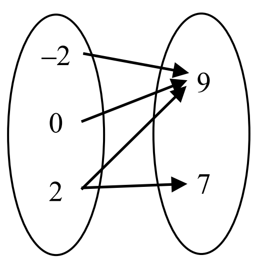
x	y
–1	5
0	10
–1	15
2	20

A function can be represented as a mapping where each element of the input (usually x) is mapped to only one element of the output [usually y or $f(x)$].

Function

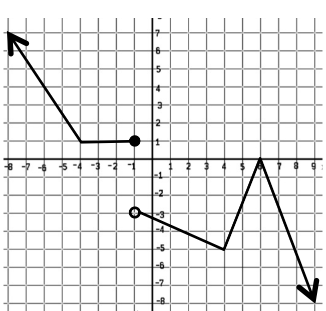


Not a function



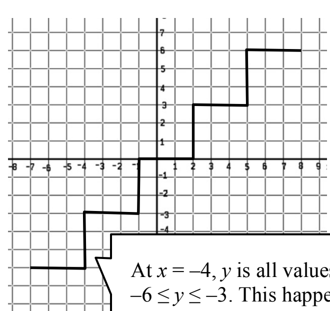
A function can be represented as a graph where each x-value is graphed to only one corresponding y-value [or value for $f(x)$].

Function



At $x = -1$, $y = 1$ and $y \neq -3$, so this is the graph of a function.

Not a function

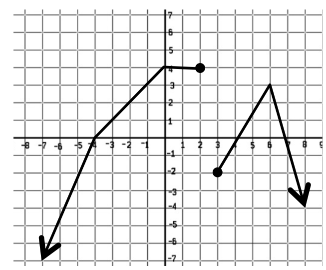


At $x = -4$, y is all values $-6 \leq y \leq -3$. This happens for other x-values also. So this is not a function.

F-IF.1

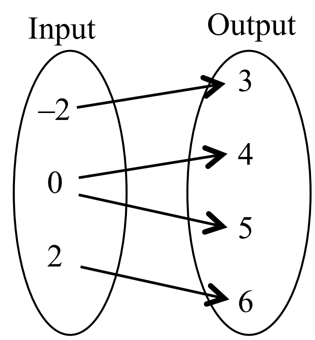
6′ Examine the following tables, mappings, and graphs. Select Yes or No to indicate which represent functions.

A)



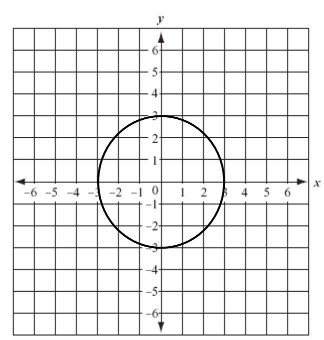
○ Yes ○ No

B)



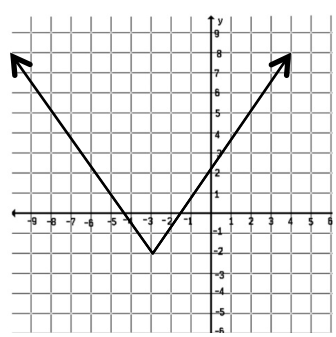
○ Yes ○ No

C)



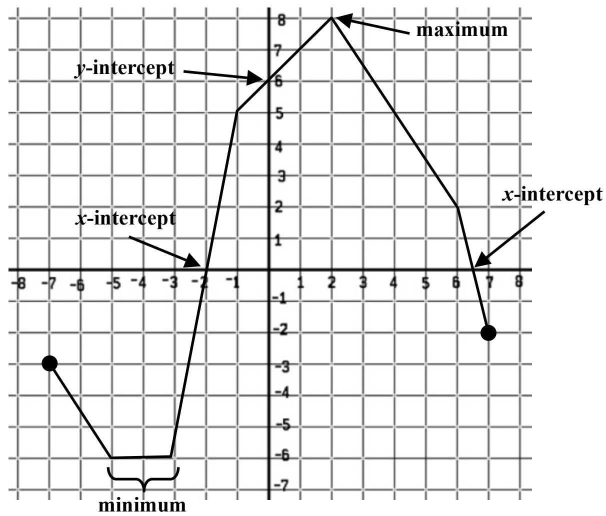
○ Yes ○ No

D)



○ Yes ○ No

7 Answer the following questions about the graph of the function $f(x)$ shown below.



a) What are the y-intercept(s)?

