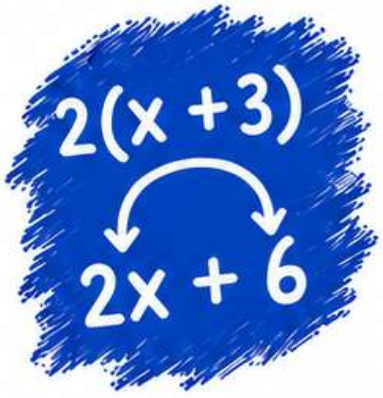


BEYOND THE ALGORITHM

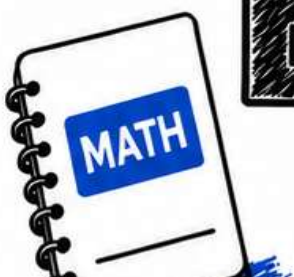


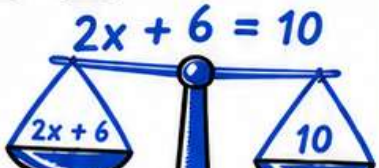
GRADE 7 MATH

UNIT 2

EXPRESSIONS & EQUATIONS

EXTENSION BOOKLET





Name:

How to use this booklet

FOCUS 0 / START HERE

Complete each focus after the corresponding lessons in your Grade 7 Expressions & Equations note package. Each topic has four questions that ask you to investigate, construct examples, test a claim, or make a decision. Some allow more than one valid response.

Make your thinking visible

Show steps, define variables, explain decisions, and include units. Use words, algebra, diagrams, or number lines as appropriate. A numerical example can test a claim; algebra can help establish why it holds in general.

Focus	Topic	Pages	Done
1	Exponent rules	3–4	☐
2	Order of operations	5–6	☐
3	Substitution	7–8	☐
4	The distributive property	9–10	☐
5	Equivalent expressions	11–12	☐
6	GCF and factoring	13–14	☐
7	Writing expressions	15–16	☐
8	One- and two-step equations	17–18	☐
9	Multi-step equations	19–20	☐
10	Equations in context	21–22	☐
11	Solving inequalities	23–24	☐
12	Inequalities in context	25–26	☐
T	Transfer tasks	27–28	☐

Extension habits

Try another representation. Check in the original statement. Look for a counterexample. Explain why a list is complete.

Calculator use: Follow your teacher's directions. A calculator may support a check; written reasoning is still required.

Exponent rules

FOCUS 1 / QUESTIONS 1.1–1.2

1.1 A square tile has side length 2^3 cm, and a larger square has side length 2^5 cm. How many small tiles, with no gaps or overlaps, cover the large square exactly? Justify your answer in two ways: with an area diagram and with exponent rules.

1.2 Two nonnegative whole numbers p and q satisfy $a^p a^q = a^{10}$ and $(a^p)^q = a^{21}$ for every $a > 1$. Find *all* possible ordered pairs (p, q). Explain why there are no others.

Exponent rules

FOCUS 1 / QUESTIONS 1.3–1.4

1.3 Find all pairs of whole numbers m, n from 1 to 8 for which $\dfrac{(x^m)^2}{x^n} = x^6$ for every nonzero x. Describe a pattern that lets you find the pairs without testing all 64 possibilities.

1.4 A classmate says $(2x)^0$ and $2x^0$ are always equal because both have an exponent of zero. Evaluate both for $x = 4$, then explain the difference for every nonzero x. Why must $x = 0$ be excluded?

Order of operations

FOCUS 2 / QUESTIONS 2.1–2.2

2.1 Use $1, 2, 3, 4$ exactly once each to make 24 in two structurally different ways. You may use $+, -, \times, \div$ and brackets. Explain the order of operations in each solution.

2.2 A student evaluates $8 + 12 \div 3 \times 2^2$ and gets 9. Show how the student may have inserted brackets to get 9. Then evaluate the expression *as written*, explaining the left-to-right step.

Order of operations

FOCUS 2 / QUESTIONS 2.3–2.4

2.3 Two students disagree about $-3^2 + (-3)^2 \times 2$. One treats -3^2 as 9; the other treats $(-3)^2$ as -9. Explain both errors and find the correct value. Create a new expression whose value is -9.

2.4 For which digits d from 1 to 9 is $\dfrac{52}{4 + (d-2)^2}$ a whole number? Use factors of 52 to justify that your list is complete; avoid nine long divisions.

Substitution

FOCUS 3 / QUESTIONS 3.1–3.2

3.1 Evaluate $E = 2p^2 - pq$ for $(p, q) = (-2, 3)$ and for $(p, q) = (2, -3)$. Conjecture what happens if *both* inputs change sign together, and justify your conjecture algebraically.

3.2 For $x = -2, 0, 2$, evaluate $3x^2 - 2x$ and $3x^2 + 2x$. At which of these inputs are they equal? Decide whether they can be equal at any other input, and explain.

Substitution

FOCUS 3 / QUESTIONS 3.3–3.4

3.3 Find every integer pair (a, b) with $-3 \le a, b \le 3$ for which $2a - 3b = 1$. Organise your search so you can explain why no pair was missed.

3.4 A student substitutes $x = -2$ into $5 - 3x^2$ and writes $5 - 3(-2)^2 = (5 - 3(-2))^2 = 121$. Explain precisely which part should be squared, and calculate the correct value.