Day 320 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 F = ma: find the force or the mass (All boards)

A particle of mass 40 kg has acceleration 0.5 m s^{-2}. Find the magnitude of the resultant force acting on it.

F = ma
F = 40 × 0.5
Answer: 20 N

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

An interviewer outside a college must talk to 10 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

3 Midpoint and length of a line segment (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

M(2, 6) is the midpoint of the line segment AB.
A is the point (−2, 3). Find the coordinates of B.

x-coordinate: $\frac{-2 + x_B}{2} = 2$, so $x_B = 6$

y-coordinate: $\frac{3 + y_B}{2} = 6$, so $y_B = 9$

Answer: B(6, 9)

4 Trapezium rule: strips shown (diagram) (AQA, Edexcel, OCR, MEI, Eduqas)

The diagram shows the curve y = ln x + 1 from x = 1 to x = 5 divided into 6 strips of equal width.
Use the trapezium rule with these strips to estimate the shaded area to 3 s.f.

h = 0.6666666666666666; y values: 1.000, 1.511, 1.847, 2.099, 2.299, 2.466, 2.609

Area ≈ $\frac{0.6666666666666666}{2}$[1.000 + 2.609 + 2(10.22)]

= 8.02
Answer: 8.02

5 Finding a quadratic from its turning point (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows a sketch of a quadratic curve.
Find its equation in the form $y = a(x - p)^2 + q$.

The turning point is (−2, −1), so $y = a(x + 2)^2 - 1$.
The curve passes through (0, 7):
$7 = a(2)^2 - 1$, so $8 = 4a$
$a = 2$
Answer: $y = 2(x + 2)^2 - 1$

6 Binomial: at least one success (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Each customer buys a coffee with probability 0.1.
Find the probability that at least one of 7 customers buys a coffee, to 3 s.f.

P(zero) = 0.9^7
P(at least one) = $1 - 0.9^7$
Answer: 0.522

Day 320 **A Level Maths: C Tier 10-a-day: Model Solutions**

7 Integrate using partial fractions (All boards)

$\frac{-4x-11}{(x+2)(x+3)} \equiv \frac{A}{x+2} + \frac{B}{x+3}$.

Find A and B, and hence find $\int \frac{-4x-11}{(x+2)(x+3)}\,dx$.

$-4x - 11 \equiv A(x+3) + B(x+2)$

$x = -2$ gives $A = -3$; $x = -3$ gives $B = -1$

$\int \left(\frac{-3}{x+2} + \frac{-1}{x+3}\right) dx = -3 \ln|x+2| + -1 \ln|x+3| + c$

Answer: $A = -3, B = -1$; $-3 \ln|x+2| - \ln|x+3| + c$

8 Tangent condition for a line and a curve (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The line $y = 4x + k$ is a tangent to the curve

$y = x^2 + 6x + 4$.

Find the value of k.

$x^2 + 6x + 4 = 4x + k$

$x^2 + 2x + (4 - k) = 0$

A tangent touches once: discriminant = 0

$(2)^2 - 4(4 - k) = 0$

Answer: k = 3

9 Trapezium rule from a function (AQA, Edexcel, OCR, MEI, Eduqas)

Use the trapezium rule with 4 strips to estimate

$\int_0^1 e^{x^2}\,dx$,

giving your answer to 3 significant figures.

$h = \frac{1-0}{4} = 0.25$; $x = 0, 0.25, 0.5, 0.75, 1$

$y = 1.000, 1.064, 1.284, 1.755, 2.718$

Area $\approx \frac{h}{2}$[first + last + 2(sum of the rest)] $= \frac{0.25}{2}[1.000 + 2.718 + 2 \times 4.104]$

$= 1.49$

Answer: 1.49

10 Velocity-time graph: acceleration and distance (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The graph shows the velocity of a cyclist over 35 seconds as it moves in a straight line.

(a) Find its acceleration in the first 10 s.

(b) Find the total distance travelled.

(a) acceleration = gradient $= \frac{16}{10}$

(b) distance = area of trapezium

$= \frac{1}{2}(15 + 35) \times 16$

Answer: (a) 1.6 m s^{-2} (b) 400 m