LESSON 2 KEY - ALGEBRA & FUNCTIONS

A) SIMPLIFYING EXPRESSIONS

An expression does not have an equal sign with a left side and a right side.
In an expression we can only simplify rather than solve.

Simplify each expression:

1) 13x + 5x – 7 + 1 **18x – 6**

2) 8 – 5(6x – 2) 8 – 30x + 10 **18 – 30x**

3) 4 – (2x + 7) 4 – 2x – 7 **-3 – 2x**

4) Which of the following expressions is equivalent to the expression 17 − 4*x* for all values of *x*?

e) 5 – (4x – 12)

5 – (4x – 12)
= 5 – 4x + 12
= 17 – 4x

5) Which of the following is equivalent to $14x^2$?
Choose all correct answers.

☒ **a)** $10x^2 + 9x^2 - 5x^2$

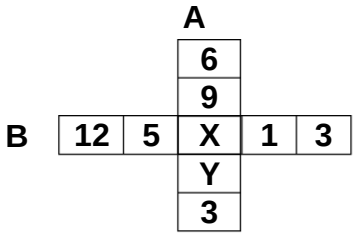
☒ **b)** $(2x)(7x)$

☒ **d)** $\frac{42x^3}{3x}$

a) $10x^2 + 9x^2 - 5x^2 = 19x^2 - 5x^2 = 14x^2$

b) $(2x)(7x) = 14x^2$

d) $\frac{42x^3}{3x} = 14x^2$



6) If the sum of the numbers in column A is equal to the sum of the numbers in row B, then find the value of Y.

3

6 + 9 + X + Y + 3 = 12 + 5 + X + 1 + 3 =
18 + X + Y = 21 + X Subtract X from both sides.
18 + Y = 21
Y = 3

B) MORE SOLVING EQUATIONS

Remember, when solving an equation, always do **ADDING** & **SUBTRACTING** first. To remove a fraction, multiply by the **RECIPROCAL**.

1) If $\frac{1}{8}x - 5 = 3$, then x =

b) 64

$$\frac{1}{8}x - 5 = 3$$
$$\frac{1}{8}x = 8$$
$$8\left(\frac{1}{8}x\right) = 8(8)$$
$$x = 64$$

2) "Type" the number in the box. Give your answer as a fraction.
If $7(3x - 5) = 4(x - 4) - 9$, what is the value of x?

$$7(3x - 5) = 4(x - 4) - 9$$
$$21x - 35 = 4x - 16 - 9$$
$$21x - 35 = 4x - 25$$
$$17x - 35 = -25$$
$$17x = 10$$
$$x = \frac{10}{17}$$

$x = \frac{10}{17}$

3) Which of the following sequence of steps, when completed, will solve the equation $4 + 5y = 19$ for y?

a) Subtract 4 from both sides of the equation, then divide both sides of the new equation by 5.

4) If $k + m = 41$ and $j + p = 20$, what is the value of $(4k + 4m)(3j + 3p)$?

a) 9840

Since k + m = 41,
4k + 4m = 4(41) = 164

Since j + p = 20,
3j + 3p = 3(20) = 60

(4k + 4m)(3j + 3p)
= (164) (60) = 9840

5) If $8a - 5b = 44$ and $b = 2$, find a.

c) $\frac{27}{4}$

$$8a - 5b = 44$$
$$8a - 5(2) = 44$$
$$8a - 10 = 44$$
$$8a = 54$$
$$a = \frac{54}{8} = \frac{27}{4}$$

6) $30\left(\frac{1}{10}x + \frac{2}{3}x\right) = ?$

$$30\left(\frac{1}{10}x + \frac{2}{3}x\right) = \frac{30}{1} \bullet \frac{1}{10}x + \frac{30}{1} \bullet \frac{2}{3}x$$
$$= \frac{30}{10}x + \frac{60}{3}x = 3x + 20x = 23x$$

23x

7) Solve for y : $\sqrt{y + 3.7} + 18 = 30$

$$\sqrt{y + 3.7} + 18 = 30$$
$$\sqrt{y + 3.7} = 12 \quad \text{square both sides}$$
$$\left(\sqrt{y + 3.7}\right)^2 = (12)^2$$
$$y + 3.7 = 144$$
$$y = 140.3$$

140.3

8) Given the fraction $\frac{x}{x+11}$ If 7 is added to t he numerator and the denominator, the resulting fraction is $\frac{9}{20}$. What is the value of $\frac{x}{x+11}$?

