Unit 4 · Systems of Linear Equations Cheat Sheet

Unit 4 focus: slope-intercept form and solving systems by graphing

1 KEY VOCABULARY

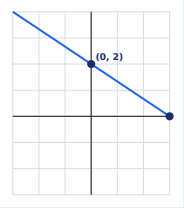
system	Two or more equations with the same variables.	two lines
solution	An ordered pair that makes every equation true.	$(2, 3)$
slope-intercept	$y = mx + b$: slope m, y-intercept b.	$y = 4x - 3$
parallel	Same slope, different intercepts; never meet.	$y = 2x$ and $y = 2x + 5$

2 SLOPE-INTERCEPT GRAPHS

Plot the y-intercept b, then use the slope (rise over run) to find more points.

Example: Graph $2x + 3y = 6$.
Solve for y: $3y = -2x + 6$, $y = -\frac{2}{3}x + 2$
Plot: start at $(0, 2)$, down 2, right 3

Answer: line through $(0, 2)$ and $(3, 0)$

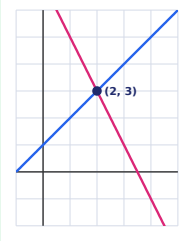


3 SOLVING BY GRAPHING

Graph both lines. The point where they cross is the solution. Check it in both equations.

Example: $y = x + 1$ and $y = -2x + 7$
Crossing: $(2, 3)$
Check: $3 = 2 + 1$ ✓ and $3 = -4 + 7$ ✓

Answer: $(2, 3)$



4 HOW MANY SOLUTIONS?

One: different slopes (lines cross). **None**: same slope, different b (parallel). **Infinitely many**: same slope and same b (the same line).



one | none | infinitely many

5 SOLVING BY INSPECTION

System	Look at…	Solutions
$y = 3x + 1$, $y = 3x - 4$	same slope, different b	none
$x + y = 5$, $2x + 2y = 10$	second = first × 2	infinitely many
$y = 2x$, $y = -x + 6$	different slopes	one

6 QUICK REMINDERS & COMMON MISTAKES

✓ Do remember

- Write the solution as an ordered pair (x, y).
- Check the pair in **both** equations.
- Line up x, y and numbers before eliminating.

✘ Common mistakes

- Solving for x only: find y too
- Subtracting only part of an equation: subtract every term
- "$0 = 0$ means no solution": it means infinitely many

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More practice: substitution, elimination, inspection and word problems

1 SUBSTITUTION

Use when one equation is already solved for a variable. Replace that variable in the other equation.

Example: $y = 2x - 1$ and $3x + y = 14$
Substitute: $3x + (2x - 1) = 14$
Solve: $5x = 15,\ x = 3$
Back-substitute: $y = 2(3) - 1 = 5$
Answer: $(3, 5)$

2 ELIMINATION

Add or subtract the equations so one variable cancels. Multiply an equation first if needed.

Example: $2x + 3y = 12$ and $4x - 3y = 6$
Add: $6x = 18,\ x = 3$
Substitute: $2(3) + 3y = 12,\ y = 2$
Answer: $(3, 2)$

3 MULTIPLY, THEN ELIMINATE

Make the coefficients of one variable opposites.

Example: $x + 2y = 7$ and $3x - y = 7$
Multiply 2nd by 2: $6x - 2y = 14$
Add: $7x = 21,\ x = 3$, then $y = 2$
Answer: $(3, 2)$

4 WHICH METHOD?

If you see…	Use
a variable already alone ($y = \ldots$)	substitution
opposite coefficients ($3y$ and $-3y$)	elimination (add)
same slopes / multiples	inspection
a picture or a quick estimate	graphing

5 WORD PROBLEMS

Define two variables, write two equations, solve, then answer in words.

Example: Tickets: adults \$8, students \$5. 20 tickets cost \$121. How many of each?
Equations: $a + s = 20,\ 8a + 5s = 121$
Substitute $s = 20 - a$**:** $3a + 100 = 121,\ a = 7$
Answer: 7 adult and 13 student tickets

6 CHECK YOURSELF

- Does my ordered pair make **both** equations true?
- Did I find both x and y?
- If the variables vanished, did I decide none (false) or infinitely many (true)?
- Does my word-problem answer make sense (whole tickets, positive amounts)?