Grade 9 Math Review — Getting Ready for Grade 10

You will need both lined paper and graph paper.

A. Exponent laws

Grade 10 connection: you will expand expressions like $(2x+5)^2$, and meet zero and negative exponents in $y = 2^x$.

A1 Evaluate.

a) 2^5 b) $(-3)^4$ c) -3^4 d) 5^0 e) 2^{-3}

A2 Write as a single power.

a) $3^4 \times 3^5$ b) $7^{10} \div 7^4$ c) $(5^3)^4$

d) $\dfrac{2^6 \times 2^3}{2^5}$ e) $(x^3)(x^7)$ f) $\dfrac{(y^5)^2}{y^3}$

A3 Simplify.

a) $(4x^3)(-3x^5)$ b) $\dfrac{18a^7b^3}{6a^2b}$ c) $(2m^3)^4$

d) $(-3x^2y)^3$ e) $\dfrac{(6x^5)(2x^3)}{4x^6}$ f) $(x^4)^3 \times (5x)^0$

A4 Scientific notation.

a) Write 4 500 000 in scientific notation.

b) Write 0.000 032 in scientific notation.

c) Evaluate $(3 \times 10^4)(2 \times 10^5)$. Give your answer in scientific notation.

d) A student wrote $2^3 \times 2^4 = 4^7$. Explain the mistake and give the correct value.

B. Simplifying expressions

Grade 10 connection: expanding and factoring are the main tools for solving quadratic equations.

B1 Simplify by collecting like terms.

a) $5x + 3 - 2x + 7$ b) $4a^2 - 3a + 2a^2 + 5a - 1$ c) $3xy - 5x + 2xy + x$

B2 Expand and simplify.

a) $4(2x - 5)$ b) $-3(x^2 - 4x + 2)$ c) $2x(3x + 7)$

d) $5(x + 2) - 3(2x - 1)$ e) $3(2a - 4) + 2(a + 6)$ f) $x(x + 4) - 2(x^2 - 3x)$

B3 Which of these expressions are equivalent to $6x - 9$? Show how you know.

a) $3(2x - 3)$ b) $6(x - 9)$ c) $2(3x - 4) - 1$ d) $9 - 6x$

B4 A rectangle has a length of $x + 5$ and a width of $2x$.

a) Write and simplify an expression for its perimeter.

b) Write and simplify an expression for its area.

c) Find the perimeter and the area when $x = 3$.

C. Solving equations

Grade 10 connection: solving linear systems and rearranging to $y = mx + b$ happen in almost every lesson.

C1 Solve. Check each answer by substituting it into the equation.

a) $5 - 2x = 17$ b) $7x - 4 = 3x + 18$ c) $2(3x + 1) - 5 = 4x + 9$

d) $\frac{x}{4} + 3 = 7$ e) $\frac{2x - 1}{3} = 5$ f) $0.5(x + 6) = 2x - 3$

C2 Rearrange each formula to solve for the variable shown.

a) $y = 3x - 6$, for x b) $2x + 5y = 10$, for y c) $P = 2l + 2w$, for w

C3 A number is tripled and then decreased by 8. The result is 25. Write an equation and solve it to find the number.

D. Graphing lines

Grade 10 connection: slope, y-intercepts, and parallel and perpendicular lines are the base of analytic geometry, and moving a line prepares you for moving parabolas.

D1 State the slope and the y-intercept of each line.

a) $y = 2x - 5$ b) $y = -\frac{3}{4}x + 1$ c) $y = 6$

d) $3x + y = 8$ e) $2x - 4y = 12$

D2 On grid paper, graph each relation. Use a table of values, or the slope and y-intercept.

a) $y = 3x - 2$ b) $y = -\frac{1}{2}x + 4$ c) $x + y = 5$

d) $x = -3$ e) $2x - 3y = 6$

D3 Find the slope of the line through each pair of points.

a) $(1, 2)$ and $(4, 11)$ b) $(-2, 5)$ and $(4, 1)$ c) $(3, -1)$ and $(3, 6)$ d) $(-5, 4)$ and $(2, 4)$

D4 Write the equation of each line in the form $y = mx + b$.

a) slope 4, y-intercept -7

b) slope -2, through $(3, 1)$

c) through $(2, 3)$ and $(6, 11)$

d) the line in the graph below

e) the line in the table below

Graph for part d:

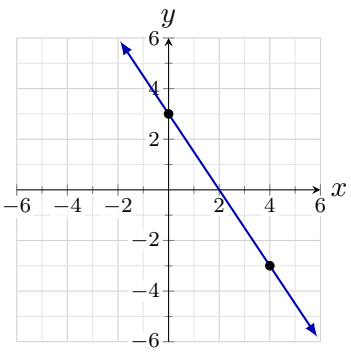


Table for part e:

x	y
0	5
1	8
2	11
3	14

D5 Parallel and perpendicular lines.

a) Which of these lines are parallel? $y = 2x + 3$ $y = 3x + 2$ $y = 2x - 5$ $4x - 2y = 6$

b) Write the equation of the line that is parallel to $y = -3x + 4$ and has a y-intercept of -2.

c) **Preview of Grade 10:** on one grid, graph $y = 2x$ and $y = -\frac{1}{2}x$. Measure the angle where they cross. What do you notice about the two slopes?