Since 7 was added to the numerator and demonimator, simply reverse the process and subtract 7 from both.

$$\frac{9-7}{20-7} = \frac{2}{13}$$

$$\frac{\boxed{2}}{\boxed{13}}$$

9) Nishanka has twice as many coins as Paola. Brenda has 5 more coins than Nishanka. If the total number of coins is 50, how many coins does Brenda have?

Let **P** = # of coins Paola has
Let **2P** = # of coins Nishanka has
Let **2P + 5** = # of coins Brenda has

P + 2P + 2P + 5 = 50
5P + 5 = 50
5P = 45
P = 9

Paola has 9 coins
Nishanka has 2(9) = 18 coins
Brenda has 18 + 5 = 23 coins

e) 23

x	f(x)
4	50
7	65
10	80
12	90
35	205

10) Which equation satisfies every entry in the above table?

e) f(x) = 5x + 30

Use trial and error.

Ex.a) f(x) = 10x + 10 so if x =4, then 10(4) + 10 = 50 so it "satisfied" the first one.
Then try x = 7
10(7) + 10 = 80, not 65, so it does not "satisfy" the second one.

<u>Eventually</u> you will find that e) f(x) = 5x + 30 will work for all pairs of numbers.
5(4) + 30 = 50
5(7) + 30 = 65
5(10) + 30 = 80 etc.

11) A repairperson charges $70/hour plus a service charge of $170. If the bill came to $800, which of the following will find the number of hours she worked?

a) $\frac{800-170}{70}$

Let x = # of hours worked

$$70x + 170 = 800$$

$$70x = 800 - 170$$

$$800 - 170 = 70x$$

$$x = \frac{800-170}{70}$$

C) SOLVING PROBLEMS WITH LOTS OF LETTERS

1) Sheryl deposits $2,800 in her bank. It is all in twenties and fifties. If z represents the number of twenty dollar bills, which of the following represents the number of fifty dollar bills?

c) $\dfrac{2800-20z}{50}$

We need to make up a letter to stand for the number of fifty dollar bills.
Let f = # of fifty dollar bills
20z + 50f = 2800 Now solve for f.

50f = 2800 – 20z

$f = \dfrac{2800-20z}{50}$

2) If x + 2 = 3y + 6, **what is y** in terms of x?

d) $\dfrac{x-4}{3}$

$x+2=3y+6$ **Solve for y.**
$-6 \quad -6$
$x-4=3y$
$\dfrac{x-4}{3}=\dfrac{3y}{3}$

$y=\dfrac{x-4}{3}$

3) If 8x + 113y = 501, **find x** in terms of y.

b) $\dfrac{501-113y}{8}$

Solve for x:
$8x+113y=501$
$8x=501-113y$
$x=\dfrac{501-113y}{8}$

$$16x + 34y$$

4) The expression above represents the total amount, in dollars, earned by selling *x* tee shirts and y sweatshirts at a recent Back-To-School Night. A total of $2,260 was collected in sales of tee shirts and sweatshirts. The amount earned by selling **sweatshirts (34y)** is what fraction of the **total** amount earned **($2,260)?**

a) $\frac{34y}{2260}$

$$\frac{\text{amount \$ for sweatshirts}}{\text{total amount of \$}} = \frac{34y}{2260}$$

5) *H* is 5 times *M*, and *M* is 3 less than 7 times *W*. Which of the following statements describes the relationship between *H* and *W*?

e) *H* is 15 less than 35 times W.

