

Grade 9 Skills 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



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QUICK REFERENCE

Slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$, rise over run, subtracting in the same order on top and bottom. A horizontal line $y = k$ has slope 0; a vertical line $x = k$ has an undefined slope.

Expanding: every term of one bracket multiplies every term of the other. $(a + b)^2 = a^2 + 2ab + b^2$, **not** $a^2 + b^2$.

Map scale 1 : n : 1 cm on the map is n cm in reality. 1 km = 100 000 cm.

Show your work on separate paper.

Core Skills (K)

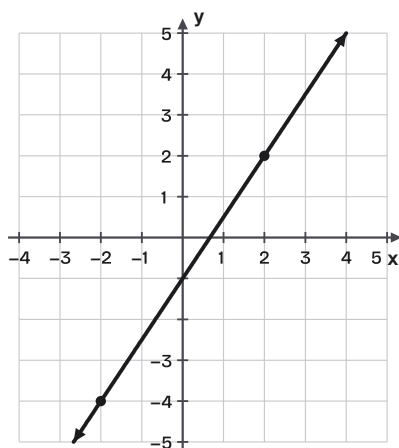
Slope · Equations of Lines · Expanding · Pythagorean Theorem · Proportions

K1 Reading Slope

- Determine the slope of the line through $(-3, 4)$ and $(5, -2)$.
- The points in the table lie on a line. Determine its equation in the form $y = mx + b$.

x	-1	1	3	5
y	8	5	2	-1

- Determine the equation of the line graphed below. Each grid square is 1 unit.



K2 Forms of a Line

From $Ax + By + C = 0$ **to** $y = mx + b$: isolate y , then divide **every** term by B . For an intercept, set the other variable to 0.

Pythagorean theorem: $a^2 + b^2 = c^2$, where c is the hypotenuse, the longest side, opposite the right angle. To find a leg, subtract: $a^2 = c^2 - b^2$.

- Write $3x - 4y + 8 = 0$ in the form $y = mx + b$.
- Find the x - and y -intercepts of $5x - 2y = 20$.
- Determine the equation of the line through $(-2, 7)$ with slope -3 , in the form $Ax + By + C = 0$.

K3 Distribute Every Term

Expand and simplify.

- $-3x(2x^2 - 5x + 4)$
- $4(2x - 3) - (5x - 7)$
- $2x(x + 5) - 3(x^2 - 2x + 1)$

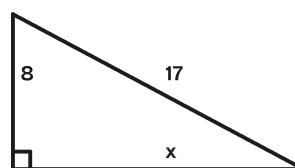
K4 Multiplying Binomials

Expand and simplify.

- $(x - 6)(x + 4)$
- $(3x - 2)^2$
- $3(x + 2)^2 - (2x - 1)(2x + 1)$

K5 Right Triangles & Proportions

- A right triangle has legs 6 cm and 9 cm. Find the hypotenuse, to the nearest tenth.
- Find x in the right triangle below.



- Solve $\frac{9}{x} = \frac{12}{20}$.

Real World (A)

Linear Models · Ladders · Map Scales

A1 Rain Barrel

A full rain barrel drains through a tap at a constant rate. The table shows the volume of water left.

t (min)	0	4	8	12
V (L)	180	156	132	108

- Determine an equation for V in terms of t . What do the slope and the V -intercept mean for the barrel?
- After how many minutes will 75 L remain?
- The equation gives $V = -60$ when $t = 40$. How much water is in the barrel after 40 minutes?

A2 Ladder Safety

A painter has a 6.5 m ladder. Safety guidelines say the foot of a ladder should be 1 m out from the wall for every 4 m of height it reaches up the wall. Round answers to the nearest hundredth of a metre.

- The foot of the ladder is 1.2 m from the wall. How high up the wall does the ladder reach?
- The painter follows the guideline: the height reached is 4 times the distance d from the foot to the wall. Find d and the height reached.
- A gutter is 6.35 m high, less than the ladder's length. Can the painter reach it safely with this ladder?

A3 Park Map

A map of a provincial park has the scale 1 : 25 000.

- A portage trail measures 7.4 cm on the map. Find its real length in kilometres.
- On the map, a campsite is 6 cm east and 4.5 cm north of the canoe launch. Find the real straight-line distance between them in kilometres.
- A camper enlarges the map to 200% on a photocopier. The copy still prints "1 : 25 000". What length does the trail from (a) measure on the copy, what real length does the printed scale give, and what is the true scale of the copy?

Think It Through (T)

Error Analysis · Counterexamples · Building Lines

T1 Spot the Flaw

A student expands $3(x - 4)^2$:

$$3(x - 4)^2 = (3x - 12)^2 = 9x^2 - 144$$

- Evaluate $3(x - 4)^2$ and $9x^2 - 144$ at $x = 5$. What does the result tell you?
- Identify the two errors.

- Expand $3(x - 4)^2$ correctly, and check your answer at $x = 5$.

T2 Lines from Clues

- A student claims: "Every line has exactly one y -intercept." Give the equation of a line that is a counterexample, and state its slope.
- Determine the equation of the line through $(-4, 1)$ that has the same y -intercept as $3x - 2y + 6 = 0$.
- Determine the equation of the line parallel to $2x + 5y = 10$ with x -intercept 4, in the form $Ax + By + C = 0$.

Boss Level

Optional challenge

Hidden Hypotenuse

A right triangle has legs a and b and hypotenuse c , in centimetres. The legs add up to 17 cm and the area is 30 cm².

- Find ab .
- Find c without finding a and b .
- Find $(a - b)^2$, then the lengths of the two legs.



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