D6 Describe how the graph of $y = 2x$ changes to become each line (translation, reflection or rotation).

a) $y = 2x + 3$ b) $y = -2x$ c) $y = 5x$

E. Linear relations in real situations

Grade 10 connection: you will write and solve linear systems to compare real plans and prices.

E1 Maple Movers charges a \$120 flat fee (a fixed amount) plus \$85 per hour.

a) Write an equation for the total cost, C, in dollars, for a move that takes h hours.

b) How much does a 4.5-hour move cost?

c) A family has \$800 to spend on movers. How many hours can they afford?

d) What does the slope mean in this situation? What does the C-intercept mean?

E2 Speedy Moves charges a $200 flat fee (a fixed amount) plus $60 per hour.

a) Write an equation for Speedy Moves' total cost.
b) On the same axes, graph the cost equations for both companies, from 0 to 8 hours.
c) Find the point of intersection algebraically.
d) Explain what the point of intersection means for a family choosing a mover.
e) A move takes 6 hours. Which company is cheaper, and by how much?

E3 Water drains from a pool at a steady rate.

Time, t (min)	0	5	10	15	20
Water, W (L)	12 000	11 250	10 500	9 750	9 000

a) Is the relationship linear? How do you know?
b) What is the rate of change? Include units.
c) Write an equation for the water remaining, W, after t minutes.
d) When will the pool be empty?

E4 Is each relationship linear or non-linear?

a) A phone plan costs $25 per month plus $0.10 per text.
b) Money in a bank account earning compound interest.
c) The area of a square compared with its side length.
d) The cost of gas at $1.60 per litre.

F. Right triangles and proportions

Grade 10 connection: the Pythagorean theorem and proportions lead to the length formula, similar triangles and trigonometry.

F1 Find the unknown side length of each right triangle.

a) The legs are 9 cm and 12 cm. Find the hypotenuse.
b) The hypotenuse is 13 m and one leg is 5 m. Find the other leg.

F2 At the same time of day, a 1.8 m tall student makes a 2.4 m shadow and a tree makes a 16 m shadow. How tall is the tree?

Grade 9 Math Review — Final Answers

Final answers only. Equivalent forms are fine (for example, 0.125 for $\frac{1}{8}$).

A. Exponent laws

A1 a) 32 b) 81 c) -81 d) 1 e) $\frac{1}{8}$

A2 a) 3^9 b) 7^6 c) 5^{12}
d) 2^4 e) x^{10} f) y^7

A3 a) $-12x^8$ b) $3a^5b^2$ c) $16m^{12}$
d) $-27x^6y^3$ e) $3x^2$ f) x^{12}

A4 a) 4.5×10^6
b) 3.2×10^{-5}
c) 6×10^9
d) The bases should not be multiplied. Keep the base and add the exponents: $2^3 \times 2^4 = 2^7 = 128$.

B. Simplifying expressions

B1 a) $3x + 10$ b) $6a^2 + 2a - 1$ c) $5xy - 4x$

B2 a) $8x - 20$ b) $-3x^2 + 12x - 6$ c) $6x^2 + 14x$
d) $-x + 13$ e) $8a$ f) $-x^2 + 10x$

B3 a) equivalent b) not equivalent ($6x - 54$)
c) equivalent d) not equivalent

B4 a) $6x + 10$
b) $2x^2 + 10x$
c) perimeter 28, area 48

C. Solving equations

C1 a) $x = -6$ b) $x = 5.5$ c) $x = 6$
d) $x = 16$ e) $x = 8$ f) $x = 4$

C2 a) $x = \dfrac{y+6}{3}$ b) $y = -\dfrac{2}{5}x + 2$ c) $w = \dfrac{P-2l}{2}$ or $w = \dfrac{P}{2} - l$

C3 $3n - 8 = 25$, so the number is 11.