$H = 5M$ $M = 7W - 3$ (Remember 3 less than means take 3 away from!)

Replace M with $7W - 3$

$$H = 5(7W - 3)$$

$$H = 35W - 15$$

6) If $h = \frac{1}{3}j$ and $j = \frac{1}{4}k$, what is the relationship between h and k?

d) $k = 12h$

$$h = \frac{1}{3}j \quad j = \frac{1}{4}k$$

$$h = \frac{1}{3}\left(\frac{1}{4}k\right)$$

$h = \frac{1}{12}k$ **but this is not a choice.**

So multiply both sides by 12 to get:

$$12(h) = 12\left(\frac{1}{12}k\right)$$

$12h = k$ **or** $k = 12h$

D) INEQUALITIES

One important thing to remember about inequalities:

If I multiply or divide BOTH SIDES of an inequality by a **NEGATIVE**, then I must **REVERSE THE INEQUALITY SYMBOL**!

Always put the letter on the **LEFT**. Don't write 2 < x. Write **x > 2**.

Solve each inequality for x:

1) $2x + 7 > -13$

$2x > -20$

$\boxed{x > -10}$

2) $-4x + 3 \leq x + 18$

$-5x + 3 \leq 18$

$-5x \leq 15$ **Divide both sides by -5!**

$\boxed{x \geq -3}$

3) Solve the inequality for x. Choose all that apply.

2x + 3 > 40

☒ **c) 19** ☒ **d) 19.5** ☒ **e) 21**

$2x + 3 > 40$

$2x > 37$

$x > 18.5$

Note: It must be greater than 18.5 but it can't be equal to 18.5!

4) Solve the inequality for x. Choose all that apply.

-3x – 5 ≥ 34

☒ **a) -14.5** ☒ **b) -14** ☒ **c) -13.9** ☒ **d) -13**

$-3x - 5 \geq 34$

$-3x \geq 39$

$x \leq -13$

Note: Now it can be less than or EQUAL to – 13.

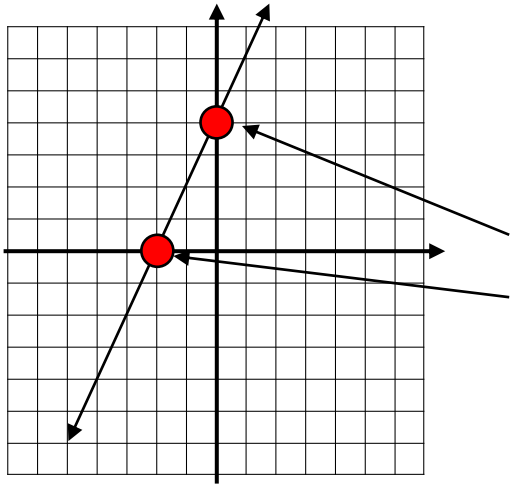
E) ALGEBRAIC GRAPHS

To find the points where a graph will hit the x and y axes, use the "Intercept-Intercept" Method. Let x = 0 and solve for y. Let y = 0 and solve for x.

Ex. 2y – 4x = 8

If x is 0, then **2y = 8**
y = 4

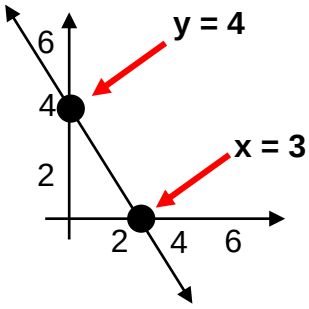
If y is 0, then **-4x = 8**
x = -2



x	y
0	4
-2	0

1) Which is the correct graph of the equation: 4x + 3y = 12?

