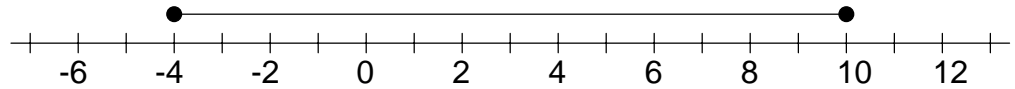


1. (a) **Solve** the inequality  $|x - 3| \leq 7$ .

$$-7 \leq x - 3 \leq 7, \quad -7 + 3 \leq x - 3 + 3 \leq 7 + 3$$

$-4 \leq x \leq 10$	or
$[-4, 10]$	

(b) **Graph** the solution to the inequality in (a), above.



2. Write the set  $\{x \mid 2 \leq x\}$  in **interval notation**.  $[2, \infty)$

3. **State** if the number is **rational** or **irrational**. If the number is rational, write it as a **reduced fraction**. If irrational, find a calculator **approximation**.

(a)  $\sqrt{0.625}$  0.790569415, irrational

(b)  $\sqrt{0.0625}$  0.25 = 1/4, rational

4. Name the **property** illustrated in each example.

(a)  $x + y = y + x$  commutative property of addition

(b)  $5(ab) = (5a)b$  associative property of multiplication

5. Given the equation  $2x + 7y = 28$ , find

(a) the **x-intercept** Let  $y = 0$ , then  $7y = 0$ ,  $2x = 28$ ,  $x = 14$ .  $(14, 0)$

(b) the **y-intercept** Let  $x = 0$ , then  $2x = 0$ ,  $7y = 28$ ,  $y = 4$ .  $(0, 4)$

(c) one additional point. Let  $y = 2$ , then  $7y = 14$ ,  $2x = 14$ ,  $x = 7$ .

(d) the **graph**, with the intercepts and the additional point with coordinates.

6. Given the two points  $(-2, 5)$  and  $(8, -1)$  find (a) the **distance** between them

$$d = \sqrt{(-2 - 8)^2 + (5 - (-1))^2} = \sqrt{(-10)^2 + 6^2} = \sqrt{100 + 36} = \sqrt{136} \text{ or } 2\sqrt{34}$$

(b) the **midpoint** of the line segment joining them

$$\left(\frac{-2+8}{2}, \frac{5+(-1)}{2}\right) = (3, 2)$$

(c) the **slope** of the straight line through them

$$m = \frac{-1-5}{8-(-2)} = \frac{-6}{10} = \frac{-3}{5}$$

GO TO PAGE 2.

7. Find  $f\left(\frac{-3}{2}\right)$  if  $f(x) = 2x^2 + 5x - 6$ .

$$f\left(\frac{-3}{2}\right) = 2\left(\frac{-3}{2}\right)^2 + 5\left(\frac{-3}{2}\right) - 6 = 2\left(\frac{9}{4}\right) - \frac{15}{2} - 6 = \frac{9}{2} - \frac{15}{2} - 6 = -3 - 6 = -9$$

8. (a) **Solve** the equation  $4x - 5 = -3(3 - 2x) + 16$

$$4x - 5 = -9 + 6x + 16$$

$$4x - 5 = 6x + 7$$

$$4x - 6x = 5 + 7$$

$$-2x = 12$$

$$x = -6$$

(b) **Check** your answer to the equation, or check if 2 is a solution or not.

$$4(-6) - 5 = -3(3 - 2(-6)) + 16$$

$$-24 - 5 = -3(3 + 12) + 16$$

$$-29 = -3(15) + 16$$

$$-29 = -45 + 16$$

$$-29 = -29$$

- 6 is a solution.

**In the following word problems, set up an appropriate algebraic equation, solve it, check, and answer with a sentence.**

11. Monty starts walking South at 12 noon, at a rate 3 miles per hour. Mike starts at the same place at 1 pm that day and runs after Monty at a rate of 5 miles per hour. What time is it when Mike catches up with Monty, and how far have they Gone?

	distance	rate	time
Monty	$3t$	3	$t$
Mike	$5(t - 1)$	5	$t - 1$

$$5(t - 1) = 3t,$$

$$5t - 3t = 5,$$

$$t = 2.5$$

$$t - 1 = 1.5$$

$$3t = 3(2.5) = 7.5$$

$$5t - 5 = 3t,$$

$$2t = 5,$$

Check

$$5(t - 1) = 5(1.5) = 7.5$$

Mike catches up with Monty at 2:30 pm, and they have each gone 7.5 miles.

