

Systems of Linear Equations Review

Try each problem first. You don't need to finish everything.

Core path ~55 min · Full sheet ~1 h 45 min

Recommended: K1-K5, then one A and one T problem

K = Knowledge & Understanding · A = Application · T = Thinking · Boss = Challenge



vertexmath.ca
Hints, answers &
more worksheets

QUICK REFERENCE

Solution of a system: an ordered pair (x, y) that satisfies **both** equations. On a graph, it is the point where the lines intersect.

Number of solutions: different slopes, one solution. Same slope and different y -intercepts, none (inconsistent). Same slope and same y -intercept, infinitely many (dependent).

Check your answer in **both** original equations, not only the one you used last.

Show your work on separate paper.

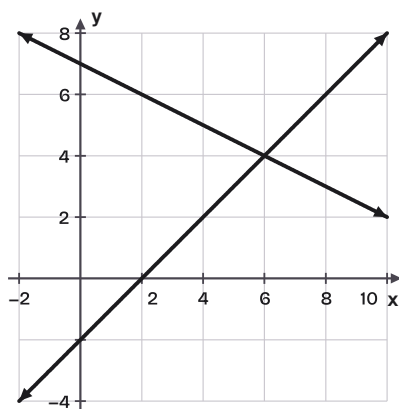
Core Skills (K)

Graphing · Substitution · Elimination · Number of Solutions · Modelling

K1 Is It a Solution?

Consider the system $x + y = 5$ and $2x - y = -2$.

- Determine whether $(1, 4)$ is a solution of the system.
- Determine whether $(4, 1)$ is a solution of the system.
- A different system is graphed below. Determine its solution.



K2 Substitution

Solve each system by substitution.

- $$\begin{cases} y = 3x - 5 \\ 4x + 2y = 20 \end{cases}$$
- $$\begin{cases} x = 2y + 1 \\ 3x - 4y = 7 \end{cases}$$
- $$\begin{cases} 2x + y = 1 \\ 5x - 3y = 19 \end{cases}$$

Substitution: isolate a variable, then replace it in the **other** equation, in brackets. **Elimination:** multiply every term, constant included, so one variable has matching coefficients, then add or subtract.

If the variables cancel and you get $0 = 0$, there are **infinitely many** solutions, not none. A false statement such as $0 = 5$ means no solution.

K3 Elimination

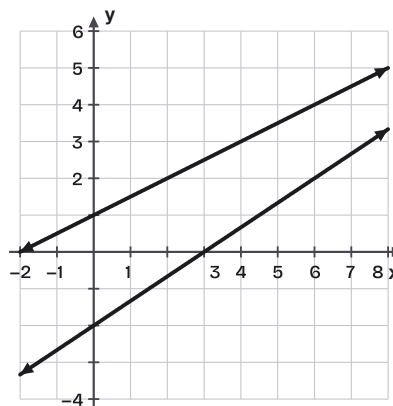
Solve each system by elimination.

- $$\begin{cases} 3x + 2y = 11 \\ 5x - 2y = 13 \end{cases}$$
- $$\begin{cases} 2x + 3y = 4 \\ x - 2y = 9 \end{cases}$$
- $$\begin{cases} 3x + 4y = 2 \\ 2x + 3y = 1 \end{cases}$$

K4 How Many Solutions?

Determine the number of solutions of each system without solving it.

- $$\begin{cases} y = 2x + 5 \\ y = 3x + 5 \end{cases}$$
- $$\begin{cases} 6x - 4y = 8 \\ 3x = 2y + 4 \end{cases}$$
- The system graphed below. Tick marks are 1 unit apart.



K5 Words to Equations

Define two variables and write a linear system for each situation. Do not solve.

- Two numbers have a sum of 42. The larger number is 6 more than twice the smaller.
- A theatre sold 220 tickets. Student tickets cost \$8, adult tickets cost \$12, and sales totalled \$2160.
- A class trip has 3 times as many students as teachers, and 52 people in all.

Real World (A)

Modelling with Systems · Interpreting Solutions

A1 Food Truck Sales

A food truck in Ottawa sells poutine for \$9 and hot dogs for \$5. On Saturday it sold 64 items for a total of \$440.

- Write a linear system that models Saturday's sales.
- Solve the system. How many of each item were sold?
- On Sunday the owner records 50 items sold for \$500. Solve this new system. What does the result tell you about the record?

A2 Climbing Gym Plans

Two climbing gyms in Toronto charge for a season as shown. $A(v)$ and $B(v)$ are the season costs, in dollars, for v visits at Gym A and Gym B.

v	0	5	10
$A(v)$	60	100	140
$B(v)$	0	75	150

- Write equations for $A(v)$ and $B(v)$.
- Solve the system $C = A(v)$, $C = B(v)$. Give v to one decimal place and C to the nearest cent.
- Visits come in whole numbers. Which gym is cheaper for 8 visits, and which for 9? Will the two gyms ever cost exactly the same?

A3 Against the Current

Leah paddles her canoe 12 km downstream on the Ottawa River in 1.5 h, then paddles back upstream in 3 h. Let c be her paddling speed in still water and r the speed of the current, both in km/h.

- Write a linear system for c and r .
- Solve the system and state both speeds.
- In spring the current reaches 7 km/h. Find Leah's upstream speed at the same paddling speed. Can she paddle the 12 km upstream?

Think It Through (T)

Error Analysis · Building Systems

T1 Spot the Flaw

A student solves the system $4x + 3y = 10$ and $2x - y = 10$:

"Multiply the second equation by 2: $4x - 2y = 10$. Subtract it from the first: $5y = 0$, so $y = 0$. Then $4x = 10$, so $x = 2.5$. Check: $4(2.5) + 3(0) = 10$. The solution is $(2.5, 0)$."

- Show that $(2.5, 0)$ is not a solution of the system.
- Identify the student's error, then solve the system correctly.
- Explain why the student's check worked even though the answer is wrong. What should the check have been?

T2 Tune the Constant

Consider the system $2x + ky = 6$ and $3x - 6y = 9$, where k is a constant.

- Find the value of k for which the system has infinitely many solutions.
- Keep $3x - 6y = 9$. Write a new first equation so that the system has no solution.
- A student claims some value of k makes the original system have no solution. Explain why the student is wrong.

Boss Level

Optional challenge

Systems in Disguise

These systems are not linear in x and y , but each becomes linear after a substitution.

- Solve $\begin{cases} \frac{3}{x} + \frac{2}{y} = 2 \\ \frac{x}{6} - \frac{y}{4} = 0 \end{cases}$
- Solve $\begin{cases} \frac{4}{x-1} + \frac{3}{y+2} = 5 \\ \frac{x-1}{2} - \frac{y+2}{9} = -1 \end{cases}$
- The system $\frac{1}{x} + \frac{1}{y} = 2$ and $\frac{2}{x} + \frac{2}{y} = 4$ has infinitely many solutions. Find two of them, and the one nonzero value that x can never take.



vertexmath.ca
Hints, answers &
more worksheets

Free to print, copy, adapt and share for
classroom use · CC BY-NC 4.0 · ©
VertexMath