Day 350 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Normal distribution: probabilities (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

$X \sim N(70, 6^2)$. Find $P(X < 64)$, giving your answer to 3 s.f.

Standardise: $z = (64 - 70) \div 6 = -1$

$P(Z < -1)$ from calculator

Answer: 0.159

2 Pythagorean identity: find cos and tan (All boards)

θ is acute and $\sin\theta = \frac{20}{29}$.

Find the exact values of $\cos\theta$ and $\tan\theta$.

$\sin^2\theta + \cos^2\theta = 1$, so $\cos^2\theta = 1 - \frac{400}{841} = \frac{441}{841}$

θ is acute, so $\cos\theta = \frac{21}{29}$

$\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{20}{21}$

Answer: $\cos\theta = \frac{21}{29}$, $\tan\theta = \frac{20}{21}$

3 Centre and radius of a circle (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A circle has equation $x^2 + y^2 + 12y + 18 = 0$.

Find the centre and the radius of the circle.

Complete the square in x and in y:

$x^2 + (y + 6)^2 = 18$

Centre $(0, -6)$, radius $= 3\sqrt{2}$

Answer: Centre $(0, -6)$, radius $3\sqrt{2}$

4 Differentiating displacement to find velocity (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A particle P moves in a straight line. Its displacement from O at time t seconds is s metres, where $s = 3t^3 + 4t^2 - t + 2$.

Find its velocity when $t = 1$.

$v = \frac{ds}{dt} = 9t^2 + 8t - 1$

When $t = 1$: $v = 9 \times 1^2 + 8 \times 1 - 1$

Answer: 16 m s^{-1}

5 Solve with a shifted angle (All boards)

Solve $\sin(x - 60°) = \frac{\sqrt{2}}{2}$ for $0° \leq x \leq 360°$.

Let $u = x - 60°$, so $-60° \leq u \leq 300°$

$\sin u = \frac{\sqrt{2}}{2}$: $u = 45°, 135°$

$x = u + 60°$: $x = 105°, 195°$

Answer: $x = 105°, 195°$

6 Equation of a transformed curve (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The curve C has equation $y = x^3 - 4x + 1$.

C is reflected in the x-axis. Find the equation of the image, in the form $y = ...$

Reflection in the x-axis: y becomes $-y$.

$-y = x^3 - 4x + 1$

$y = -x^3 + 4x - 1$

Answer: $y = -x^3 + 4x - 1$

Day 350 **A Level Maths: C Tier 10-a-day: Model Solutions**

7 Car towing a caravan (All boards)

A car of mass 800 kg tows a caravan of mass 500 kg on a level road with acceleration 0.25 m s^{-2}. Resistances: 300 N on the car, 100 N on the caravan. Find the driving force and the tow bar tension.

Whole system: $D - 300 - 100 = 1300 \times 0.25$

Caravan: $T - 100 = 500 \times 0.25$

Answer: D = 725 N, T = 225 N

8 Partial fractions (Edexcel, OCR, MEI, CIE, AQA, Eduqas)

Express $\frac{8x + 4}{(x + 2)(x - 4)}$ in partial fractions.

Write $\frac{8x + 4}{(x + 2)(x - 4)} = \frac{A}{(x + 2)} + \frac{B}{(x - 4)}$

$8x + 4 = A(x - 4) + B(x + 2)$

$x = -2$: $-12 = A(-6)$ so $A = 2$

$x = 4$: $36 = B(6)$ so $B = 6$

Answer: $\frac{2}{(x + 2)} + \frac{6}{(x - 4)}$

9 Normal approximation to the binomial (CIE)

$X \sim B(60, 0.2)$. Use a normal approximation to find $P(X \leq 14)$, to 3 s.f.

$np = 12$ and $npq = 9.6$, so use $Y \sim N(12, 9.6)$

Continuity correction: $P(Y < 14.5)$

$z = (14.5 - 12) \div \sqrt{9.6}$

Answer: 0.790

10 Integration by substitution (All boards)

Use the substitution $u = \sin x$ to find

$\int \cos x \sin^2 x \, dx$.

$u = \sin x$, so $du = \cos x \, dx$

$\int 1 \, u^2 \, du = \frac{1 \, u^3}{3}$

Replace u by sin x

Answer: $\frac{1 \sin^3 x}{3} + c$