12. How much of a 20% acid solution and a 36% acid solution should be mixed to make 128 ml of a 25% acid solution?

solute	strength	solution
$0.2x$	0.2	$x$
$0.36(128 - x)$	0.36	$128 - x$
$0.25(128)$	0.25	128

$$\begin{aligned}
 .2x + .36(128 - x) &= .25(128), & .2x + 46.08 - .36x &= 32, \\
 -.16x + 46.08 &= 32, & -.16x &= 32 - 46.08 \\
 -.16x &= -14.08 & x &= -14.08 \div (-.16) = 88 \\
 \text{Check} & & .2x &= .2(88) = 17.6 \\
 .36(128 - 88) &= .36(40) = 14.4 & 17.6 + 14.4 &= 32
 \end{aligned}$$

Mix 88 milliliters of 20% solution with 40 milliliters of 36% solution.

13. Sam is offered a choice of \$550 per month, plus 10% of sales, or \$740 per month, plus 8% of sales. Find the sales amount at which each choice would yield the same salary. State what this salary is.

$$\begin{aligned}
 0.10x + 550 &= 0.08x + 740 \\
 0.10x - 0.08x &= 740 - 550 \\
 0.02x &= 190, \quad x = 190 \div 0.02 = 9500 \\
 \text{Check} &
 \end{aligned}$$

$$\begin{aligned}
 0.10(9500) + 550 &= 0.08(9500) + 740 \\
 950 + 550 &= 760 + 740, \quad 1500 = 1500
 \end{aligned}$$

At \$9500 in sales both options give a salary of \$1500.

14. Determine if each of the relations below is a **function or not**, giving a **valid reason** in each case.

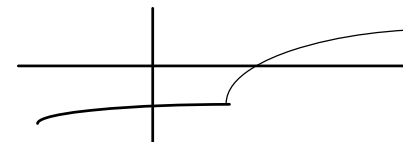
(a)  $\{(5, 7), (1, 4), (2, 8), (5, 3)\}$

Not a function. The number 5 is repeated as a **first** component.

(b)  $3x + 4|y| = 64$  Not a function. If  $x = 0$ ,  $|y| = 16$ ,  $y = -16$  or  $16$ .

(c)  $x^2 + y^7 = 1$ ,  $y^7 = 1 - x^2$ ,  $y = \sqrt[7]{1 - x^2}$  7 is odd, so there is a unique real value of  $y$  for each  $x$ . This is a function.

(d) Function. The graph passes the **vertical line test**.



