Day 95 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Rearrange and iterate (All boards)

(a) Show that $x^2 - x - 3 = 0$ can be rearranged to $x = 1 + \frac{3}{x}$.

(b) Use x_{n+1} = this formula with $x_0 = 2$ to find x_1, x_2 to 3 d.p.

(a) Divide $x^2 - x = 3$ by x: $x - 1 = \frac{3}{x}$, so $x = 1 + \frac{3}{x}$

(b) $x_1 = 2.5000$, $x_2 = 2.2000$

Answer: (a) shown (b) $x_1 = 2.500$, $x_2 = 2.200$

2 Geometric series: sum of n terms (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Find the sum of the first 5 terms of the geometric series 6 + 24 + 96 + ...

$a = 6$, $r = 4$, $n = 5$

$S_n = \frac{a(r^n - 1)}{r - 1} = \frac{6(4^5 - 1)}{4 - 1}$

$= 2046$

Answer: 2046

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

The 190 residents are numbered. A computer generates 25 different random numbers and those people are asked to take part.

Name the sampling method used.

This is simple random sampling: every person has the same chance of selection and the choice is made purely by random numbers.

Answer: simple random sampling

4 Parametric equations to Cartesian form (Edexcel, OCR, MEI, CIE, AQA, Eduqas)

A curve has parametric equations

$x = t$, $y = \frac{3}{t}$, $t \neq 0$.

Find a Cartesian equation of the curve.

$t = x$

$y = \frac{3}{t} = \frac{3}{x}$

Answer: $y = \frac{3}{x}$

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

The graph shows the velocity of a car.

(a) Find the acceleration in the first 4 s.

(b) Find the deceleration in the last 5 s.

(c) Find the total distance travelled.

(a) $a = \frac{17 - 5}{4}$

(b) $a = \frac{17 - 0}{5}$, a deceleration of 3.4

(c) area $= \frac{1}{2}(5 + 17) \times 4 + 17 \times 12 + \frac{1}{2} \times 5 \times 17$

Answer: (a) 3 m s^{-2} (b) 3.4 m s^{-2} (c) 290.5 m

6 Chain rule: gradient at a point (All boards)

Find the gradient of the curve $y = (2x - 1)^3$
at the point where $x = 1$.

Use the chain rule: $dy/dx = 2 \times 3(2x - 1)^2$

At $x = 1$: $dy/dx = 6$

Answer: 6

7 Finding an unknown using the factor theorem (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

When $x^3 + kx^2 + 2x - 7$ is divided by $(x - 1)$, the remainder is -5. Find the value of k.

$f(1) = -5$
$1 + k - 5 = -5$
$k = -1$
Answer: $k = -1$

8 Exact trigonometric values (All boards)

Write down the exact value of sin 150°.

sin 150° has the same size as sin 30°, and the sign comes from the quadrant (CAST).

sin 30° = $\frac{1}{2}$, so sin 150° = $\frac{1}{2}$

Answer: $\frac{1}{2}$

9 Friction: acceleration along rough ground (All boards)

A block of mass 4 kg is pulled along rough horizontal ground by a horizontal force of 17.84 N. The coefficient of friction is 0.2. Take g = 9.8 m s^{-2}. Find the acceleration.

$R = 4 \times 9.8 = 39.2$
$F = \mu R = 0.2 \times 39.2 = 7.84$
$P - F = ma$: $17.84 - 7.84 = 4a$
Answer: 2.5 m s^{-2}

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

The probability that it rains is 0.4. If so, the probability that Sam is late is 0.7; otherwise it is 0.5. Given that Sam is late, find the probability that it rains.

P(both) = 0.4 × 0.7 = 0.28; P(not first and second) = 0.6 × 0.5 = 0.3
P(second) = 0.28 + 0.3 = 0.58
P = 0.28 ÷ 0.58
Answer: $\frac{14}{29}$ = 0.483