

Systems of Equations/Inequalities

1. Calculator

$$\begin{aligned}x + y &= -9 \\x + 2y &= -25\end{aligned}$$

According to the system of equations above, what is the value of x ?

$$(7, -16)$$

$$x = 7$$

2. Non-Calculator

$$\begin{aligned}x + y &= 0 \\3x - 2y &= 10\end{aligned}$$

Which of the following ordered pairs (x, y) satisfies the system of equations above?

- A) $(3, -2)$
- B) $(2, -2)$
- C) $(-2, 2)$
- D) $(-2, -2)$

3. Calculator

A worker uses a forklift to move boxes that weigh either 40 pounds or 65 pounds each. Let x be the number of 40-pound boxes and y be the number of 65-pound boxes. The forklift can carry up to either 45 boxes or a weight of 2,400 pounds. Which of the following systems of inequalities represents this relationship?

A) $\begin{cases} 40x + 65y \leq 2,400 \\ x + y \leq 45 \end{cases}$

B) $\begin{cases} \frac{x}{40} + \frac{y}{65} \leq 2,400 \\ x + y \leq 45 \end{cases}$

C) $\begin{cases} 40x + 65y \leq 45 \\ x + y \leq 2,400 \end{cases}$

D) $\begin{cases} x + y \leq 2,400 \\ 40x + 65y \leq 2,400 \end{cases}$

4. Calculator

In one semester, Doug and Laura spent a combined 250 hours in the tutoring lab. If Doug spent 40 more hours in the lab than Laura did, how many hours did Laura spend in the lab?

$$\begin{cases} x + y = 250 \\ x = y + 40 \end{cases}$$

$$(145, 105)$$

105 hours

5. Non-Calculator

$$\begin{aligned} 2(-3x + 4y &= 20) \\ 6x + 3y &= 15 \end{aligned}$$

If (x, y) is the solution to the system of equations above, what is the value of x ?

$$\begin{array}{r} -6x + 8y = 40 \\ + 6x + 3y = 15 \\ \hline 11y = 55 \\ \hline 11 \quad 11 \\ \hline y = 5 \end{array} \quad (0, 5)$$

$$\begin{array}{r} -3x + 4(5) = 20 \\ -3x + 20 = 20 \\ \quad -20 \quad -20 \\ \hline -3x = 0 \\ x = 0 \end{array}$$

6. Calculator

Last week Raul worked 11 more hours than Angelica. If they worked a combined total of 59 hours, how many hours did Angelica work last week?

- A) 24
- B) 35
- C) 40
- D) 48

$$\begin{cases} x + y = 59 \\ x = y + 11 \end{cases}$$

$$(35, 24)$$

7. Non-Calculator

Jackie has two summer jobs. She works as a tutor, which pays \$12 per hour, and she works as a lifeguard, which pays \$9.50 per hour. She can work no more than 20 hours per week, but she wants to earn at least \$220 per week. Which of the following systems of inequalities represents this situation in terms of x and y , where x is the number of hours she tutors and y is the number of hours she works as a lifeguard?

- A) $12x + 9.5y \leq 220$
 $x + y \geq 20$
- B) $12x + 9.5y \leq 220$
 $x + y \leq 20$
- C) $12x + 9.5y \geq 220$
 $x + y \leq 20$
- D) $12x + 9.5y \geq 220$
 $x + y \geq 20$

8. Calculator

An online bookstore sells novels and magazines. Each novel sells for \$4, and each magazine sells for \$1. If Sadie purchased a total of 11 novels and magazines that have a combined selling price of \$20, how many novels did she purchase?

- A) 2
- B) 3
- C) 4
- D) 5

$$\begin{cases} x + y = 11 \\ 4x + 1y = 20 \end{cases}$$

$$(3, 8)$$

9. Calculator

$$\frac{1}{2}y = 4$$

$$x - \frac{1}{2}y = 2$$

The system of equations above has solution (x, y) .
What is the value of x ?

A) 3

B) $\frac{7}{2}$

C) 4

D) 6

$(6, 8)$

10. Calculator

$$y \leq 3x + 1$$

$$x - y > 1$$

Which of the following ordered pairs (x, y) satisfies the system of inequalities above?

A) $(-2, -1)$ $-1 \leq -5$ X

B) $(-1, 3)$ $3 \leq -2$ X

C) $(1, 5)$ $5 \leq 4$ X

D) $(2, -1)$ $-1 \leq 7$ ✓

11. Non-Calculator

A laundry service is buying detergent and fabric softener from its supplier. The supplier will deliver no more than 300 pounds in a shipment. Each container of detergent weighs 7.35 pounds, and each container of fabric softener weighs 6.2 pounds. The service wants to buy at least twice as many containers of detergent as containers of fabric softener. Let d represent the number of containers of detergent, and let s represent the number of containers of fabric softener, where d and s are nonnegative integers. Which of the following systems of inequalities best represents this situation?