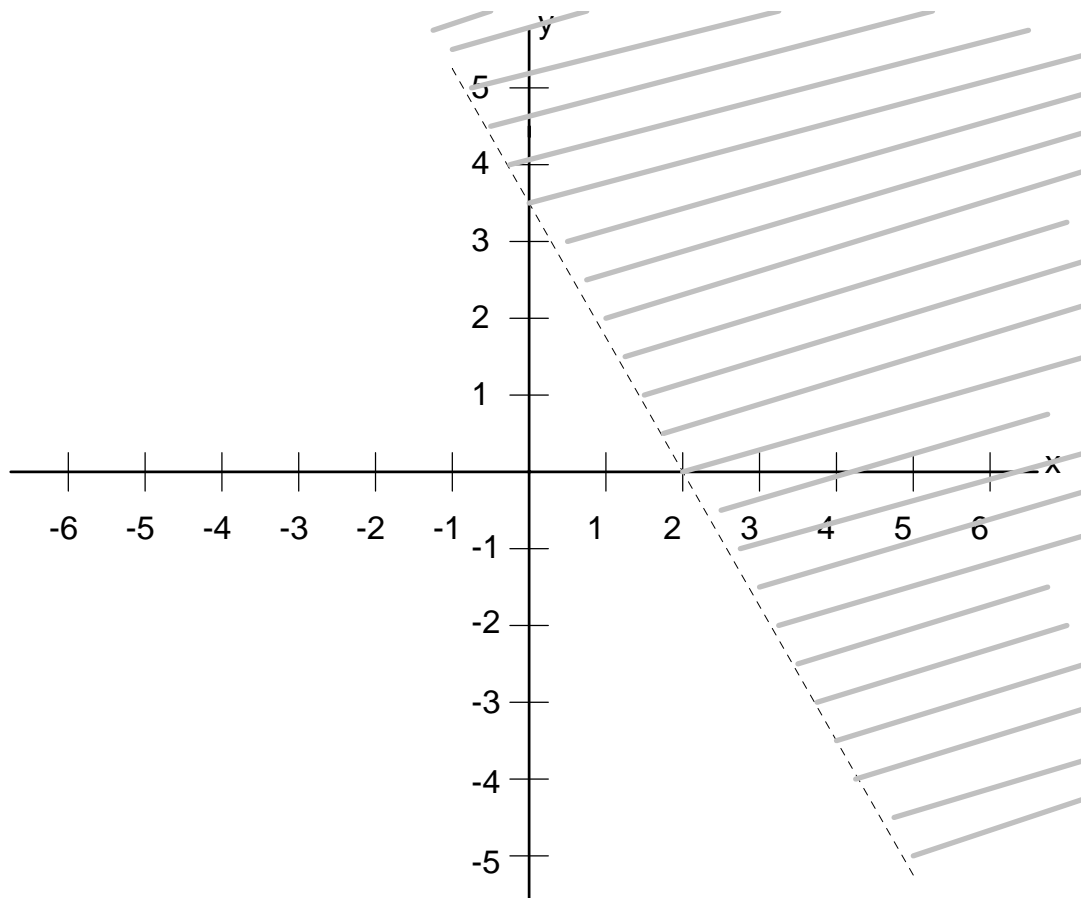
15.  $f(x) = x^2 + 2x - 6$  Compute (a)  $f(0) = 0^2 + 2(0) - 6 = -6$

(b)  $f(-3) = (-3)^2 + 2(-3) - 6 = 9 - 6 - 6 = -3.$

16. Graph the inequality  $7x + 4y > 14$  in the plane.

On  $x$ -axis,  $y = 0$ ,  $7x > 14$ ,  $x > 2$

On  $y$ -axis,  $x = 0$ ,  $4y > 14$ ,  $y > 3.5$



17. Compute the determinant  $\begin{vmatrix} -5 & 3 \\ 7 & -6 \end{vmatrix} = -5(-6) - 3(7) = 30 - 21 = 9$

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18. **Solve** the system  $\begin{matrix} -5x + 3y = 7 \\ 7x - 6y = -11 \end{matrix}$  by **Cramer's Rule** and **check** your answer.

$$D = \begin{vmatrix} -5 & 3 \\ 7 & -6 \end{vmatrix} = -5(-6) - 3(7) = 30 - 21 = 9$$

$$D_x = \begin{vmatrix} 7 & 3 \\ -11 & -6 \end{vmatrix} = 7(-6) - 3(-11) = -42 + 33 = -9$$

$$D_y = \begin{vmatrix} -5 & 7 \\ 7 & -11 \end{vmatrix} = -5(-11) - 7(7) = 55 - 49 = 6$$

$$x = \frac{D_x}{D} = \frac{-9}{9} = -1, \quad y = \frac{D_y}{D} = \frac{6}{9} = \frac{2}{3}$$

Check

$$-5(-1) + 3\left(\frac{2}{3}\right) = 5 + 2 = 7$$

$$7(-1) - 6\left(\frac{2}{3}\right) = -7 - 4 = -11$$

The solution is  $\left(-1, \frac{2}{3}\right)$ .

