Day 66 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Describing transformations of graphs (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Describe the single transformation that maps the graph of y = f(x) onto the graph of y = 3f(x).

y = 3f(x) is obtained from y = f(x) by a:
stretch parallel to the y-axis, scale factor 3
Answer: stretch parallel to the y-axis, scale factor 3

2 Braking: deceleration and time (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A cyclist travelling at 12 m s^{-1} brakes uniformly and comes to rest after travelling 36 m.
(a) Find the deceleration.
(b) Find the time taken to stop.

(a) $v^2 = u^2 + 2as$: $0 = 12^2 + 2 \times a \times 36$
so $a = -2$, a deceleration of 2

(b) $s = \frac{(u + v)}{2} t$: $36 = 6t$

Answer: (a) 2 m s^{-2} (b) 6 s

3 Solving quadratics: surd answers (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Solve $x^2 - 4x - 9 = 0$, giving your answers in the form $p \pm \sqrt{q}$.

Complete the square: $(x - 2)^2 - 4 - 9 = 0$
$(x - 2)^2 = 13$
$x - 2 = \pm\sqrt{13}$
Answer: $x = 2 \pm \sqrt{13}$

4 Reciprocal trig functions: exact values (All boards)

Write down the exact values of
(a) cosec 30° (b) cosec 210°

(a) $\text{cosec } 30° = \frac{1}{\sin 30°} = \frac{1}{\frac{1}{2}} = 2$

(b) $\text{cosec } 210° = \frac{1}{\sin 210°} = \frac{1}{-\frac{1}{2}} = -2$

Answer: (a) 2 (b) −2

5 Equilibrium of forces given as vectors (AQA, Edexcel, OCR, MEI, Eduqas)

Three forces $(-4\mathbf{i} + 5\mathbf{j})$ N, $(p\mathbf{i} + q\mathbf{j})$ N and $(\mathbf{i} + \mathbf{j})$ N act on a particle which is in equilibrium. **i** and **j** are perpendicular unit vectors. Find the values of p and q.

Sum of forces = 0:
i components: $p + (-4) + (1) = 0$
j components: $q + (5) + (1) = 0$
Answer: $p = 3$, $q = -6$

6 The factor theorem and factorising (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

$f(x) = x^3 - 11x^2 + 38x - 40$
(a) Show that $(x - 4)$ is a factor of f(x).
(b) Factorise f(x) completely.

$f(4) = 64 + (-176) + 152 + (-40) = 0$, so $(x - 4)$ is a factor.
$f(x) = (x - 4)(x^2 - 7x + 10)$
$x^2 - 7x + 10 = (x - 2)(x - 5)$
Answer: (b) $f(x) = (x - 2)(x - 4)(x - 5)$

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7 Integrate using double angle formulae (All boards)

Use a double angle formula to find
$\int \sin 5x \cos 5x \, dx$.

$\sin 2\theta = 2 \sin \theta \cos \theta$, so $\sin 5x \cos 5x = \frac{1}{2} \sin 10x$

Integrate term by term

Answer: $-\frac{\cos 10x}{20} + c$

8 Box plots (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The box plot summarises the delivery times, in minutes, of a pizza company.
Find the range and the interquartile range.

Range = $70 - 25 = 45$
IQR = $60 - 40 = 20$
Answer: range = 45, IQR = 20

9 Sector: arc length and area (diagram) (All boards)

The diagram shows sector OAB of a circle.
Find, in terms of π, (a) the arc length AB, (b) the area of the sector.

(a) Arc length = $r\theta = 12 \times \frac{2\pi}{3} = 8\pi$ cm

(b) Area = $\frac{1}{2}r^2\theta = \frac{1}{2} \times 12^2 \times \frac{2\pi}{3} = 48\pi$ cm^2

Answer: (a) 8π cm (b) 48π cm^2

10 Conditional probability (Bayes) (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The probability that a patient takes the drug is 0.6. If so, the probability that the patient recovers is 0.8; otherwise it is 0.2.
Given that the patient recovers, find the probability that a patient takes the drug.

P(both) = $0.6 \times 0.8 = 0.48$; P(not first and second) = $0.4 \times 0.2 = 0.08$
P(second) = $0.48 + 0.08 = 0.56$
P = $0.48 \div 0.56$

Answer: $\frac{6}{7} = 0.857$