Day 284 **B Tier 10-a-day: Model Solutions**

1 Substitution

Work out the value of 2m + 3 when m = 8

Replace m with 8: 2 × 8 + 3
16 + 3 = 19
Answer: 19

2 Mean from a frequency table

The table shows the shoe sizes of students in a class.
Work out the mean.

Multiply each value by its frequency and add: 5 × 5 + 6 × 9 + 7 × 6 + 8 × 6 = 169
Total frequency = 5 + 9 + 6 + 6 = 26
Mean = 169 ÷ 26 = 6.5
Answer: 6.5

3 Using the nth term

The nth term of a sequence is 9n + 9
(a) Work out the 11th term.
(b) Is 162 a term in the sequence? You must show how you get your answer.

(a) Replace n with 11: 9 × 11 + 9 = 108
(b) Solve 9n + 9 = 162: 9n = 153
n = 153 ÷ 9 = 17, a whole number, so 162 is in the sequence
Answer: (a) 108 (b) Yes, it is term number 17

4 Mixed numbers

Work out $3\frac{1}{2} + 3\frac{7}{8}$

Give your answer as a mixed number.

Whole numbers: 3 + 3 = 6

Fractions: $\frac{1}{2} + \frac{7}{8} = \frac{11}{8} = 1\frac{3}{8}$

Total = $7\frac{3}{8}$

Answer: $7\frac{3}{8}$

5 Equations with brackets

Solve 6(2x + 7) = 138

Divide both sides by 6: 2x + 7 = 23
Subtract 7 from both sides: 2x = 16
Divide both sides by 2
Answer: x = 8

6 Fractions and decimals

(a) Write $\frac{29}{40}$ as a decimal.

(b) Write $\frac{2}{15}$ as a recurring decimal.

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

(a) 29 ÷ 40 = 0.725
(b) 2 ÷ 15: use short division, adding zeros
2 ÷ 15 = 0.13333333...
The digit 3 repeats
Answer: (a) 0.725 (b) 0.13333333... (3 repeats)

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7 Trigonometry in isosceles triangles

Triangle PQR is isosceles with PQ = PR = 6 m. (Calculator)
The base QR = 4 m.
Work out the size of angle PQR.
Give your answer correct to 1 decimal place.

Split the triangle into two right-angled triangles. Half the base = 4 ÷ 2 = 2

$\cos Q = \frac{2}{6}$

Angle PQR = $\cos^{-1}(\frac{2}{6})$ = 70.529...

= 70.5° (1 d.p.)

Answer: 70.5°

8 Fraction problems

A storage tank is $\frac{2}{3}$ full.

56 litres of oil are added.

The storage tank is now $\frac{9}{10}$ full.

Work out the capacity of the storage tank.

Fraction added = $\frac{9}{10} - \frac{2}{3} = \frac{7}{30}$

$\frac{7}{30}$ of the capacity = 56 litres

$\frac{1}{30}$ of the capacity = 56 ÷ 7 = 8 litres

Whole capacity = 8 × 30 = 240 litres

Answer: 240 litres

9 Bearings with Pythagoras and trigonometry

A boat sails 9 km on a bearing of 000° from P to Q, then 13 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

$PR^2 = 9^2 + 13^2 = 250$

PR = $\sqrt{250}$ = 15.811... km

(b) tan (angle QPR) = $\frac{13}{9}$, so angle QPR = 55.305° (to 3 d.p.)

PQ is on a bearing of 000° and R is 55.3° clockwise from PQ

Bearing = 0 + 55.305 = 55.3°

Answer: (a) 15.8 km (b) 055.3°

10 Average speed

A cyclist travels at 80 km/h for 0.5 hours and then at 20 km/h for 2.5 hours.
Work out its average speed for the whole journey.

Distance: 80 × 0.5 = 40 km and 20 × 2.5 = 50 km

Total distance = 90 km and total time = 3 hours

Average speed = 90 ÷ 3 = 30

Answer: 30 km/h