19. A straight line contains the two points  $(-3, 6)$  and  $(3, -2)$ . Find

(a) the **slope** of the line  $m = \frac{-2 - 6}{3 - (-3)} = \frac{-8}{6} = \frac{-4}{3}$

- (b) the slope-intercept **equation** of the line Using the first point,

$$y - 6 = \frac{-4}{3}(x - (-3))$$

$$y - 6 = \frac{-4}{3}x - 4$$

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

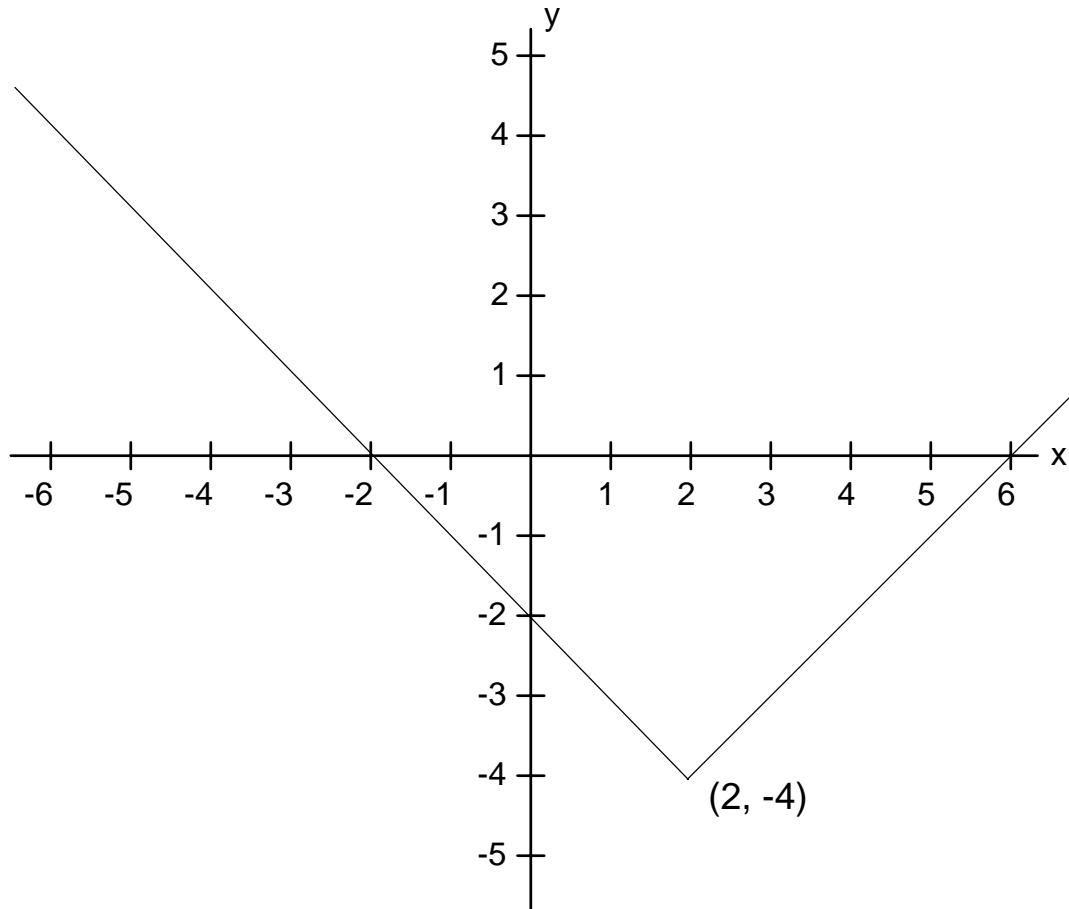
Check

$$\frac{-4}{3}(-3) + 2 = 4 + 2 = 6,$$

$$\frac{-4}{3}(3) + 2 = -4 + 2 = -2$$

20. Find an equation for the curve graphed below. It is made by shifting the graph of the relation  $y = |x|$

$y + 4 = |x - 2|$



21. **Solve** the system  $7x + 2y + 3z = 0$   
 $4x + 3y + 2z = 8$  by the **addition** method,  
 $3x + 5y + 2z = 21$

or by **Cramer's Rule**, or by **matrices**, and **check** your answer.