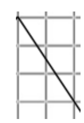
The y-intercept is where the graph crosses the y-axis, in this case at the point (0, 6) or $y = 6$.

b) What are the x-intercept(s)?

The x-intercept is where the graph crosses the x-axis, in this case at the points (–2, 0) and (6.5, 0) or $x = -2$ or 6.5.

c) Is $f(x)$ increasing or decreasing on the interval $2 < x < 4$?

If we look only at the portion of the graph between $x = 2$ and $x = 4$, we can see that the graph is decreasing.



d) Does the graph have a minimum, maximum, both or neither? If so, where are these points?

A minimum occurs when the graph reaches its smallest y-value. This function has a minimum at $-5 \le x \le -3$ when $y = -6$ because –6 is the lowest value for the range of this function. A maximum occurs when the graph reaches its largest y-value. This function has a maximum at $x = 2$, when $y = 8$, or at the point (2, 8).

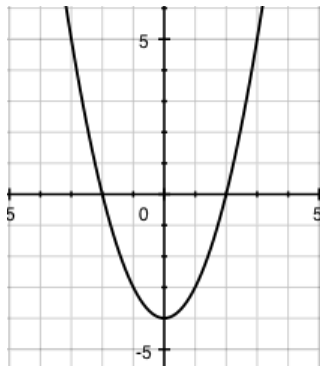
e) What is $f(1)$?

We are looking at the graph where $x = 1$ and determining what the y-value is at that point. We can see $f(1) = 7$.

F-IF.4

"You Try" problems for #7 are on the next page.

7a′ Answer the following questions about the graph of the function $g(x)$ shown below.



a) What are the y-intercept(s)?

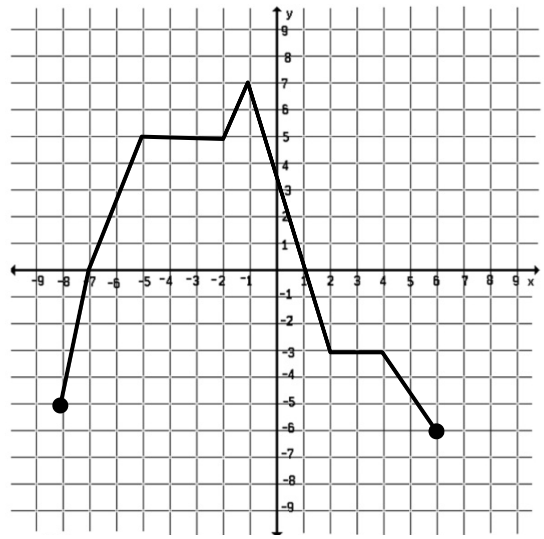
b) What are the x-intercept(s)?

c) Is $g(x)$ increasing or decreasing on the interval $0 < x < 2$?

d) Does the graph have a minimum, maximum, both or neither? If so, where are these points?

e) What is $g(-3)$?

7b′ A function, $p(x)$ is shown on the graph below.



Determine whether each of the following statements are True or False for the function above.

A) $p(x)$ is increasing on the interval $-1 < x < 0$

◯ True ◯ False

B) $p(x)$ has an x-intercept at $x = 1$

◯ True ◯ False

C) $p(x)$ has a y-intercept at $y = -7$

◯ True ◯ False

D) $p(x)$ has a minimum at $x = -8$

◯ True ◯ False

E) $p(2) = -3$

◯ True ◯ False

End of Study Guide

You Try Solutions:

1a′ Solve the equation for c: $-8 = 9c - (c + 24)$.

