Day 29 **B Tier 10-a-day: Model Solutions**

1 Substitution

Work out the value of 9m + 1 when m = 9

Replace m with 9: 9 × 9 + 1
81 + 1 = 82
Answer: 82

2 Time

A concert starts at 7:55 pm.
It lasts 3 hours 30 minutes.
At what time does it finish? Give your answer using am or pm.

7:55 pm + 3 hours = 10:55 pm
10:55 pm + 30 minutes = 11:25 pm
Answer: 11:25 pm

3 Column vectors

$\mathbf{a} = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -1 \\ 0 \end{pmatrix}$

Work out
(a) $\mathbf{a} + \mathbf{b}$
(b) $3\mathbf{a} - 2\mathbf{b}$

(a) $\begin{pmatrix} 2 \\ 0 \end{pmatrix} + \begin{pmatrix} -1 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$

(b) $\begin{pmatrix} 6 \\ 0 \end{pmatrix} - \begin{pmatrix} -2 \\ 0 \end{pmatrix} = \begin{pmatrix} 8 \\ 0 \end{pmatrix}$

Answer: (a) $\begin{pmatrix} \mathbf{1} \\ \mathbf{0} \end{pmatrix}$ **(b)** $\begin{pmatrix} \mathbf{8} \\ \mathbf{0} \end{pmatrix}$

4 Equations with brackets

Solve 7(2x + 7) = 21

Divide both sides by 7: 2x + 7 = 3
Subtract 7 from both sides: 2x = −4
Divide both sides by 2
Answer: x = −2

5 Two-way tables

The table shows some information about 95 students.
A person is chosen at random.
Find the probability that the person chose "Bus".

Boys who chose Bus = 53 − 24 = 29
Girls who chose Bus = 28
Total who chose Bus = 29 + 28 = 57
P = 57 out of 95
Answer: $\frac{3}{5}$

6 Fractions and decimals

(a) Write $\frac{16}{25}$ as a decimal.

(b) Write $\frac{5}{9}$ as a recurring decimal.

For part (b), write down the first 8 decimal places and say which digits repeat.

(a) 16 ÷ 25 = 0.64
(b) 5 ÷ 9: use short division, adding zeros
5 ÷ 9 = 0.55555555...
The digit 5 repeats
Answer: (a) 0.64 (b) 0.55555555... (5 repeats)

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7 Trigonometry: finding a side

Calculate the length of t. (Calculator)
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Label the sides: t is the adjacent and 11 m is the hypotenuse
We use cos (adjacent and hypotenuse)

$\cos 61° = \frac{t}{11}$

$t = 11 \times \cos 61° = 5.333...$
$t = 5.3$ m (1 d.p.)
Answer: t = 5.3 m

8 Venn diagram problems

35 pupils were asked.
22 of them study French and 19 of them study German.
8 of them did both.
(a) How many did neither?
(b) One is chosen at random. Find the probability that they study French but do not study German.

(a) Union = 22 + 19 − 8 = 33
Neither = 35 − 33 = 2
(b) Only study French = 22 − 8 = 14
P = 14 out of 35
Answer: (a) 2 (b) $\frac{2}{5}$

9 Growth in standard form

There are 7.6×10^2 cells in a sample.
The number doubles every day.
How many are there after 3 days?
Give your answer in standard form.

Each day multiply by 2, so multiply by $2^3 = 8$
$7.6 \times 10^2 \times 8 = 60.8 \times 10^2$
In standard form: 6.08×10^3
Answer: 6.08×10^3

10 Bearings with Pythagoras and trigonometry

A boat sails 4 km on a bearing of 000° from P to Q, then 5 km on a bearing of 090° to R. (Calculator)
(a) Work out the distance PR.
(b) Work out the bearing of R from P.
Give your answers correct to 1 decimal place.

(a) Triangle PQR has a right angle at Q
$PR^2 = 4^2 + 5^2 = 41$
$PR = \sqrt{41} = 6.403...$ km
(b) tan (angle QPR) = $\frac{5}{4}$, so angle QPR = 51.340° (to 3 d.p.)
PQ is on a bearing of 000° and R is 51.3° clockwise from PQ
Bearing = 0 + 51.340 = 51.3°
Answer: (a) 6.4 km (b) 051.3°