Day 91 **B Tier 10-a-day: Model Solutions**

1 Forming expressions

A pencil costs p pence.
A pen costs 35 pence more than a pencil.
(a) Write an expression, in terms of p, for the cost of a pen.
(b) Write an expression, in terms of p, for the total cost of 3 pencils and 4 pens. Give your answer in its simplest form.

(a) A pen costs 35p more than a pencil: p + 35
(b) 3 pencils cost 3p and 4 pens cost 4(p + 35)
3p + 4p + 140
Collect like terms: 7p + 140
Answer: (a) p + 35 (b) 7p + 140 pence

2 Powers and roots

Work out
(a) $2^2 + 2^3$
(b) $\sqrt{9} - 3^2$

(a) $2^2 = 4$ and $2^3 = 8$, so $4 + 8 = 12$
(b) $\sqrt{9} = 3$ and $3^2 = 9$, so $3 - 9 = -6$
Answer: (a) 12 (b) −6

3 Gradient of a line

Work out the gradient of the straight line that passes through the points (5, 7) and (6, 9).

Gradient = $\frac{\text{change in y}}{\text{change in x}}$
Change in y = 9 − 7 = 2
Change in x = 6 − 5 = 1
Gradient = $\frac{2}{1} = 2$
Answer: 2

4 Ratio and changes

In a room, the ratio of red counters to blue counters is 2 : 5.
There are 20 blue counters.
More red counters join so that there are equal numbers of red counters and blue counters.
How many red counters join?

5 parts = 20, so 1 part = 4
Originally there are 2 × 4 = 8 red counters
To equal 20, add 20 − 8 = 12
Answer: 12

5 Pythagoras' theorem

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

Use Pythagoras: $a^2 + b^2 = c^2$, where c is the longest side
$p^2 + 5^2 = 19^2$
$p^2 = 361 - 25 = 336$
$p = \sqrt{336} = 18.330...$
p = 18.3 cm (1 d.p.)
Answer: p = 18.3 cm

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6 Frequency trees

There are 100 visitors.

$\frac{3}{10}$ of them are men and the rest are women.

$\frac{2}{5}$ of the men and $\frac{2}{5}$ of the women buy a drink.

One person is chosen at random. Work out the probability that they buy a drink.

men: $\frac{3}{10} \times 100 = 30$ and women: $100 - 30 = 70$

men who buy a drink: $\frac{2}{5} \times 30 = 12$

women who buy a drink: $\frac{2}{5} \times 70 = 28$

P = (12 + 28) out of 100

Answer: $\frac{2}{5}$

7 Radius from area or circumference

The circumference of a circle is 95 cm. (Calculator)
Work out the diameter of the circle.
Give your answer correct to 1 decimal place.

Circumference = $\pi \times$ diameter
Diameter = $95 \div \pi = 30.239...$
= 30.2 cm (1 d.p.)
Answer: 30.2 cm

8 Stratified sampling

A stratified sample of 30 students is taken from the 300 students in the table.
Work out how many students should be sampled from Group C.

Sample fraction = $30 \div 300$
Group C: $90 \div 300 \times 30 = 9$
Answer: 9

9 Volume of cones and pyramids

A pyramid has a rectangular base 11 cm by 6 cm and vertical height 12 cm.

Volume of a pyramid = $\frac{1}{3} \times$ base area $\times$ height

Work out the volume of the pyramid.

Base area = $11 \times 6 = 66$

Volume = $\frac{1}{3} \times 66 \times 12 = 264$

Answer: 264 cm^3

10 Standard form calculations

A spacecraft travels at 6×10^6 km per hour.
It travels for 4.1×10^4 hours at this speed.
Work out how far it travels.
Give your answer in standard form.

Distance = speed $\times$ time
$(6 \times 10^6) \times (4.1 \times 10^4) = 24.6 \times 10^{10}$
In standard form: 2.46×10^{11}
Answer: 2.46×10^{11} km