Inverse Operations

$-8 = 9c - (c+24)$	Given
$-8 = 9c + (-1)(c+24)$	Change subtr. to add (-)
$-8 = 9c + (-1)(c) + (-1)(24)$	Distributive property
$-8 = 9c + (-1c) + (-24)$	Simplify
$-8 = 8c - 24$	Combine like terms
$-8 + 24 = 8c - 24 + 24$	Additive inverse
$16 = 8c$	Combine like terms
$\frac{16}{8} = \frac{8c}{8}$	Multiplicative inverse
$2 = c$	Simplify

1b′ Mark Yes or No to indicate which of the following equations are equivalent to

$$2(3x-1)-(3x+2)=-13$$

A) $6x - 2 - 3x - 2 = -13$ ● Yes ○ No

B) $6x - 2 - 3x + 2 = -13$ ○ Yes ● No

C) $6x - 3x - 4 + 4 = -13 + 4$ ● Yes ○ No

D) $3x = -13$ ○ Yes ● No

E) $3x = -9$ ● Yes ○ No

2a′ Solve $2(-2c+7)+10 = 4c$ for c. Justify each step.

$2(-2c+7)+10 = 4c$	Given
$2(-2c)+2(7)+10 = 4c$	Distributive property
$-4c+14+10 = 4c$	Simplify
$-4c+24 = 4c$	Combine like terms
$-4c+4c+24 = 4c+4c$	Additive inverse
$24 = 8c$	Combine like terms
$\frac{24}{8} = \frac{8c}{8}$	Multiplicative inverse
$3 = c$	Simplify

2b′ Tania's work on a problem is shown below.

Given:	$4x-(9x-1)=-6x$
Step 1:	$4x-9x+1=-6x$
Step 2:	$-5x+1=-6x$
Step 3:	$-5x+6x+1=-6x+6x$
Step 4:	$x+1=0$
Step 5:	$x+1-1=0-1$
Step 6:	$x=-1$

Select True or False for each justification.

A) Step 1 is justified by the distributive property.
● True ○ False

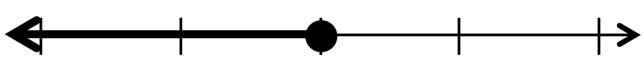
B) Step 2 is justified by the associative property.
○ True ● False

C) Step 3 is justified by the commutative property.
○ True ● False

D) Step 4 is justified by the property of additive inverses.
● True ○ False

3a′ Solve the inequality for a: $-3(a+4) \ge 2(a-6)$
Graph the solution(s).

$-3(a+4) \ge 2(a-6)$	Given
$-3(a)-3(4) \ge 2(a)+2(-6)$	Distributive property
$-3a-12 \ge 2a-12$	Simplify
$-3a+3a-12 \ge 2a+3a-12$	Additive inverse
$-12 \ge 5a-12$	Combine like terms
$-12+12 \ge 5a-12+12$	Additive inverse
$0 \ge 5a$	Combine like terms
$\frac{0}{5} \ge \frac{5a}{5}$	Multiplicative inverse
$0 \ge a$	Simplify
$a \le 0$	Reverse the inequality



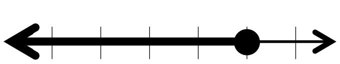
3b′ Mark Yes or No to indicate which of the following represent the solution(s) to

$$6+3n \ge -4(n-5)$$

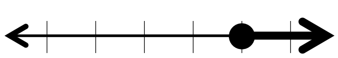
A) $n \ge 2$ ● Yes ○ No

B) $2 \ge n$ ○ Yes ● No

C) $n \le 2$ ○ Yes ● No

D)


○ Yes ● No

E)


● Yes ○ No

4a′ Solve $3|2x-1|+3=18$

First, isolate the absolute value.
Rewrite the equation in the form $|ax+b|=c$

$3\lvert 2x-1\rvert+3=18$	Given
$3\lvert 2x-1\rvert+3-3=18-3$	Additive inverse
$3\lvert 2x-1\rvert=15$	Simplify
$\frac{3\lvert 2x-1\rvert}{3}=\frac{15}{3}$	Multiplicative inverse
$\lvert 2x-1\rvert=5$	Simplify

Do not distribute the 3.

