Year 8 · Algebra: Solving Equations and Spotting Patterns

Name: _____ Date: _____

Kia ora! This sheet helps you get confident forming and solving equations, simplifying expressions, and finding the rules behind number patterns. Take your time and check each answer by substituting back in.

Warm-up

1. Solve: $x + 8 = 15$

2. Simplify: $4a + 3a - a$

3. If $w = 5$, find the value of $w + 12$.

4. Solve: $3s = 18$

Practice

5. Solve: $5s + 9 = -6$

6. Solve: $t + 7 = 6.5$

7. Expand and simplify: $2(x + 3) + 1$

8. Factorise fully: $5x - 35$

9. Aroha buys 4 identical smoothies at the Avondale market and pays with a $20 note. She gets $3.20 change. Write and solve an equation to find the price of one smoothie.

10. To hire a kayak on the Whau River costs a $12 booking fee plus $9 for each hour. The cost C in dollars for h hours is $C = 9h + 12$. (a) Find the cost for 4 hours. (b) Tane paid $75. Solve for how many hours he hired the kayak.

Challenge

11. Solve the inequality $t - 3 \geq -5$ and show the solution on a number line.

12. A tiling pattern grows so that shape 1 uses 5 tiles, shape 2 uses 8 tiles, shape 3 uses 11 tiles. (a) Write a rule for the number of tiles t in terms of the shape number n. (b) How many tiles are in shape 10? (c) Which shape uses 62 tiles?

Answer key (for parents and tutors)

1. Solve: $x + 8 = 15$
   Subtract 8 from both sides: $x = 15 - 8 = 7$. Check: $7 + 8 = 15$. ✓ So $x = 7$.

2. Simplify: $4a + 3a - a$
   Collect like terms: $4a + 3a = 7a$, then $7a - a = 6a$. Answer: $6a$.

3. If $w = 5$, find the value of $w + 12$.
   Substitute $w = 5$: $5 + 12 = 17$. Answer: 17.

4. Solve: $3s = 18$
   Divide both sides by 3: $s = 18 \div 3 = 6$. Check: $3 \times 6 = 18$. ✓ So $s = 6$.

5. Solve: $5s + 9 = -6$
   Subtract 9 from both sides: $5s = -6 - 9 = -15$. Divide by 5: $s = -15 \div 5 = -3$. Check: $5 \times (-3) + 9 = -15 + 9 = -6$. ✓ So $s = -3$.

6. Solve: $t + 7 = 6.5$
   Subtract 7 from both sides: $t = 6.5 - 7 = -0.5$. Check: $-0.5 + 7 = 6.5$. ✓ So $t = -0.5$.

7. Expand and simplify: $2(x + 3) + 1$
   Expand the bracket: $2 \times x + 2 \times 3 = 2x + 6$. Then add 1: $2x + 6 + 1 = 2x + 7$. Answer: $2x + 7$.

8. Factorise fully: $5x - 35$
   The common factor of $5x$ and 35 is 5. Take it out: $5x - 35 = 5(x - 7)$. Check by expanding: $5 \times x - 5 \times 7 = 5x - 35$. ✓

9. Aroha buys 4 identical smoothies at the Avondale market and pays with a $20 note. She gets $3.20 change. Write and solve an equation to find the price of one smoothie.
   Let p be the price of one smoothie. Total spent = $20 - 3.20 = $16.80. Equation: $4p = 16.80$. Divide by 4: $p = 16.80 \div 4 = 4.20$. Each smoothie costs $4.20. Check: $4 \times 4.20 = 16.80$, and $20 - 16.80 = 3.20$. ✓

10. To hire a kayak on the Whau River costs a $12 booking fee plus $9 for each hour. The cost C in dollars for h hours is $C = 9h + 12$. (a) Find the cost for 4 hours. (b) Tane paid $75. Solve for how many hours he hired the kayak.
    (a) Substitute $h = 4$: $C = 9 \times 4 + 12 = 36 + 12 = 48. (b) Set $C = 75$: $9h + 12 = 75$. Subtract 12: $9h = 63$. Divide by 9: $h = 7$. Tane hired it for 7 hours. Check: $9 \times 7 + 12 = 63 + 12 = 75$. ✓

11. Solve the inequality $t - 3 \geq -5$ and show the solution on a number line.
    Add 3 to both sides: $t \geq -5 + 3$, so $t \geq -2$. On a number line, draw a filled (closed) circle at -2 (because $\geq$ includes -2) and shade the arrow to the right, covering all values greater than -2. Check with $t = 0$: $0 - 3 = -3$, and $-3 \geq -5$ is true. ✓

12. A tiling pattern grows so that shape 1 uses 5 tiles, shape 2 uses 8 tiles, shape 3 uses 11 tiles. (a) Write a rule for the number of tiles t in terms of the shape number n. (b) How many tiles are in shape 10? (c) Which shape uses 62 tiles?
    (a) The tiles increase by 3 each time, so the pattern is $t = 3n + d$. Using shape 1 ($n = 1$, $t = 5$): $5 = 3 \times 1 + d$, so $d = 2$. Rule: $t = 3n + 2$. (b) Substitute $n = 10$: $t = 3 \times 10 + 2 = 32$ tiles. (c) Set $t = 62$: $3n + 2 = 62$, so $3n = 60$, $n = 20$. Shape 20 uses 62 tiles. Check: $3 \times 20 + 2 = 62$. ✓