Day 290 **B Tier 10-a-day: Model Solutions**

1 Number machines

Here is a number machine.
Input → × 3 → + 10 → Output
(a) The input is 3. Work out the output.
(b) The output is 22. Work out the input.

(a) 3 × 3 = 9, then 9 + 10 = 19
(b) Work backwards: undo + 10 to get 12, then undo × 3 to get 4
Answer: (a) 19 (b) 4

2 Rounding

Write 62.4639
(a) correct to 2 decimal places,
(b) correct to 3 significant figures.

(a) Look at the next digit after the second decimal place: 3
So 62.4639 rounds to 62.46
(b) The first significant figure is the first non-zero digit. Count 3 figures and look at the next digit.
62.4639 rounds to 62.5
Answer: (a) 62.46 (b) 62.5

3 Radius from area or circumference

The area of a circle is 336 cm^2. (Calculator)
Work out the radius of the circle.
Give your answer correct to 1 decimal place.

Area = πr^2, so $r^2 = 336 \div \pi = 106.952...$
$r = \sqrt{106.952} = 10.342...$
r = 10.3 cm (1 d.p.)
Answer: 10.3 cm

4 Best buys

Juice is sold in two sizes.
Small: 500 ml for £1.40
Large: 1 litres for £3.30
Which size is better value for money?
You must show your working.

Compare the cost of 1000 ml of each
Large: 1 × £3.30 = £3.30
Small: 2 × £1.40 = £2.80
The small is cheaper for the same amount
Answer: The small size

5 Bearings with Pythagoras and trigonometry

A boat sails 8 km on a bearing of 270° from P to Q, then 6 km on a bearing of 000° 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
$PR^2 = 8^2 + 6^2 = 100$
$PR = \sqrt{100} = 10$ km
(b) tan (angle QPR) = $\frac{6}{8}$, so angle QPR = 36.870° (to 3 d.p.)
PQ is on a bearing of 270°, and R is a further 36.870° clockwise from PQ
Bearing = 270 + 36.870 = 306.9°
Answer: (a) 10 km (b) 306.9°

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6 Ratio with a difference

Femi and Maya share some money in the ratio 8 : 3.
Femi gets £30 more than Maya.
How much money does Maya get?

Difference in parts: 8 − 3 = 5
5 parts = £30, so 1 part = £6
Maya gets 3 × £6 = £18
Answer: £18

7 Fractions and decimals

(a) Write $\frac{3}{5}$ as a decimal.

(b) Write $\frac{2}{3}$ as a recurring decimal.

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

(a) 3 ÷ 5 = 0.6
(b) 2 ÷ 3: use short division, adding zeros
2 ÷ 3 = 0.66666666...
The digit 6 repeats
Answer: (a) 0.6 (b) 0.66666666... (6 repeats)

8 Trigonometry: finding a side

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

Label the sides: b is the hypotenuse and 16 m is the opposite
We use sin (opposite and hypotenuse)

$\sin 60° = \frac{16}{b}$

$b = \frac{16}{\sin 60°} = 18.475...$

b = 18.5 m (1 d.p.)
Answer: b = 18.5 m

9 Changing the subject

Make t the subject of the formula

$s = \frac{d}{t}$

Multiply both sides by t: st = d
Divide both sides by s

Answer: $t = \frac{d}{s}$

10 Relative frequency

Sam tests a biased coin landing on tails.
In 200 trials it happens 48 times.
Estimate how many times it will happen in 800 trials.

Relative frequency = 48 ÷ 200 = 0.24
0.24 × 800 = 192
Answer: 192