$|ax+b|=c$ is equivalent to the statement
$ax+b=c$ or $ax+b=-c$

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

$2x-1=5$	or	$2x-1=-5$
$2x-1+1=5+1$	or	$2x-1+1=-5+1$
$2x=6$	or	$2x=-4$
$\frac{2x}{2}=\frac{6}{2}$	or	$\frac{2x}{2}=\frac{-4}{2}$
$x=3$	or	$x=-2$

4b′ Mark Yes or No to indicate which of the following represent the solution(s) of

$$6|m|-11=1$$

A) $m=-3$ ○ Yes ● No

B) $m=-2$ ● Yes ○ No

C) $m=0$ ○ Yes ● No

D) $m=2$ ● Yes ○ No

E) $m=3$ ○ Yes ● No

5a′ Solve this system of equations using any method:

$$\begin{cases} x+y=13 \\ 6x-8y=36 \end{cases}$$

Method 1: Eliminate *x*

1. Multiply the top equation by –6 to create opposites with the *x*.

$$\begin{cases} x+y=13 \\ 6x-8y=36 \end{cases} \xrightarrow{\bullet(-6)} \begin{cases} -6x-6y=-78 \\ 6x-8y=36 \end{cases}$$

2. Add the equations together.

$$\begin{aligned} -6x-6y&=-78 \\ +\quad 6x-8y&=36 \\ \hline -14y&=-42 \\ \frac{-14y}{-14}&=\frac{-42}{-14} \\ y&=3 \end{aligned}$$

3. Substitute value for *y* into one of the equations.

$$\begin{aligned} x+y&=13 \\ x+3&=13 \\ x+3-3&=13-3 \\ x&=10 \end{aligned}$$

The solution to the system is (10, 3).

Method 2: Eliminate *y*

1. Multiply the top equation by 8 to create opposites with the *y*.

$$\begin{cases} x+y=13 \\ 6x-8y=36 \end{cases} \xrightarrow{\bullet(8)} \begin{cases} 8x+8y=104 \\ 6x-8y=36 \end{cases}$$

2. Add the equations together.

$$\begin{aligned} 8x+8y&=104 \\ +\quad 6x-8y&=36 \\ \hline 14x\quad&=140 \\ \frac{14x}{14}&=\frac{140}{14} \\ x&=10 \end{aligned}$$

3. Substitute value for *x* into one of the equations.

$$\begin{aligned} x+y&=13 \\ 10+y&=13 \\ 10-10+y&=13-10 \\ y&=3 \end{aligned}$$

The solution to the system is (10, 3).

Method 3: Substitution

1. Solve the top equation for *x* or *y*.

$$\begin{cases} x+y=13 \\ 6x-8y=36 \end{cases} \xrightarrow{\text{Solve for } x} \begin{cases} x=13-y \\ 6x-8y=36 \end{cases}$$

2. Substitute 13 – *y* for *x* and solve.

$$\begin{aligned} 6x-8y&=36 \\ 6(13-y)-8y&=36 \\ 78-6y-8y&=36 \\ -14y+78-78&=36-78 \\ \frac{-14y}{-14}&=\frac{-42}{-14} \\ y&=3 \end{aligned}$$

3. Substitute value for *y* into one of the equations.

$$\begin{aligned} x+y&=13 \\ x+3&=13 \\ x+3-3&=13-3 \\ x&=10 \end{aligned}$$

The solution to the system is (10, 3).

5b′

$$\begin{cases} 8x+y=31 \\ 3x-2y=14 \end{cases}$$

State whether or not each of these statements could be the first step to solve the system above.

	Yes	No
A) Add the equations together.	○	●
B) Multiply both sides of one equation by 2.	●	○
C) Multiply both sides of one equation by 3 and both sides of the other equation by 2.	○	●
D) Subtract $8x$ from both sides of one equation.	●	○
E) Subtract $2y$ from both sides of one equation.	○	●
F) Multiply both sides of one equation by –4.	○	●
G) Divide both sides of one equation by 2.	●	○

5c′ The following are statements about the solution to

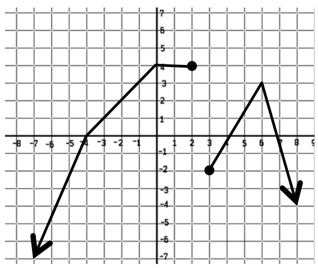
$$\begin{cases} 4x+y=-4 \\ x-y=-1 \end{cases}$$

Choose whether each statement is True or False.

