

Expressions and Equations Review

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

Core path ~55 min · Full sheet ~1 h 50 min

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

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



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QUICK REFERENCE

Like terms have the same variables with the same exponents: $3x^2$ and $-x^2$ are like terms; $3x^2$ and $3x$ are not.

Solving: expand brackets, multiply **every** term by the LCD to clear fractions, collect the variable on one side, then undo $+/-$ before $\times/ \div$.

7 less than x is $x - 7$, not $7 - x$.

Show your work on separate paper.

Core Skills (K)

Expressions · Like Terms · Two-Step · Multi-Step · Formulas

K1 Words to Algebra

- Write an expression for 7 less than three times a number n .
- Write an expression for twice the sum of a number k and 4.
- Evaluate $-x^2 + 5x$ for $x = -3$.

K2 Simplify

- Simplify $4x^2 + 3x - x^2 + 5 - 7x$. Then state the number of terms and the coefficient of x in your answer.
- Simplify $-3(2a - 5) + 4a$.
- Simplify $5(y - 2) - 2(3y + 4)$.

K3 Two-Step Equations

Solve each equation.

- $\frac{n}{4} - 3 = 2$
- $5x + 8 = -12$
- $7 - 3x = 22$

K4 Multi-Step Equations

Solve each equation.

- $-3(x - 4) = 2x - 3$
- $4x + 7 = 9x - 18$
- $\frac{x-1}{3} + 2 = \frac{x}{2}$

K5 Rearranging Formulas

- Solve $y = 3x - 6$ for x .
- Solve $A = \frac{bh}{2}$ for h . Then find h when $A = 30 \text{ cm}^2$ and $b = 12 \text{ cm}$.

Distribute the sign too: $-2(x - 3) = -2x + 6$. Multiply before you subtract: $5 - 2(x - 3)$ is **not** $3(x - 3)$.

Check: substitute your answer into the **original** equation. Both sides must be equal.

- The angles inside a polygon with n sides add to $S = 180(n - 2)$ degrees. Solve for n .

Real World (A)

Equations in Context · Perimeter · Comparing Plans

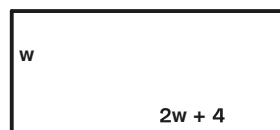
A1 Canoe Rental

An outfitter in Algonquin Park rents canoes for \$15 plus \$12 for each hour.

- Write an equation for the total cost C , in dollars, of renting a canoe for h hours. Then find the cost of a 3-hour rental.
- A group paid \$75. For how many hours did they rent the canoe?
- The outfitter charges any part of an hour as a full hour. You have \$70. Solve $12h + 15 = 70$, then state the longest rental you can afford.

A2 Community Garden

A rectangular community garden in Hamilton is enclosed by 62 m of fencing. Its length is 4 m more than twice its width w .



- Write an equation for the perimeter and solve it. State the width and the length.
- Compost is spread at 2 kg per square metre. How much compost does the garden need?

- c) The council asks for a design with the same 62 m of fencing where the length is 35 m more than the width. Solve for the width. What does your answer tell the council?

A3 Phone Plans

The table shows the monthly cost, in dollars, of two phone plans for g gigabytes (GB) of data. Each plan charges a fixed fee plus a rate per GB.

Data (GB)	0	2	4	6
Plan A cost	25	29	33	37
Plan B cost	40	41	42	43

- a) Write an equation for the cost of each plan, A and B , in terms of g .
- b) Solve $A = B$. For how much data do the plans cost the same, and what is that cost?
- c) Plan B allows at most 8 GB per month. Can a Plan B customer ever pay the same as on Plan A? Which plan is cheaper for every amount of data Plan B allows?

Think It Through (T)

Error Analysis · Counterexamples

T1 Spot the Flaw

A student solves $5 - 2(x - 3) = 4x - 1$:

"First $5 - 2 = 3$, so $3(x - 3) = 4x - 1$. Then

$3x - 9 = 4x - 1$, so $x = -8$."

- a) Substitute $x = -8$ into both sides of the original equation. Is it a solution?
- b) Identify the student's error and explain why the step is not allowed.
- c) Solve the equation correctly and verify your answer.

T2 One Test Isn't Proof

Three students solve the rectangle formula $P = 2(l + w)$ for w .

Ava: $w = \frac{P}{2} - l$ · Jun: $w = \frac{P - 2l}{2}$ · Noor: $w = P - l - 14$

- a) Test all three formulas on a rectangle with $l = 10$ cm and $w = 4$ cm. Which formulas give the correct width?
- b) Find a rectangle that proves Noor's formula is wrong.
- c) Show that Ava's and Jun's formulas are equivalent. Explain why one successful test can't prove a formula is correct.

Boss Level

Optional challenge

There and Back

Maya cycles 30 km along the Niagara River Recreation Trail at 20 km/h, then rides the same 30 km back.

Average speed for a trip is the total distance divided by the total time.

- a) She rides back at 30 km/h. Find her average speed for the whole trip.
- b) At what speed must she ride back for her average speed over the whole trip to be 30 km/h?
- c) Is there a return speed that makes her average speed 40 km/h? Justify with an equation.



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