Test answers - Solving linear equations and rearranging formulae

Year: Year 9 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. Add 9 to both sides: $4x = 28$. Divide by 4: $x =$**7**. Check: $4 \times 7 - 9 = 19$. (1 mark)
b. Divide both sides by 5 first: $x + 2 = 8$. Subtract 2: $x =$**6**. Expanding first, $5x + 10 = 40$, gives the same answer. (1 mark)
c. Subtract $4x$ from both sides to collect the x terms on the left: $3x + 3 = 24$. Subtract 3: $3x = 21$ (1 mark for collecting correctly). Divide by 3: $x =$**7** (1 mark).

Check (c): the left side is $7 \times 7 + 3 = 52$ and the right side is $4 \times 7 + 24 = 52$, so both sides balance. Moving the smaller x term keeps the coefficient positive and avoids sign errors. Check (b): $5 \times (6 + 2) = 40$.

Answer to Question 2 (4 marks)

a. Multiply both sides by 3 to clear the fraction: $x + 4 = 21$ (1 mark). Subtract 4: $x =$ **17** (1 mark). Check: $(17 + 4) \div 3 = 7$.
b. Add 1 to both sides: $\frac{x}{2} + 4 = x$ (1 mark). Multiply every term by 2: $x + 8 = 2x$. Subtract x from both sides: $x =$**8** (1 mark).

Check (b): the left side is $8 \div 2 + 3 = 7$ and the right side is $8 - 1 = 7$. When multiplying an equation by a number, every term on both sides must be multiplied, not just the fraction; forgetting to double the 4 would give $x + 4 = 2x$ and the wrong answer $x = 4$.

Answer to Question 3 (4 marks)

a. The perimeter is twice the length plus twice the width: $2(3x - 1) + 2(x + 2) = 42$. (1 mark)
b. Expand: $6x - 2 + 2x + 4 = 42$, which simplifies to $8x + 2 = 42$ (1 mark). Subtract 2: $8x = 40$. Divide by 8: $x =$**5** (1 mark).
c. Substitute $x = 5$: length $= 3 \times 5 - 1 =$**14 cm** and width $= 5 + 2 =$**7 cm**. (1 mark)

Check: $2 \times 14 + 2 \times 7 = 28 + 14 = 42$ cm, the perimeter in the question. The rectangle's area would be $14 \times 7 = 98$ cm². A common error is using only one length and one width, $4x + 1 = 42$, which gives $x = 10.25$.

Answer to Question 4 (4 marks)

a. Undo the operations on x in reverse order. Add 3 to both sides: $y + 3 = 5x$ (1 mark). Divide both sides by 5: $x = \frac{y+3}{5}$ (1 mark).
b. In $V = lwh$, h is multiplied by both l and w, so divide both sides by their product lw (1 mark): $h = \frac{V}{lw}$ (1 mark).

Check (a) with a number: if $x = 2$, then $y = 10 - 3 = 7$, and the new formula gives $\frac{7+3}{5} = 2$. Check (b): a cuboid 5 by 4 by 3 has volume 60, and $\frac{60}{5 \times 4} = 3$, the height. Writing $x = \frac{y}{5} + 3$ in (a) would be wrong because the steps were undone in the wrong order.

Answer to Question 5 (4 marks)

a. If a tickets are for adults, the other $30 - a$ are for children. Adults pay $9a$ and children pay $6(30 - a)$, so $9a + 6(30 - a) = 219$. (1 mark)
b. Expand: $9a + 180 - 6a = 219$, which simplifies to $3a + 180 = 219$ (1 mark). Subtract 180: $3a = 39$. Divide by 3: $a =$**13** (1 mark).
c. Subtract the adult tickets from the total: $30 - 13 =$**17** child tickets. (1 mark)

Check the money: $9 \times 13 + 6 \times 17 = 117 + 102 = 219$ pounds, and $13 + 17 = 30$ tickets. Using one letter and $30 - a$ avoids needing two separate equations.