Test answers - Formulae and rearranging

Year: Year 8 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. Replace each letter with its value, keeping the negative in brackets: $v = 6 + (-2) \times 4$ (1 mark). Multiply before adding: $(-2) \times 4 = -8$, so $v = 6 - 8 = -2$ (1 mark).
b. To make x the subject, undo the operations on x in reverse order. First add 8 to both sides: $y + 8 = 5x$ (1 mark). Then divide both sides by 5: $x = \frac{y + 8}{5}$ (1 mark).

Check (b) with a number: if $x = 2$, then $y = 5 \times 2 - 8 = 2$, and the new formula gives $x = \frac{2 + 8}{5} = 2$. The value comes back unchanged, so the rearrangement is right. In (a) a negative v means the object is moving in the opposite direction.

Answer to Question 2 (4 marks)

a. $2x + 3 = 11$ is an **equation**: it is true for just one value of x ($x = 4$). An expression has no equals sign, and a formula links two or more different quantities. (1 mark)
b. Divide both sides by 2 to remove the bracket: $\frac{P}{2} = a + b$ (1 mark). Subtract b from both sides: $a = \frac{P}{2} - b$ (1 mark).
c. Substitute into the rearranged formula: $a = \frac{30}{2} - 4 = 15 - 4 =$**11**. (1 mark)

Check (c): $2(11 + 4) = 2 \times 15 = 30$. The formula $P = 2(a + b)$ is the perimeter of a rectangle of length a and width b.

Answer to Question 3 (4 marks)

a. Substitute $C = 20$: $F = 1.8 \times 20 + 32 = 36 + 32 =$**68 °F**. (1 mark)
b. Undo the operations on C in reverse order. Subtract 32 from both sides: $F - 32 = 1.8C$ (1 mark). Divide both sides by 1.8: $C = \frac{F - 32}{1.8}$ (1 mark).
c. Use the new formula with $F = 59$: $C = \frac{59 - 32}{1.8} = \frac{27}{1.8} =$**15 °C**. (1 mark)

Check (c) with the original formula: $1.8 \times 15 + 32 = 27 + 32 = 59$. A quick mental estimate also helps: doubling and adding 30 gives $2 \times 15 + 30 = 60$, close to 59.

Answer to Question 4 (4 marks)

a. Substitute $d = 5$: $C = 25 + 8 \times 5 = 25 + 40 =$**£65**. (1 mark)

b. Subtract 25 from both sides, $C - 25 = 8d$, then divide by 8: $d = \dfrac{C - 25}{8}$. (1 mark)

c. Put $C = 70$ into the rearranged formula: $d = \dfrac{70 - 25}{8} = \dfrac{45}{8} = 5.625$ (1 mark).

Josh can only hire for whole days, and 6 days would cost $25 + 48 = £73$, more than he has. The longest hire is **5 days** (1 mark).

This is a case where the answer must be rounded down even though 5.625 is nearer to 6. Josh would have £5 left over after paying £65 for 5 days.

Answer to Question 5 (4 marks)

a. Set the two costs equal: $25 + 8d = 15 + 10d$ (1 mark). Subtract $8d$ from both sides: $25 = 15 + 2d$. Subtract 15: $10 = 2d$, so $d =$**5 days** (1 mark).

b. For 10 days, Speedy Hire costs $25 + 8 \times 10 = £105$ and Handy Hire costs $15 + 10 \times 10 = £115$ (1 mark for each cost). **Speedy Hire** is cheaper, by £10 (the remaining mark for the conclusion).

Check (a): at 5 days both firms charge £65. Handy Hire has the lower fixed charge, so it is cheaper for hires shorter than 5 days, but its higher daily rate makes it more expensive for longer hires.