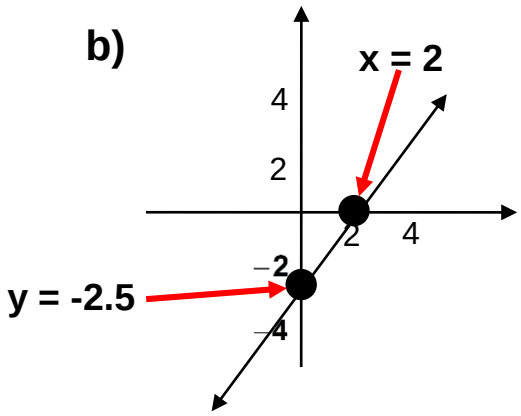
d)



Let x = 0 :
3y = 12
y = 4

Let y = 0 :
4x = 12
x = 3

2) Which graph represents the equation: 5x – 4y = 10?



Let x = 0 :

–4y = 10

$$y = \frac{10}{-4}$$

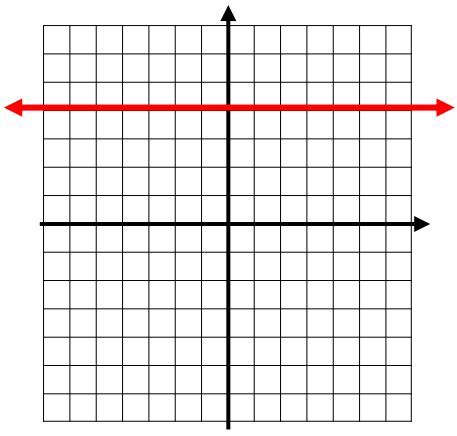
y = –2.5

Let y = 0 :

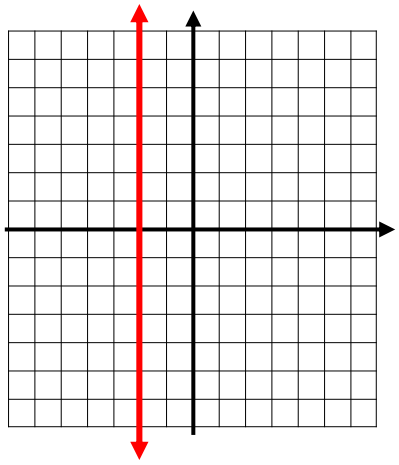
5x = 10

x = 2

NOTE: The equation of all horizontal lines is y = the number where it hits the y-axis.
The equation of all vertical lines is x = the number where it hits the x-axis.



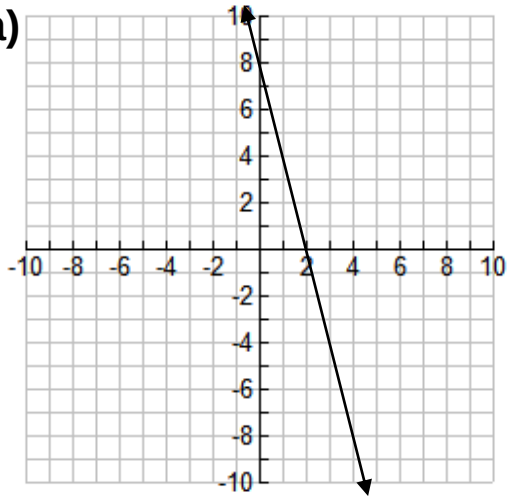
The equation of the line above is y = 4.



The equation of the line above is x = -2 .

3) Which of the following graphs shows that as y decreases by 4, x increases by 1?

a)

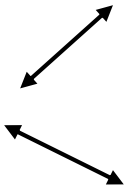


From the y-axis to the x axis you would go down 8 and right 2. This is equivalent to down 4 and right 1 *or* as y decreases by 4, x increases by 1.

SLOPE-INTERCEPT FORM OF A LINE: $y = mx + b$ where *m* is the slope or rise/run and *b* is the y-intercept or place where the graph intersects the y-axis.