A) $7.35d + 6.2s \leq 300$
 $d \geq 2s$

B) $7.35d + 6.2s \leq 300$
 $2d \geq s$

C) $14.7d + 6.2s \leq 300$
 $d \geq 2s$

D) $14.7d + 6.2s \leq 300$
 $2d \geq s$

12. Non-Calculator

Between 1497 and 1500, Amerigo Vespucci embarked on two voyages to the New World. According to Vespucci's letters, the first voyage lasted 43 days longer than the second voyage, and the two voyages combined lasted a total of 1,003 days. How many days did the second voyage last?

A) 460

B) 480

C) 520

D) 540

$$\begin{cases} x + y = 1003 \\ x = y + 43 \end{cases}$$

$(523, 480)$

13. Non-Calculator

$$3x + 4y = -23$$

$$2y - x = -19$$

What is the solution (x, y) to the system of equations above?

- A) $(-5, -2)$
- B) $(3, -8)$
- C) $(4, -6)$
- D) $(9, -6)$

14. Calculator

$$y < -x + a$$

$$y > x + b$$

In the xy -plane, if $(0, 0)$ is a solution to the system of inequalities above, which of the following relationships between a and b must be true?

- A) $a > b$
- B) $b > a$
- C) $|a| > |b|$
- D) $a = -b$

$$0 < a$$

$$0 > b$$

15. Calculator

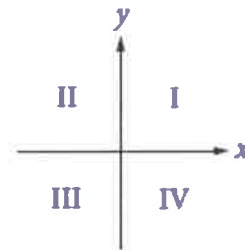
A food truck sells salads for \$6.50 each and drinks for \$2.00 each. The food truck's revenue from selling a total of 209 salads and drinks in one day was \$836.50. How many salads were sold that day?

- A) 77
- B) 93
- C) 99
- D) 105

$$\begin{cases} x + y = 209 \\ 6.5x + 2y = 836.50 \end{cases}$$

$$(93, 116)$$

16. Calculator



If the system of inequalities $y \geq 2x + 1$ and $y > \frac{1}{2}x - 1$ is graphed in the xy -plane above, which quadrant contains no solutions to the system?

- A) Quadrant II
- B) Quadrant III
- C) Quadrant IV
- D) There are solutions in all four quadrants.

17. Non-Calculator

$$\begin{aligned} ax + by &= 12 \\ 2x + 8y &= 60 \end{aligned} \quad \left. \begin{array}{l} \\ \end{array} \right\} \times 5$$

In the system of equations above, a and b are constants. If the system has infinitely many solutions, what is the value of $\frac{a}{b}$?

↑
same line!

$$a = 0.4$$

$$b = 1.6$$

$$\frac{a}{b} = \frac{0.4}{1.6} = 0.25 \text{ or } \frac{1}{4}$$

18. Non-Calculator

$$2x - 3y = -14$$

$$3x - 2y = -6$$

If (x, y) is a solution to the system of equations above, what is the value of $x - y$?

A) -20

B) -8

C) -4

D) 8

$$(2, 6)$$

$$x - y = 2 - 6 = -4$$

19. Non-Calculator

$$kx - 3y = 4 \Rightarrow y = \frac{-k}{3}x + \frac{4}{3}$$

$$4x - 5y = 7 \Rightarrow y = \frac{4}{5}x - \frac{7}{5}$$

In the system of equations above, k is a constant and x and y are variables. For what value of k will the system of equations have no solution?

A) $\frac{12}{5}$

B) $\frac{16}{7}$

C) $-\frac{16}{7}$

D) $-\frac{12}{5}$

↑
same slope, different y-int

$$\frac{-k}{3} = \frac{4}{5}$$

$$-5k = 12$$

$$k = -\frac{12}{5}$$

20. Non-Calculator

In the xy -plane, the parabola with equation $y = (x - 11)^2$ intersects the line with equation $y = 25$ at two points, A and B . What is the length of \overline{AB} ?

