Test answers - Formulae and identities

Year: Year 10 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. $s = 6 \times 4 + \frac{1}{2} \times (-2) \times 16$ (1) $= 24 - 16 =$ **8** (1) Square t first, and remember that a is negative. So $s = 8$.

b. $y + 3 = 5x$ (1), so $x = \dfrac{y+3}{5}$ (1) Add 3 to both sides, then divide by 5.

In (a), a common mistake is to work out $\frac{1}{2} \times (-2) \times 4$ and then square, or to give $24 + 16 = 40$; the order of operations means $t^2 = 16$ is found first. Check (b) by substitution: with $x = 2$, $y = 7$, and $\frac{7+3}{5} = 2$, so the rearranged formula gives the same x.

Answer to Question 2 (4 marks)

a. $r^2 = \dfrac{A}{\pi}$ (1), $r = \sqrt{\dfrac{A}{\pi}}$ (1) Divide both sides by π, then take the positive square root because $r > 0$.

b. $2E = mv^2$ (1), $m = \dfrac{2E}{v^2}$ (1) Multiply both sides by 2, then divide by v^2.

In (a), the square root must be applied to the whole fraction, not just to A. Check: if $r = 3$, $A = 9\pi$, and $\sqrt{9\pi/\pi} = 3$. In (b), check with $m = 4$, $v = 3$: $E = 18$, and $2 \times 18 \div 9 = 4$ as expected.

Answer to Question 3 (4 marks)

a. $x^2 - 4x + 4x - 16 + 16$ (1) $= x^2$ (1) The middle terms cancel, and $-16 + 16 = 0$, so the left-hand side equals x^2 for every value of x.

b. $2n + 2n + 2 + 2n + 4 = 6n + 6$ (1) $= 6(n + 1)$, a multiple of 6 (1) Since $n + 1$ is a whole number, the sum is always 6 times a whole number, so it is a multiple of 6.

In (a), the symbol $\equiv$ means the statement is true for all values of x, so checking one value is not enough. In (b), the conclusion sentence is required for the final mark.

Answer to Question 4 (4 marks)

a. $2.50 + 1.70 \times 12 =$ **£22.90** (1) Substitute $d = 12$: $1.70 \times 12 = 20.40$. The journey costs £22.90.

b. $29.40 - 2.50 = 26.90$ (1), $26.90 \div 1.70 =$ **15.8 miles** (1) Subtract the fixed charge,

then divide by the price per mile. The journey was about 15.8 miles.

c. $d = \dfrac{C - 2.50}{1.70}$ (1) Subtract 2.50 from both sides, then divide by 1.70.

In (b), the exact value is $15.82\ldots$ miles, so 15.8 miles is a sensible rounding; a common error is to divide £29.40 by 1.70 straight away. Check (c) with part (a): $(22.90 - 2.50) \div 1.70 = 12$ miles.

Answer to Question 5 (4 marks)

a. $y(x - 1) = x + 4$ (1), $xy - x = y + 4$ (1), $x = \dfrac{y + 4}{y - 1}$ (1) Multiply both sides by $x - 1$, collect the x terms on one side and factorise: $x(y - 1) = y + 4$. Then divide by $y - 1$.

b. $t = \dfrac{v - u}{a} = \dfrac{15}{2.5} =$ **6** (1) Subtract u from both sides, then divide by a. With the given values, $t = 6$.

Check (a) with a value: if $x = 2$, then $y = 6$, and $\frac{6+4}{6-1} = 2$. The answer $\frac{y+4}{y-1}$ is equivalent to $\frac{-y-4}{1-y}$, which also scores full marks.