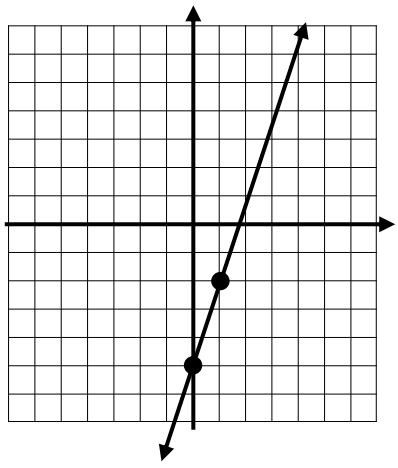
A positive slope rises to the right.

A negative slope rises to the left.

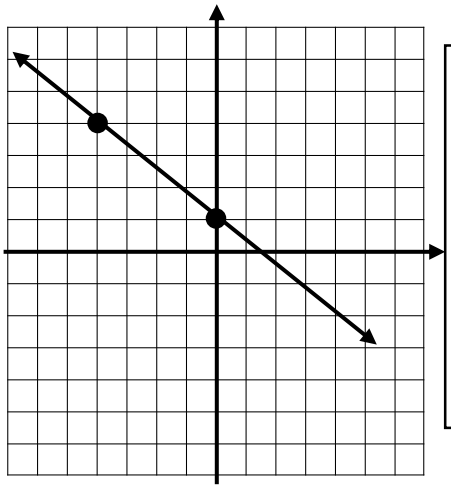


4) Which graph below shows the line $y = 3x - 5$?

b)



This line intersects the y-axis at negative 5 and has a slope of 3 over 1.

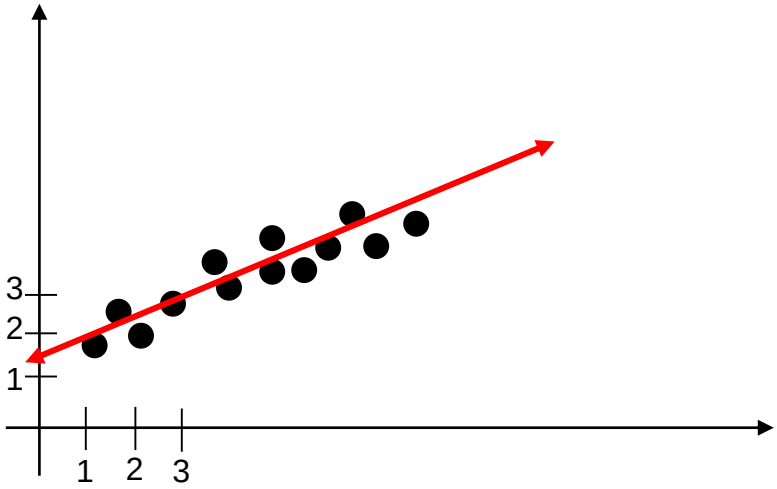


The line intersects the y-axis at 1 so b = 1.
The slope is rise 3 and run to the left 4 or $-\frac{3}{4}$.
Equation: y = mx + b

$$y = -\frac{3}{4}x + 1$$

5) What is the equation of the line shown in the graph above?

c) $y = -\frac{3}{4}x + 1$

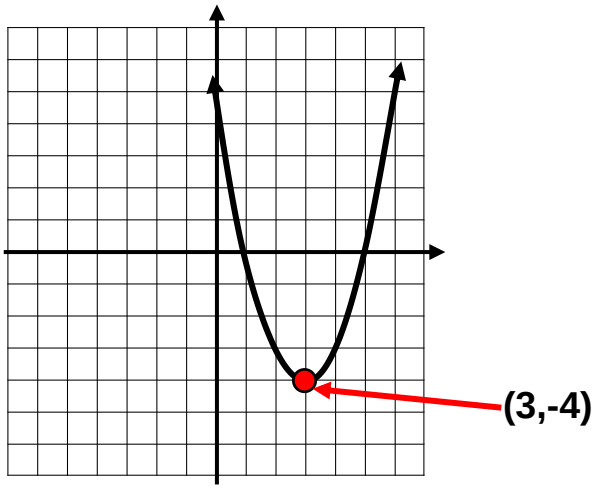


6) Which of the following linear models best fits the data shown in the scatterplot above?