A) 10

B) 12

C) 14

D) 16

$$25 = (x - 11)^2$$

$$\pm 5 = x - 11$$

$$x = 6, 16$$

$$(6, 25) \text{ and } (16, 25)$$

* can use distance formula, but not necessary

21. Non-Calculator

At a lunch stand, each hamburger has 50 more calories than each order of fries. If 2 hamburgers and 3 orders of fries have a total of 1700 calories, how many calories does a hamburger have?

$$\begin{cases} h = f + 50 \\ 2h + 3f = 1700 \end{cases}$$

$$2h + 3(h - 50) = 1700$$

$$2h + 3h - 150 = 1700$$

$$5h = 1850$$

$$h = 370 \text{ calories}$$

22. Calculator

The sum of three numbers is 855. One of the numbers, x , is 50% more than the sum of the other two numbers. What is the value of x ?

- A) 570
B) 513
C) 214
D) 155

$$\begin{cases} x + y + z = 855 \\ x = 1.5(y + z) \end{cases}$$

$$1.5(y + z) + y + z = 855$$

$$\frac{2.5(y + z)}{2.5} = \frac{855}{2.5}$$

$$y + z = 342$$

$$y + z = 342$$

$$\Rightarrow x + (342) = 855$$

$$x = 513$$

23. Calculator

$$y \leq -15x + 3000$$

$$y \leq 5x$$

In the xy -plane, if a point with coordinates (a, b) lies in the solution set of the system of inequalities above, what is the maximum possible value of b ?

24. Non-Calculator

$$\frac{x}{y} = 6 \Rightarrow x = 6y$$

$$4(y + 1) = x$$

If (x, y) is the solution to the system of equations above, what is the value of y ? $(12, 2)$

- A) 2
B) 4
C) 12
D) 24

$$4(y + 1) = 6y$$

$$4y + 4 = 6y$$

$$4 = 2y$$

$$y = 2$$

25. Non-Calculator

$$x = 2y + 5 \Rightarrow y = \frac{x}{2} + \frac{5}{2}$$

$$y = (2x - 3)(x + 9)$$

How many ordered pairs (x, y) satisfy the system of equations shown above?

- A) 0
- B) 1
- C) 2
- D) Infinitely many

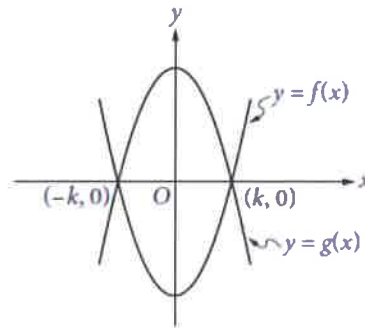
$$\frac{x}{2} + \frac{5}{2} = (2x - 3)(x + 9)$$

$$x + 5 = 2(2x - 3)(x + 9)$$

$$x + 5 = 4x^2 + 30x - 54$$

$$0 = 4x^2 + 29x - 59$$

26. Non-Calculator



The functions f and g , defined by $f(x) = 8x^2 - 2$ and $g(x) = -8x^2 + 2$, are graphed in the xy -plane above. The graphs of f and g intersect at the points $(k, 0)$ and $(-k, 0)$. What is the value of k ?

- A) $\frac{1}{4}$
 - B) $\frac{1}{2}$
 - C) 1
 - D) 2
- $$8x^2 - 2 = -8x^2 + 2$$
- $$16x^2 - 4 = 0$$
- $$4(4x^2 - 1) = 0$$
- $$4(2x + 1)(2x - 1) = 0$$
- $$x = \pm \frac{1}{2}$$

27. Non-Calculator

$$y = x^2$$

$$2y + 6 = 2(x + 3)$$

If (x, y) is a solution of the system of equations above and $x > 0$, what is the value of xy ?

- A) 1
 - B) 2
 - C) 3
 - D) 9
- $$2(x^2) + 6 = 2(x + 3)$$
- $$2x^2 + 6 = 2x + 6$$
- $$2x^2 - 2x = 0$$
- $$2x(x - 1) = 0$$
- $$\downarrow \quad \downarrow$$
- $$x = 0 \quad x = 1$$
- $$\Rightarrow x = 1$$
- $$y = (1)^2$$
- $$y = 1$$
- $$xy = 1 \cdot 1 = 1$$

28. Non-Calculator

$$\frac{1}{2}(2x + y) = \frac{21}{2}$$

$$y = 2x$$

The system of equations above has solution (x, y) . What is the value of x ?

$$\frac{1}{2}(2x + (2x)) = \frac{21}{2}$$

$$\frac{1}{4}(4x) = \frac{21}{2}$$

$$x = \frac{21}{2}$$

29. Calculator

$$7x + 3y = 8$$

$$6x - 3y = 5$$

For the solution (x, y) to the system of equations above, what is the value of $x - y$?