The **reduced row echelon** matrix for  $\begin{pmatrix} 7 & 2 & 3 & 0 \\ 4 & 3 & 2 & 8 \\ 3 & 5 & 2 & 21 \end{pmatrix}$  is  $\begin{pmatrix} 1 & 0 & 0 & -17 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 1 & 41 \end{pmatrix}$ .

The solution is  $(-17, -2, 41)$

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$$7(-17) + 2(-2) + 3(41) = -119 - 4 + 123 = 0$$

Check:  $4(-17) + 3(-2) + 2(41) = -68 - 6 + 82 = 8$

$$3(-17) + 5(-2) + 2(41) = -51 - 10 + 82 = 21$$

22. **Set up** a system of **two** equations in **two** variables to solve the problem:  
 "How much of a 5% solution and an 8% solution should be mixed to make 3.5 liters of a 6% solution?" (Set up only.)

Use  $x$  liters of 5% solution and  $y$  liters of 8% solution.

$$x + y = 3.5$$

$$0.05x + 0.08y = 0.06(3.5)$$

23. The system 
$$\begin{array}{r} 4x + 5y = 25 \\ 3x + 8y = 23 \end{array}$$
 has solution  $x = 5, y = 1$ . State

(a) the **matrix** representing the system  $\begin{pmatrix} 4 & 5 & 25 \\ 3 & 8 & 23 \end{pmatrix}$

(b) the **reduced row echelon form** of the matrix in (a)  $\begin{pmatrix} 1 & 0 & 5 \\ 0 & 1 & 1 \end{pmatrix}$

24. Evaluate the determinant  $\begin{vmatrix} 7 & 3 & 4 \\ 8 & 4 & 5 \\ 5 & 2 & 3 \end{vmatrix} =$

$$7 \cdot \begin{vmatrix} 4 & 5 \\ 2 & 3 \end{vmatrix} - 3 \cdot \begin{vmatrix} 8 & 5 \\ 5 & 3 \end{vmatrix} + 4 \cdot \begin{vmatrix} 8 & 4 \\ 5 & 2 \end{vmatrix} =$$

$$7(12 - 10) - 3(24 - 25) + 4(16 - 20) =$$

$$7(2) - 3(-1) + 4(-4) = 14 + 3 - 16 = \boxed{1}$$

25. Find the **reduced row echelon** matrix for  $\begin{pmatrix} 7 & 3 & 4 & 11 \\ 8 & 4 & 5 & 11 \\ 5 & 2 & 3 & 8 \end{pmatrix}$ . Row operations

$$\begin{array}{l} r_1 \leftarrow r_1 - r_2 \\ r_2 \leftarrow r_2 - 8r_1 \\ r_3 \leftarrow r_3 + 5r_1 \end{array} \text{ give } \begin{pmatrix} -1 & -1 & -1 & 0 \\ 0 & -4 & -3 & 11 \\ 0 & -3 & -2 & 8 \end{pmatrix}, \text{ then the row operations}$$

$$\begin{array}{l} r_1 \leftarrow -r_1 \\ r_2 \leftarrow -r_2 \\ r_2 \leftarrow r_2 + r_3 \end{array} \text{ give } \begin{pmatrix} 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & -3 \\ 0 & -3 & -2 & 8 \end{pmatrix}, \text{ then the row operations}$$

$$\begin{array}{l} r_3 \leftarrow r_3 + 3r_2 \\ r_2 \leftarrow r_2 - r_3 \\ r_1 \leftarrow r_1 - r_3 \\ r_1 \leftarrow r_1 - r_2 \end{array} \text{ give } \begin{pmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 1 & -1 \end{pmatrix}, \text{ the row echelon form.}$$

26. Solve the system  $\begin{array}{l} 7x + 3y + 4z = 11 \\ 8x + 4y + 5z = 11 \\ 5x + 2y + 3z = 8 \end{array}$  by using the result of the previous problem, and check your answer.

The solution is  $(3, -2, -1)$ .

Check:

$$\begin{array}{l} 7(3) + 3(-2) + 4(-1) = 21 - 6 - 4 = 11 \\ 8(3) + 4(-2) + 5(-1) = 24 - 8 - 5 = 11 \\ 5(3) + 2(-2) + 3(-1) = 15 - 4 - 3 = 8 \end{array}$$