Day 361 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Simplifying surds (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Write $\sqrt{250}$ in the form $p\sqrt{q}$, where q is an integer as small as possible.

$\sqrt{250} = \sqrt{25 \times 10} = \sqrt{25} \times \sqrt{10}$

$= 5\sqrt{10}$

Answer: $5\sqrt{10}$

2 Solve a logarithmic equation (one log) (All boards)

Solve $\log_{10} x = 3$.

$x = 10^3$

Answer: $x = 1000$

3 Line through two axis intercepts (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows a line meeting the axes at A and B.

Find (a) the equation of AB in the form $px + qy = r$ with integers p, q and r, (b) the length AB.

Gradient $= \frac{1 - 0}{0 - 5} = -\frac{1}{5}$

Using $y = mx + c$ with $c = 1$: $y = -\frac{1}{5}x + 1$, so $x + 5y = 5$

$AB^2 = 5^2 + 1^2 = 26$

Answer: (a) $x + 5y = 5$ (b) $\sqrt{26}$

4 Mutually exclusive events (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A and B are mutually exclusive, with P(A) = 0.3 and P(B) = 0.5.

(a) Find $P(A \cup B)$.

(b) Find the probability that neither A nor B happens.

(a) Mutually exclusive, so $P(A \cap B) = 0$

$P(A \cup B) = 0.3 + 0.5 = 0.8$

(b) $1 - 0.8 = 0.2$

Answer: (a) 0.8 (b) 0.2

5 Power of an engine: driving force (CIE)

A car's engine works at a constant rate of 12 kW. Find the driving force when the vehicle is moving at 15 m s^{-1}.

$P = Fv$

$12000 = F \times 15$

Answer: 800 N

6 Normal distribution: inverse (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

$X \sim N(145, 6^2)$. Given that $P(X > a) = 0.8$, find a to 3 s.f.

$P(Z > z) = 0.8$, so $z = -0.8416$ (from the inverse normal function)

$a = 145 + -0.8416 \times 6$

Answer: 140

7 Perpendicular bisector (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A is (0, −2) and B is (4, 0).

Find the equation of the perpendicular bisector of AB, in the form $ax + by = c$ with integer a, b and c.

Midpoint of AB = (2, −1)

Gradient of AB $= \frac{2}{4} = \frac{1}{2}$, so perpendicular gradient = −2

$y - (-1) = -2(x - 2)$

Multiply out and rearrange.

Answer: $2x + y = 3$

Day 361 **A Level Maths: C Tier 10-a-day: Model Solutions**

8 Solve with a shifted angle (All boards)

Solve $\cos(x - 40°) = -\frac{\sqrt{3}}{2}$ for $0° \leq x \leq 360°$.

Let $u = x - 40°$, so $-40° \leq u \leq 320°$

$\cos u = -\frac{\sqrt{3}}{2}$: $u = 150°, 210°$

$x = u + 40°$: $x = 190°, 250°$

Answer: x = 190°, 250°

9 Starting from rest: find the time (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A skier starts from rest and moves in a straight line with constant acceleration 1.5 m s^{-2}. It travels 3 m. Find the time taken.

$s = ut + \frac{1}{2}at^2$ with $u = 0$

$3 = \frac{1}{2} \times 1.5 \times t^2$

$t^2 = 4$

Answer: 2 s

10 Integrate using partial fractions (All boards)

$\frac{-4x - 10}{(x + 2)(x + 3)} \equiv \frac{A}{x + 2} + \frac{B}{x + 3}$.

Find A and B, and hence find $\int \frac{-4x - 10}{(x + 2)(x + 3)}\,dx$.

$-4x - 10 \equiv A(x + 3) + B(x + 2)$

$x = -2$ gives $A = -2$; $x = -3$ gives $B = -2$

$\int \left(\frac{-2}{x + 2} + \frac{-2}{x + 3}\right) dx = -2 \ln|x + 2| + -2 \ln|x + 3| + c$

Answer: A = −2, B = −2; −2 ln |x + 2| − 2 ln |x + 3| + c