

A mark scheme writes “M1 A1” and leaves the reasoning to you. These are the same problems written the way you should write them in the exam: every step visible, the method marks earned before the answer, and a note on where the marks actually sit. Work each one on paper before reading the solution.

M1 A1; , .

Number

| A jacket costs \$84 after a 20% discount. Find the original price. [3]

After a 20% discount the price is 80% of the original, so the multiplier is 0.8. Therefore original $\times 0.8 = 84$, giving original $= 84 \div 0.8 = \$105$.

Commentary: The method mark is for dividing by the MULTIPLIER 0.8. Adding 20% to \$84 gives \$100.80 and is wrong – a percentage change is taken from the original, not from the new price.

Commentary: Check by working forwards: 20% of 105 is 21, and $105 - 21 = 84$. One line, and it catches the commonest error in the paper.

| Write 0.00408 in standard form, and calculate $(4.08 \times 10^{-3}) \times (2 \times 10^5)$, giving your answer in standard form. [3]

$0.00408 = 4.08 \times 10^{-3}$. Multiplying: $(4.08 \times 2) \times 10^{-3+5} = 8.16 \times 10^2$.

Commentary: Standard form needs the first number to satisfy $1 \leq a < 10$. Writing 81.6×10^1 is arithmetically correct but loses the accuracy mark.

Commentary: Add the indices when multiplying; subtract when dividing. Multiplying the indices is the standard slip.

| $p = 4.6$ and $q = 2.1$, both correct to 1 decimal place. Find the upper bound of $\frac{p}{q}$. [2]

The bounds are $4.55 \leq p < 4.65$ and $2.05 \leq q < 2.15$. A quotient is largest when the numerator is largest and the denominator is smallest, so the upper bound is $\frac{4.65}{2.05} = 2.268 \dots = 2.27$ (3 s.f.).

Commentary: The mark is for choosing the RIGHT pair of bounds. For a quotient it is $\text{max} \div \text{min}$; for a difference it is $\text{max} - \text{min}$. Using $\text{upper} \div \text{upper}$ is the usual error.

Commentary: Bounds are half of the last place: 1 d.p. gives ± 0.05 .

Algebra

| Solve $\frac{3}{x-1} + \frac{2}{x+2} = 1$, giving your answers to 2 decimal places. [6]

Multiply throughout by $(x-1)(x+2)$: $3(x+2) + 2(x-1) = (x-1)(x+2)$. Expanding: $3x+6+2x-2 = x^2+x-2$, so $5x+4 = x^2+x-2$ and $x^2-4x-6 = 0$. By the formula, $x = \frac{4 \pm \sqrt{16+24}}{2} = \frac{4 \pm \sqrt{40}}{2}$, giving $x = 5.16$ or $x = -1.16$ (2 d.p.).

Commentary: Multiplying EVERY term by the common denominator is the first method mark. Multiplying only the fractions and forgetting the 1 on the right is the commonest loss.

Commentary: Two decimal places means the formula, not factorising – check the discriminant is not a perfect square before hunting for factors.

Commentary: Both roots are wanted. Giving only the positive one loses the final accuracy mark.

| Make r the subject of $V = \frac{1}{3}\pi r^2 h$. [3]

Multiply by 3: $3V = \pi r^2 h$. Divide by πh : $r^2 = \frac{3V}{\pi h}$. Take the positive square root, since r is a length:
$$r = \sqrt{\frac{3V}{\pi h}}.$$

Commentary: Clear the fraction first, then divide by everything multiplying r^2 , then square-root LAST. Square-rooting early is where the method mark is lost.

Commentary: Saying the root is positive because r is a length is worth writing; it costs one clause.

| Solve the simultaneous equations $y = x^2 - 3x + 4$ and $y = 2x - 2$. [5]

Equating: $x^2 - 3x + 4 = 2x - 2$, so $x^2 - 5x + 6 = 0$, which factorises as $(x - 2)(x - 3) = 0$. Hence $x = 2$ or $x = 3$. Substituting into the LINEAR equation: when $x = 2$, $y = 2$; when $x = 3$, $y = 4$.

Commentary: Substitute back into the SIMPLER equation. Using the quadratic doubles the arithmetic and the chance of an error.

Commentary: Pair the answers: (2, 2) and (3, 4). A list of four separate values without pairing loses a mark.

Geometry and mensuration

| A sector of a circle has radius 8 cm and angle 135° . Find its area and its perimeter. [5]

Area = $\frac{135}{360} \times \pi \times 8^2 = \frac{3}{8} \times 64\pi = 24\pi = 75.4 \text{ cm}^2$ (3 s.f.). Arc length = $\frac{135}{360} \times 2\pi \times 8 = 6\pi = 18.85 \text{ cm}$, so the perimeter = $18.85 + 8 + 8 = 34.8 \text{ cm}$ (3 s.f.).

Commentary: The perimeter of a sector includes the TWO RADII as well as the arc. Giving the arc alone is the single commonest error on this question.

Commentary: Keep π exact until the final line; rounding 24π early costs the accuracy mark.

| In triangle ABC , $AB = 7 \text{ cm}$, $BC = 9 \text{ cm}$ and angle $ABC = 52^\circ$. Find AC , and the area of the triangle. [5]

By the cosine rule, $AC^2 = 7^2 + 9^2 - 2(7)(9)\cos 52^\circ = 49 + 81 - 126\cos 52^\circ = 130 - 77.58 = 52.42$, so $AC = 7.24 \text{ cm}$ (3 s.f.). Area = $\frac{1}{2}(7)(9)\sin 52^\circ = 24.8 \text{ cm}^2$ (3 s.f.).

Commentary: Use the cosine rule when you know two sides and the angle BETWEEN them. Reaching for the sine rule here is the usual wrong turn.

Commentary: The area formula $\frac{1}{2}ab\sin C$ needs the INCLUDED angle – the same angle, which is why both parts use 52° .

Commentary: Do not round AC and then use it for the area; use the exact given values.

Statistics and probability

| A bag holds 5 red and 3 blue counters. Two are taken without replacement. Find the probability that they are different colours. [4]

P(red then blue) = $\frac{5}{8} \times \frac{3}{7} = \frac{15}{56}$. P(blue then red) = $\frac{3}{8} \times \frac{5}{7} = \frac{15}{56}$. These are the only ways, and they are mutually exclusive, so $P(\text{different}) = \frac{15}{56} + \frac{15}{56} = \frac{30}{56} = \frac{15}{28}$.

Commentary: Without replacement means the SECOND denominator is 7, not 8. Leaving it as 8 is the commonest error and loses both method marks.

Commentary: There are TWO orders. Giving only red-then-blue halves the answer.

Commentary: An alternative is $1 - P(\text{same})$, which is quicker but needs both same-colour cases.

I The table shows the times t minutes taken by 40 students. Estimate the mean, given the grouped data with midpoints 5, 15, 25, 35 and frequencies 6, 14, 12, 8. [4]

Multiply each midpoint by its frequency: $5(6) + 15(14) + 25(12) + 35(8) = 30 + 210 + 300 + 280 = 820$.
The mean is $820 \div 40 = 20.5$ minutes.

Commentary: Use the MIDPOINT of each class, not the class boundary or the class width. That choice is the first method mark.

Commentary: Divide by the total FREQUENCY (40), never by the number of classes (4). Dividing by 4 gives 205 and should look obviously wrong.

Commentary: The answer is an ESTIMATE because the original values within each class are unknown – say so if the question asks why.