	True	False
A) $x=-1$	●	○
B) $x=0$	○	●
C) $x=1$	○	●
D) $y=-1$	○	●
E) $y=0$	●	○
F) $y=-1$	○	●
G) There is no solution.	○	●

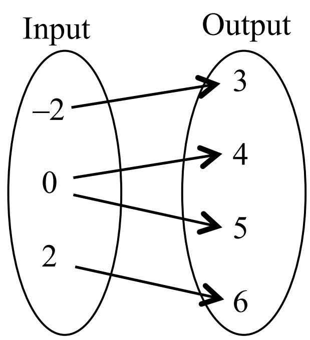
6´ Examine the following tables, mappings, and graphs. Select Yes or No to indicate which represent functions.

A)



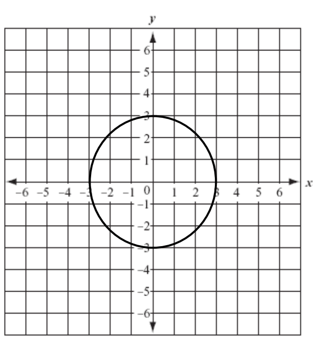
● Yes ○ No

B)



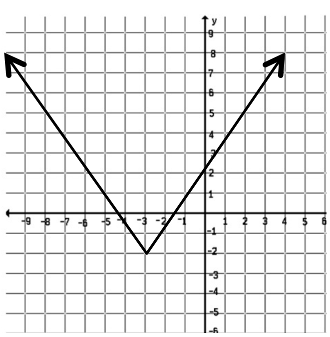
○ Yes ● No

C)



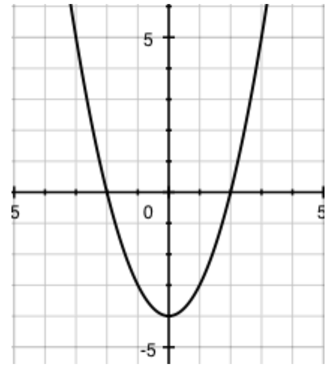
○ Yes ● No

D)



● Yes ○ No

7a´ Answer the following questions about the graph of the function $g(x)$ shown below.



a) What are the *y*-intercept(s)?

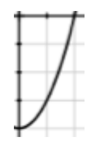
The y-intercept is at $y = -4$ or the point $(0, -4)$.

b) What are the *x*-intercept(s)?

The x-intercepts are at $x = -2$ and $x = 2$ or the points $(-2, 0)$ and $(2, 0)$.

c) Is $g(x)$ increasing or decreasing on the interval $0 < x < 2$?

If we look at the part of the graph between $x = 0$ and $x = 2$, we can see that $g(x)$ is increasing on that interval.



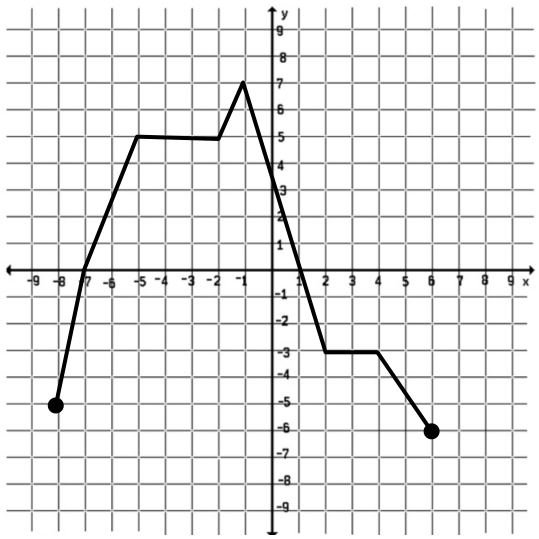
d) Does the graph have a minimum, maximum, both or neither? If so, where are these points?

The graph has a minimum at $x = 0$, when $y = -4$. This is a minimum because it is the graphs smallest value in the range.

e) What is $g(-3)$?

We are looking at the graph where $x = -3$ and determining what the y-value is at that point. We can see $g(-3) = 5$.

7b′ A function, $p(x)$ is shown on the graph below.



Determine whether each of the following statements are True or False for the function above.

A) $p(x)$ is increasing on the interval $-1 < x < 0$

○ True ● False

B) $p(x)$ has an x-intercept at $x = 1$

● True ○ False

C) $p(x)$ has a y-intercept at $y = -7$

○ True ● False

D) $p(x)$ has a minimum at $x = -8$

○ True ● False

E) $p(2) = -3$

● True ○ False