Day 25 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Natural logs and e^x (All boards)

Solve $e^{5x+1} = 5$.
Give your answer to 3 significant figures.

Take natural logs: $5x + 1 = \ln 5 = 1.609$
$x = 0.122$
Answer: x = 0.122

2 Driving force and resistance (All boards)

A car of mass 800 kg is driven along a straight horizontal road by a driving force of 600 N against a constant resistance of 400 N.
Find the acceleration of the car.

Resultant force = $600 - 400 = 200$ N
F = ma: $200 = 800\ a$
Answer: 0.25 m s^{-2}

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

A circle has equation $x^2 + (y - 5)^2 = 25$.
Write down the centre and the radius of the circle.

Compare with $(x - a)^2 + (y - b)^2 = r^2$.
Centre (0, 5); $r^2 = 25$ so $r = 5$
Answer: Centre (0, 5), radius 5

4 Reciprocal trig functions: exact values (All boards)

Write down the exact values of
(a) cosec 330° (b) cot 240°

(a) $\text{cosec } 330° = \frac{1}{\sin 330°} = \frac{1}{-\frac{1}{2}} = -2$

(b) $\cot 240° = \frac{1}{\tan 240°} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$

Answer: (a) -2 (b) $\frac{\sqrt{3}}{3}$

5 Modulus equations (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Solve $|x + 3| = |x + 6|$.

Squaring: $(x + 3)^2 = (x + 6)^2$
$x + 3 = -(x + 6)$ (the case $x + 3 = x + 6$ has no solution)
$2x = -9$
Answer: $x = -\frac{9}{2}$

6 Hypothesis test for correlation (AQA, Edexcel, OCR, MEI, Eduqas)

12 pairs of data on age of a car and its value have r = 0.44.
Test, at the 5% significance level, for evidence of positive correlation. The critical value is 0.4973.

$H_0: \rho = 0$, $H_1: \rho > 0$
r = 0.44 is not beyond the critical value 0.4973
Do not reject H_0
Answer: Do not reject H_0: there is not enough evidence of positive correlation

Day 25 **A Level Maths: C Tier 10-a-day: Model Solutions**

7 Parametric equations: finding points (Edexcel, OCR, MEI, CIE, AQA, Eduqas)

A curve has parametric equations
$x = 4t - 1$, $y = t^2 + 2$.
The point P has y-coordinate 6 and positive t.
Find the coordinates of P.

$t^2 + 2 = 6$, so $t^2 = 4$, giving $t = 2$ ($t > 0$)
$x = 4 \times 2 - 1 = 7$
Answer: (7, 6)

8 Resultant force as vectors and acceleration (AQA, Edexcel, OCR, MEI, Eduqas)

Two forces $(2\mathbf{i} + 4\mathbf{j})$ N and $(4\mathbf{i} + 2\mathbf{j})$ N act on a particle of mass 3 kg. No other horizontal forces act. Find the acceleration of the particle as a vector in terms of $\mathbf{i}$ and $\mathbf{j}$.

Resultant = $(2\mathbf{i} + 4\mathbf{j}) + (4\mathbf{i} + 2\mathbf{j})$
$= (6\mathbf{i} + 6\mathbf{j})$ N
$F = ma$: $a = \frac{1}{3}(6\mathbf{i} + 6\mathbf{j})$
Answer: $(2\mathbf{i} + 2\mathbf{j})$ m s^{-2}

9 Find a and b in y = ab^x (All boards)

The curve $y = ab^x$ passes through (0, 6) and (2, 150).
Find the values of a and b.

$x = 0$: $y = a \times b^0 = a$, so $a = 6$
$x = 2$: $6 \times b^2 = 150$, so $b^2 = 25$
$b = 5$
Answer: a = 6, b = 5

10 Grouped data: estimated mean (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The table shows grouped data.
Class: $20 \le x < 25$; $25 \le x < 30$; $30 \le x < 35$; $35 \le x < 40$
Frequency: 9, 7, 14, 11
Estimate the mean, to 3 s.f.

Midpoints: 22.5, 27.5, 32.5, 37.5
$\Sigma fx = 9\times22.5 + 7\times27.5 + 14\times32.5 + 11\times37.5 = 1262.5$
Mean $\approx 1262.5 \div 41$
Answer: 30.8