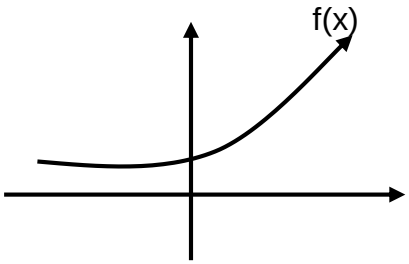
d) $y = \frac{1}{2}x + \frac{3}{2}$

The points are rising to the right so if a line were to be drawn through the points, it would have a positive slope. Therefore, the number in front of *x* must be positive. This eliminates choices *a* and *b*.
If we draw a line through these points it would hit the y-axis between 1 and 2. Choice *d* indicates a y-intercept of 3/2 or 1.5.
The correct answer is *d*.

7) The graph shows $f(x) = (x-3)^2 - 4$.
Which of the following is a point on f(x)?

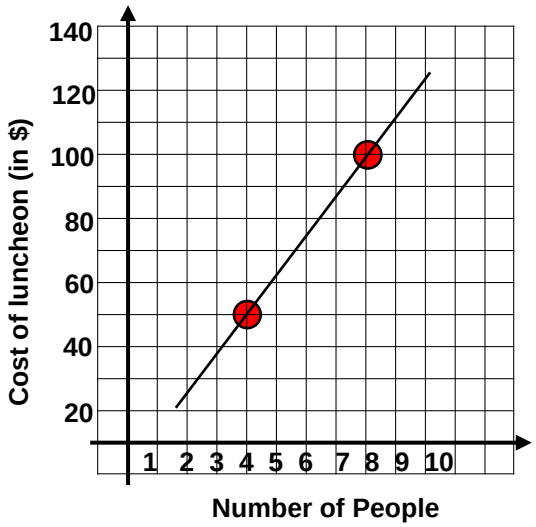


a) $(3,-4)$



8) Which of the following describes the graph of f(x) shown above?

d) It is nonlinear and as x increases, y increases.



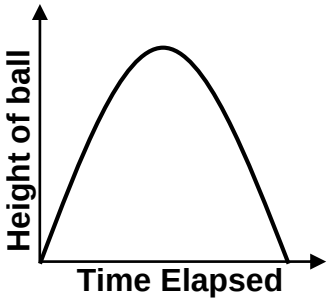
4 people cost $50, so that is $12.50 per person….

9) The graph above shows the relationship between the cost of a luncheon and the number of people attending the luncheon. According to the graph, what is the cost per person?

c) $12.50

10) Which of the following graphs most accurately shows the relationship between the time after a golf ball is struck and the height of the ball in feet?

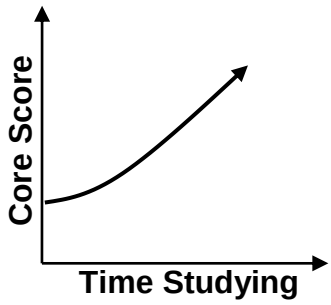
e)



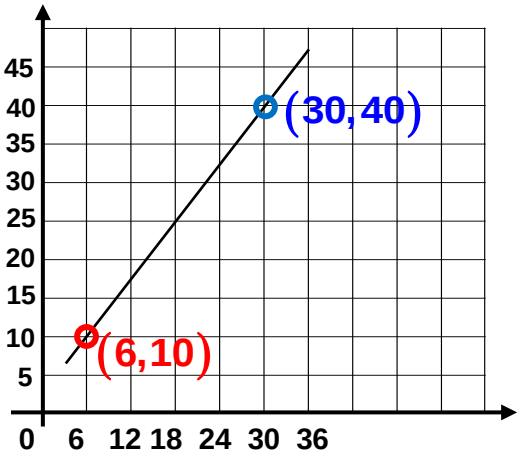
The ball is struck on the ground, then it rises into the air, then it falls back to the ground.

