Day 47 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 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 = 75 − 5 = 70
IQR = 70 − 25 = 45
Answer: range = 70, IQR = 45

2 Trapezium rule from a table (AQA, Edexcel, OCR, MEI, Eduqas)

The table shows values of y = f(x).
x: 1 3 5 7 9
y: 7.7 4.2 3.9 1.8 6.3
Use the trapezium rule to estimate the area under the curve between x = 1 and x = 9.

h = 2 with 4 strips

Area $\approx \frac{2}{2}[7.7 + 6.3 + 2(4.2 + 3.9 + 1.8)]$

$= \frac{2}{2} \times 33.8$

$= 33.8$

Answer: 33.8

3 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 = f(5x).

y = f(5x) is obtained from y = f(x) by a:

stretch parallel to the x-axis, scale factor $\frac{1}{5}$

Answer: stretch parallel to the x-axis, scale factor $\frac{1}{5}$

4 Connected rates of change (All boards)

The volume of a sphere increases at 50 cm^3/s.
Find the rate of increase of the radius when r = 6. Give your answer to 3 s.f.

$V = \frac{4}{3}\pi r^3$, so $\frac{dV}{dr} = 4\pi r^2$

$\frac{dr}{dt} = \frac{dV}{dt} \div \frac{dV}{dr} = \frac{50}{4\pi \times 6^2} = 0.111$

Answer: 0.111 cm/s

5 Velocity-time graph: acceleration from two stages (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The graph shows the velocity of a runner.
(a) Find the acceleration in the first 8 s.
(b) Find the deceleration in the last 5 s.
(c) Find the total distance travelled.

(a) $a = \frac{8 - 2}{8}$

(b) $a = \frac{8 - 0}{5}$, a deceleration of 1.6

(c) area $= \frac{1}{2}(2 + 8) \times 8 + 8 \times 6 + \frac{1}{2} \times 5 \times 8$

Answer: (a) 0.75 m s^{-2} (b) 1.6 m s^{-2} (c) 108 m

6 Position of a point relative to a circle (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A circle has equation $(x - 2)^2 + y^2 = 25$.
Determine whether the point P(8, 7) is inside, outside or on the circle.

Distance^2 from the centre (2, 0) to P:
$(8 - 2)^2 + (7 - 0)^2 = 36 + 49 = 85$
$r^2 = 25$, and $85 > 25$.
Answer: P is outside the circle

7 Vector geometry with a diagram (OAB) (All boards)

In the diagram, OA = $\mathbf{a}$, OB = $\mathbf{b}$, and P lies on AB with AP : PB = 1 : 1.
Find AB and OP in terms of $\mathbf{a}$ and $\mathbf{b}$.

$\text{AB} = \text{OB} - \text{OA} = \mathbf{b} - \mathbf{a}$

$\text{AP} = \frac{1}{2}\text{AB} = \frac{1}{2}(\mathbf{b} - \mathbf{a})$

$\text{OP} = \text{OA} + \text{AP} = \mathbf{a} + \frac{1}{2}(\mathbf{b} - \mathbf{a})$

$= \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$

Answer: $\mathbf{AB} = \mathbf{b} - \mathbf{a}$; $\mathbf{OP} = \frac{1}{2}\mathbf{a} + \frac{1}{2}\mathbf{b}$

8 Work done and kinetic energy (CIE)

A particle of mass 2 kg changes its speed from 5 m s^{-1} to 9 m s^{-1}. Find the increase in its kinetic energy.

$\text{KE} = \frac{1}{2}mv^2$

$\text{Increase} = \frac{1}{2} \times 2 \times 9^2 - \frac{1}{2} \times 2 \times 5^2$

Answer: 56 J

9 Sampling methods (AQA, Edexcel, OCR, MEI, Eduqas)

An interviewer outside a college must talk to 25 men and 25 women, and stops people until each target is met.
Name the sampling method used.

This is quota sampling: the interviewer fills fixed numbers from each group, not at random.
Answer: quota sampling

10 Real roots and the discriminant (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Find the range of values of k for which $kx^2 + 4x + 8 = 0$ has real roots.

Real roots: $b^2 - 4ac \geq 0$

$16 - 32k \geq 0$, so $k \leq \frac{1}{2}$

Also $k \neq 0$ for the equation to be a quadratic.

Answer: $k \leq \frac{1}{2}$, $k \neq 0$