

# Systems of Linear Equations: math practice, Grade 9

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21 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

### 1 Is it a solution?



Consider the system  $y = 3x - 1$  and  $x + y = 7$ . Decide whether each pair is a solution: (a)  $(2, 5)$  (b)  $(3, 4)$ .

### 2 Table of values



Complete the table for the lines  $y = x + 2$  and  $y = -x + 6$  and use it to find the solution of the system.

| x            | 0 | 1 | 2 | 3 | 4 |
|--------------|---|---|---|---|---|
| $y = x + 2$  | ? | ? | ? | ? | ? |
| $y = -x + 6$ | ? | ? | ? | ? | ? |

### 3 A quick substitution



Solve the system  $y = 2x$  and  $x + y = 12$  by substitution.

### 4 A quick elimination



Solve the system  $x + y = 15$  and  $x - y = 3$  by elimination.

### 5 How many solutions?



Without solving, decide whether each system has one solution, no solution, or infinitely many. Compare the slopes and intercepts.

- a.  $y = 4x + 1$  and  $y = 4x - 5$
- b.  $y = -x + 2$  and  $y = x + 2$
- c.  $2x + 2y = 6$  and  $y = -x + 3$

### 6 Chess club



A chess club has 31 members. There are 9 more boys than girls. Write a system and find how many boys and how many girls are in the club.

### 7 Test points in a region



Consider the system  $y \geq 2x$  and  $y < x + 3$ . For each point, say whether it is a solution of the system:  $(1, 2)$ ,  $(2, 3)$ ,  $(0, 0)$ .

### 8 Substitution with negatives



Solve by substitution:  $y = 3x - 9$  and  $5x + 2y = 4$ .

### 9 Isolate first



Solve the system  $x + 3y = 11$  and  $2x - 5y = 0$ . Start by isolating  $x$  in the first equation.

### 10 Elimination, one multiplier



Solve by elimination:  $4x + 3y = 25$  and  $2x - y = 5$ .

### 11 Elimination, two multipliers

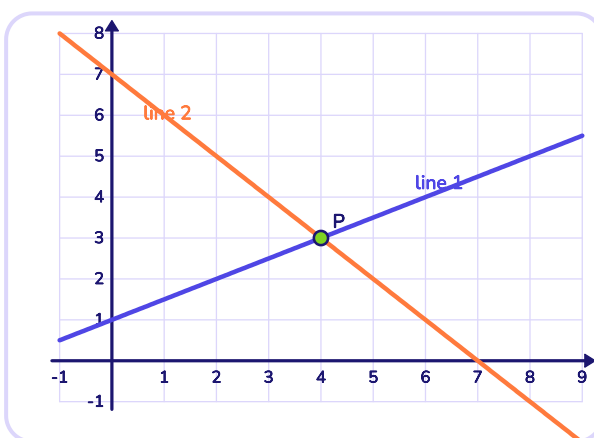


Solve by elimination:  $3x + 4y = 1$  and  $5x - 6y = 27$ .

### 12 Reading a graph



The graph shows the two lines  $y = 0.5x + 1$  (line 1) and  $y = -x + 7$  (line 2).



(a) Estimate the coordinates of the point  $P$  from the graph. (b) Confirm your answer by solving the system algebraically.

### 13 Pool tickets



At a community pool, 4 adult tickets and 3 child tickets cost 41 dollars. Two adult tickets and 5 child tickets cost 31 dollars. Find the price of each kind of ticket.

**14 A parameter**

Consider the system  $y = 3x + 2$  and  $y = kx - 5$ , where  $k$  is a number.

- For which value of  $k$  does the system have no solution?
- Solve the system when  $k = 2$ .

**15 Finding the missing constant**

Consider the system  $2x + 3y = 12$  and  $4x + 6y = c$ .

- Find the value of  $c$  for which the system has infinitely many solutions.
- Explain why the system has no solution when  $c = 20$ .

**16 Kayak trip**

A kayaker paddles 12 miles (about 19.3 km) downstream in 2 hours, then 12 miles back upstream in 3 hours. Let  $b$  be the kayaker's speed in still water and  $c$  the speed of the current, both in miles per hour. Find  $b$  and  $c$ .

**17 Juice mixture**

A juice shop mixes a drink that is 15% real juice with a drink that is 40% real juice to make 10 gallons (about 37.9 liters) of a mixture that is 25% real juice. How many gallons of each drink are needed?

**18 Fractions as coefficients**

Solve the system  $\frac{1}{2}x + \frac{1}{3}y = 4$  and  $x - y = 3$ . Start by clearing the fractions.

## 19 Ages



Mia is three times as old as her brother Leo. In 6 years, Mia will be twice as old as Leo will be then. How old are they now?

## 20 Shopping constraints



A student can spend at most 30 dollars on notebooks (2 dollars each) and pens (1 dollar each) and wants at least 5 items in all. Let  $n$  be the number of notebooks and  $p$  the number of pens, so  $n \geq 0$  and  $p \geq 0$ .

- Write a system of inequalities for the situation.
- Is buying 8 notebooks and 10 pens possible? What about 12 notebooks and 8 pens?
- What is the greatest number of items the student can buy?

## 21 A triangular region



Consider the region described by  $y \geq x - 2$ ,  $y \leq -x + 4$  and  $y \geq 0$ .

- Find the three corner points of the region.
- Find its area.



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