D. Graphing lines

D1 a) slope 2, y-intercept -5

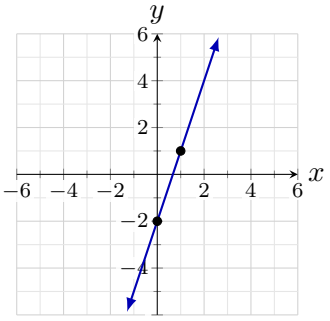
b) slope $-\dfrac{3}{4}$, y-intercept 1

c) slope 0, y-intercept 6

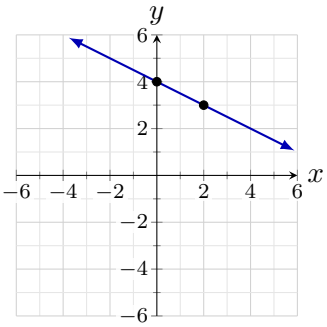
d) slope -3, y-intercept 8

e) slope $\dfrac{1}{2}$, y-intercept -3

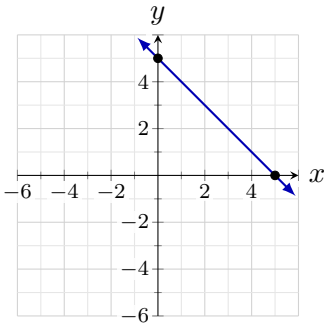
D2 a) $y = 3x - 2$



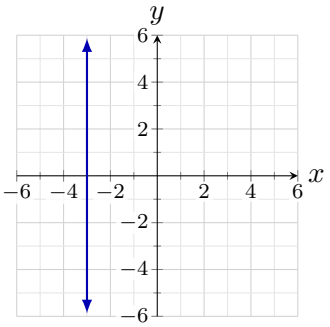
b) $y = -\frac{1}{2}x + 4$



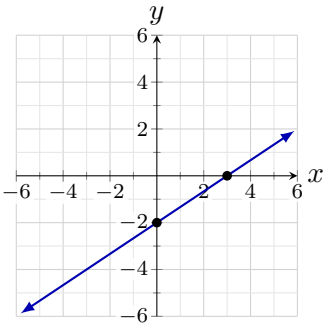
c) $x + y = 5$



d) $x = -3$



e) $2x - 3y = 6$



e) $y = \frac{2}{3}x - 2$: x-intercept 3, y-intercept -2.

D3 a) 3

b) $-\dfrac{2}{3}$

c) undefined (vertical line)

d) 0 (horizontal line)

D4 a) $y = 4x - 7$ b) $y = -2x + 7$ c) $y = 2x - 1$

d) $y = -\dfrac{3}{2}x + 3$ e) $y = 3x + 5$

D5 a) $y = 2x + 3$, $y = 2x - 5$ and $4x - 2y = 6$ (all have slope 2)

b) $y = -3x - 2$

c) They cross at 90° (perpendicular). The slopes 2 and $-\frac{1}{2}$ are negative reciprocals: their product is -1.

D6 a) translated up 3 units

b) reflected in the y-axis (or the x-axis)

c) rotated about the origin, so it is steeper (either idea is enough)

E. Linear relations in real situations

E1 a) $C = 85h + 120$

b) \$502.50

c) 8 hours

d) Slope: the cost goes up \$85 for every hour (the rate of change). C-intercept: the \$120 flat fee, charged even before any time is worked.

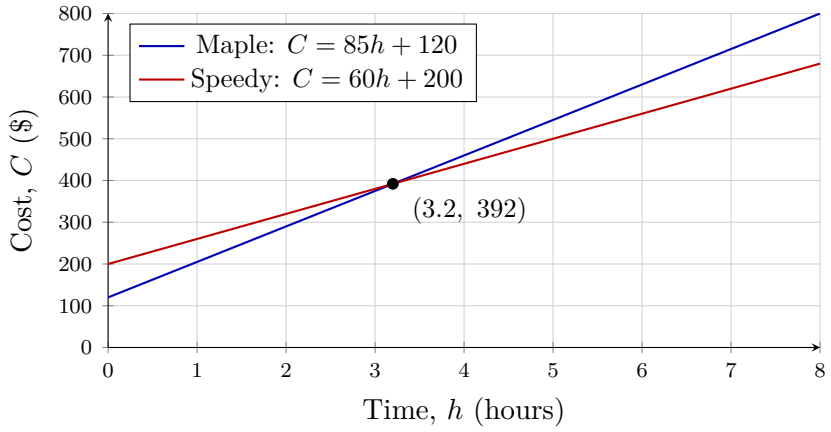
E2 a) $C = 60h + 200$

b) see the graph below

c) (3.2, 392)

d) At 3.2 hours (3 h 12 min) both companies charge \$392. Maple Movers is cheaper for shorter moves; Speedy Moves is cheaper for longer moves.

e) Speedy Moves (\$560 compared with \$630), by \$70



E3 a) Yes: the first differences are constant (-750 L every 5 minutes).

b) -150 L/min

c) $W = -150t + 12\,000$

d) after 80 minutes

E4 a) linear b) non-linear c) non-linear d) linear

F. Right triangles and proportions

F1 a) 15 cm b) 12 m

F2 12 m