Day 337 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Exact trigonometric values (All boards)

Write down the exact value of sin 60°.

Use the special angle values: $\sin 60° = \frac{\sqrt{3}}{2}$

Answer: $\frac{\sqrt{3}}{2}$

2 Simplifying surds (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Write $\sqrt{18}$ in the form $p\sqrt{q}$, where q is an integer as small as possible.

$\sqrt{18} = \sqrt{9 \times 2} = \sqrt{9} \times \sqrt{2}$

$= 3\sqrt{2}$

Answer: $3\sqrt{2}$

3 Integrate (ax + b)^n and related (All boards)

Find $\int \frac{1}{5x + 5}\,dx$.

$\int \frac{1}{ax + b}\,dx = \frac{1}{a} \ln|ax + b|$

Here a = 5

Answer: $\frac{1}{5} \ln|5x + 5| + c$

4 Vertical motion: greatest height from speed (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A stone is projected vertically upwards with speed 28 m s^{-1} from ground level. Taking g = 9.8 m s^{-2}, find the maximum height it reaches above the ground.

At the top v = 0: $v^2 = u^2 + 2as$

$0 = 28^2 - 2 \times 9.8 \times s$

$s = \frac{784}{19.6}$

Answer: 40 m

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

The curve $y = ab^x$ passes through (0, 3) and (4, 1875).
Find the values of a and b.

x = 0: $y = a \times b^0 = a$, so a = 3

x = 4: $3 \times b^4 = 1875$, so $b^4 = 625$

b = 5

Answer: a = 3, b = 5

6 Venn diagrams (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The Venn diagram shows probabilities for events A and B.
Find the value of x.

Probabilities sum to 1

$x = 1 - (0.1 + 0.15 + 0.15)$

Answer: 0.6

7 Two particles over a smooth pulley (All boards)

Two particles of masses 2 kg and 5 kg hang from the ends of a light inextensible string over a smooth pulley and are released from rest. Take g = 9.8 m s^{-2}. Find the acceleration and the tension in the string.

5 kg: $5 \times 9.8 - T = 5a$

2 kg: $T - 2 \times 9.8 = 2a$

Adding: $29.4 = 7a$, then $T = 2(9.8 + a)$

Answer: a = 4.2 m s^{-2}, T = 28 N

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8 Arithmetic series: sum of terms (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Find the sum of the first 11 terms of the series
11 + 15 + 19 + 23 + ...

$a = 11$, $d = 4$, $n = 11$

$S_n = \frac{n}{2}[2a + (n - 1)d] = \frac{11}{2}[2(11) + 10 \times 4]$

$= 341$

Answer: 341

9 Standard deviation from raw data (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Here are 5 values: 19, 10, 8, 19, 3
Find the mean and the standard deviation, to 3 s.f.

$\Sigma x = 59$, $\Sigma x^2 = 895$, $n = 5$

Mean $= 59 \div 5 = 11.80$

Variance $= \frac{895}{5} - (11.80)^2 = 39.76$

Standard deviation $= \sqrt{39.76}$

Answer: mean = 11.8, standard deviation = 6.31

10 Sigma notation (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The nth term of a sequence is $u_n = 5n + 1$.

Find $\sum_{r=1}^{9} u_r$.

$u_1 = 6$, $u_9 = 46$

Sum $= \frac{9}{2}(6 + 46)$

$= 234$

Answer: 234