A) $-\frac{4}{3}$

$(1, \frac{1}{3})$

B) $\frac{2}{3}$

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

C) $\frac{4}{3}$

D) $\frac{22}{3}$

30. Calculator

In the xy -plane, the graph of $y = 3x^2 - 14x$ intersects the graph of $y = x$ at the points $(0, 0)$ and (a, a) . What is the value of a ?

$$\begin{array}{r} x = 3x^2 - 14x \\ -x \qquad \qquad -x \\ \hline \end{array}$$

$$0 = 3x^2 - 15x$$

$$0 = 3x(x - 5)$$

$$\begin{array}{cc} \downarrow & \downarrow \\ x = 0 & x = 5 \end{array}$$

$a = 5$

31. Non-Calculator

The graph of a line in the xy -plane has slope 2 and contains the point $(1, 8)$. The graph of a second line passes through the points $(1, 2)$ and $(2, 1)$. If the two lines intersect at the point (a, b) , what is the value of $a + b$?

A) 4

$y - 8 = 2(x - 1)$

B) 3

$\Rightarrow y = 2x + 6$

C) -1

D) -4

$m = \frac{2-1}{1-2} = -1$

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

$\Rightarrow y = -x + 3$

$2x + 6 = -x + 3$

$3x = -3$

$x = -1$

$y = 2(-1) + 6$

$= -2 + 6$

$= 4$

$(-1, 4)$

32. Calculator

$$y = 3$$

$$y = ax^2 + b$$

In the system of equations above, a and b are constants. For which of the following values of a and b does the system of equations have exactly two real solutions?

A) $a = -2, b = 2$

$3 = ax^2 + b$

B) $a = -2, b = 4$

*Substitute in because it requires knowledge of the discriminant

C) $a = 2, b = 4$

D) $a = 4, b = 3$

A) $3 = -2x^2 + 2$

$1 = -2x^2$

$-\frac{1}{2} = x^2$

$x = \pm\sqrt{-\frac{1}{2}}$ X

B) $3 = -2x^2 + 4$

$-1 = -2x^2$

$\frac{1}{2} = x^2$

$x = \pm\sqrt{\frac{1}{2}}$ ✓

33. Calculator

Mr. Kohl has a beaker containing n milliliters of solution to distribute to the students in his chemistry class. If he gives each student 3 milliliters of solution, he will have 5 milliliters left over. In order to give each student 4 milliliters of solution, he will need an additional 21 milliliters. How many students are in the class?

- A) 16
 B) 21
 C) 23
 D) 26
- $$\begin{cases} y = 3n + 5 \\ y = 4n - 21 \end{cases}$$
- $$3n + 5 = 4n - 21$$
- $$n = 26$$

34. Calculator

$$\begin{aligned} 3x + b &= 5x - 7 \Rightarrow b = 2x - 7 \\ 3y + c &= 5y - 7 \Rightarrow c = 2y - 7 \end{aligned}$$

In the equations above, b and c are constants.

If b is c minus $\frac{1}{2}$, which of the following is true?

- A) x is y minus $\frac{1}{4}$. $b = c - \frac{1}{2}$
- B) x is y minus $\frac{1}{2}$. $2x - 7 = (2y - 7) - \frac{1}{2}$
- C) x is y minus 1. $2x - 7 = 2y - \frac{15}{2}$
- D) x is y plus $\frac{1}{2}$.
- $$\begin{array}{r} +7 \qquad +7 \\ \hline 2x = 2y - \frac{1}{2} \\ \frac{2}{2} \quad \frac{2}{2} \quad \frac{1}{2} \\ \hline x = y - \frac{1}{4} \end{array}$$

35. Calculator

A group of friends decided to divide the \$800 cost of a trip equally among themselves. When two of the friends decided not to go on the trip, those remaining still divided the \$800 cost equally, but each friend's share of the cost increased by \$20. How many friends were in the group originally?

$$\begin{cases} y = \frac{800}{x} \\ y + 20 = \frac{800}{x-2} \end{cases}$$

$$\frac{800}{x-2} - 20 = \frac{800}{x}$$

$$\frac{800x}{x(x-2)} - \frac{20x(x-2)}{x(x-2)} = \frac{800(x-2)}{x(x-2)}$$

$$\cancel{800x} - 20x^2 + 40x = \cancel{800x} - 1600$$

$$0 = 20x^2 - 40x - 1600$$

$$0 = 20(x^2 - 2x - 80)$$

$$0 = 20(x-10)(x+8)$$

$$x = \cancel{-8}, 10$$

10 friends originally in the group.