11) We all know that the more time we spend studying for a test the higher our test score will be. Which of the following graphs could be the graph of the relationship between time studying and score on the CORE test?

c)



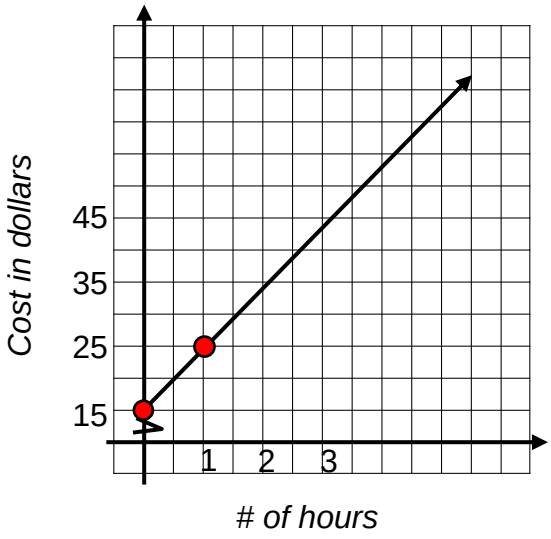
Graph *c* shows your score increasing as the amount of time studying increases!!



12) The graph of a linear equation is shown above. Which of the following tables corresponds to the graph?

b)

x	y
6	10
12	17.5
24	32.5
30	40



For 0 hours, the cost is $15 so that is the "flat rate".

After 1 hour, the price is $25. So, $25 - $15 = $10.

Therefore the hourly charge is $10.

13) The graph above represents the cost of renting a bike. What is the flat rate and what is the hourly charge?

b) Flat rate $15 Hourly rate $10

F) FUNCTIONS

In order to be a function, no x value can be repeated.

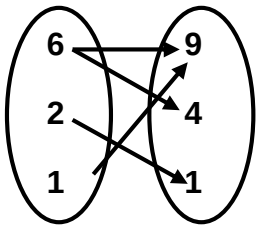
1) Which of the following is **not** a function?

d) $\{(2,8)(-2,13)(1,5)(2,3)\}$

The x-value (the first number) 2 is repeated in (2,8) and (2, 3).

2) Which of the following does **not** represent a function?

b)



This drawing represents:

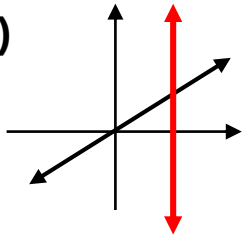
$\{(6,9)(6,4)(2,1)(1,9)\}$

If the x-value is repeated, it is NOT a function.

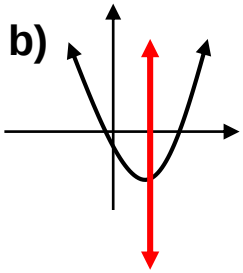
If you draw a vertical line anywhere on the graph and it intersects the graph more than once, then it is <u>not</u> a function.

3) Which of the following represents a function? Choose <u>all</u> correct answers.

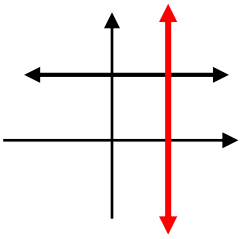
☒ **a)**



☒ **b)**



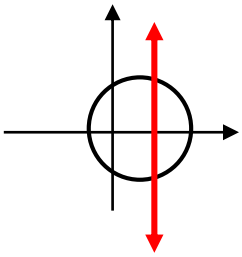
☒ **d)**



A vertical line will only hit these graphs <u>only one</u> time.

4) Which of the following does **<u>not</u>** represent a function? Choose <u>all</u> correct answers.

☒ **b)**



A vertical line will hit these graphs <u>more than</u> <u>one</u> time.

☒ **e)**