Year 7 · Algebra: Solving Equations and Spotting Patterns

Name: _____ Date: _____

Kia ora! This sheet helps you tidy up algebra expressions, solve equations step by step, and find rules in patterns. Take your time and always check your answers by substituting back in.

Warm-up

1. Simplify: $4a + a + 2a$

2. Solve for t: $t + 7 = 12$

3. If $w = 4$, find the value of $w + 12$.

4. True or false? $3 \times 5 > 2 \times 7$

Practice

5. Simplify: $6b - 2b + 3b$

6. Solve for s: $5s + 3 = 18$

7. Aria buys 3 identical drink bottles at the Avondale market. She pays with a $20 note and gets $5 change. Let c be the cost of one bottle. Write an equation and find c.

8. The area of a rectangle is $A = l \times w$. A netball court section has area $A = 48$ m² and length $l = 8$ m. Rearrange the formula to make w the subject, then find w.

9. Tane is stacking chairs for a school event. He starts with 4 chairs and adds 3 chairs each minute. The number of chairs t after n minutes is $t = 3 \times n + 4$. How many chairs are there after 6 minutes?

10. Plot these three points on a coordinate plane and state which quadrant each is in: A(3, 2), B(−4, 1), C(−2, −3).

Challenge

11. A pattern of matchstick triangles grows like this: 1 triangle uses 3 matches, 2 triangles use 5 matches, 3 triangles use 7 matches. Find a rule in the form $t = a \times n + d$ for the number of matches t for n triangles, then work out how many matches are needed for 20 triangles.

12. Solve for x: $4x - 5 = 2x + 7$. Then check your answer by substituting into both sides.

Answer key (for parents and tutors)

1. Simplify: $4a + a + 2a$
   Add the like terms: $4a + a + 2a$. Count the a's: $4 + 1 + 2 = 7$, so the answer is $7a$.

2. Solve for t: $t + 7 = 12$
   Use the inverse of adding 7, which is subtracting 7. $t = 12 - 7 = 5$. Check: $5 + 7 = 12$. ✓

3. If $w = 4$, find the value of $w + 12$.
   Substitute $w = 4$: $4 + 12 = 16$.

4. True or false? $3 \times 5 > 2 \times 7$
   Work out each side: $3 \times 5 = 15$ and $2 \times 7 = 14$. Since $15 > 14$, the statement is TRUE.

5. Simplify: $6b - 2b + 3b$
   Collect like terms: $6b - 2b = 4b$, then $4b + 3b = 7b$. The answer is $7b$.

6. Solve for s: $5s + 3 = 18$
   First subtract 3 from both sides: $5s = 18 - 3 = 15$. Then divide both sides by 5: $s = 15 \div 5 = 3$. Check: $5 \times 3 + 3 = 15 + 3 = 18$. ✓

7. Aria buys 3 identical drink bottles at the Avondale market. She pays with a $20 note and gets $5 change. Let c be the cost of one bottle. Write an equation and find c.
   The 3 bottles cost $20 - 5 = $15. Equation: $3c = 15$. Divide both sides by 3: $c = 15 \div 3 = $5. Each bottle costs $5. Check: $3 \times 5 = 15$, and $20 - 15 = 5$ change. ✓

8. The area of a rectangle is $A = l \times w$. A netball court section has area $A = 48$ m² and length $l = 8$ m. Rearrange the formula to make w the subject, then find w.
   Divide both sides of $A = lw$ by l to make w the subject: $w = A \div l$. Substitute the numbers: $w = 48 \div 8 = 6$ m. Check: $8 \times 6 = 48$ m². ✓

9. Tane is stacking chairs for a school event. He starts with 4 chairs and adds 3 chairs each minute. The number of chairs t after n minutes is $t = 3 \times n + 4$. How many chairs are there after 6 minutes?
   Substitute $n = 6$ into $t = 3 \times n + 4$: $t = 3 \times 6 + 4 = 18 + 4 = 22$ chairs.

10. Plot these three points on a coordinate plane and state which quadrant each is in: A(3, 2), B(−4, 1), C(−2, −3).
    A(3, 2): right and up, so first quadrant (top right). B(−4, 1): left and up, so second quadrant (top left). C(−2, −3): left and down, so third quadrant (bottom left). Plot by moving along the x-axis first, then up or down for y.

11. A pattern of matchstick triangles grows like this: 1 triangle uses 3 matches, 2 triangles use 5 matches, 3 triangles use 7 matches. Find a rule in the form $t = a \times n + d$ for the number of matches t for n triangles, then work out how many matches are needed for 20 triangles.
    Look at the increase: 3, 5, 7 goes up by 2 each time, so $a = 2$. To find d, use $n = 1$: $t = 2 \times 1 + d = 3$, so $2 + d = 3$, giving $d = 1$. The rule is $t = 2 \times n + 1$. For 20 triangles: $t = 2 \times 20 + 1 = 40 + 1 = 41$ matches. Check with $n = 3$: $2 \times 3 + 1 = 7$. ✓

12. Solve for x: $4x - 5 = 2x + 7$. Then check your answer by substituting into both sides.
    Get the x terms on one side by subtracting $2x$ from both sides: $4x - 2x - 5 = 7$, which gives $2x - 5 = 7$. Add 5 to both sides: $2x = 12$. Divide by 2: $x = 6$. Check: left side $4 \times 6 - 5 = 24 - 5 = 19$; right side $2 \times 6 + 7 = 12 + 7 = 19$. Both sides equal 19. ✓