Day 182 **A Tier 10-a-day: Model Solutions**

1 Loci and constructions

AB is a straight line.
A point S moves so that it is always 7 cm from the line AB, on one side of it.
Describe the locus of S.

Points a fixed distance from a straight line, on one side, form a parallel line
It is parallel to AB and 7 cm from it
Answer: A straight line parallel to AB, 7 cm away from it

2 Percentage change

Ali buys a painting for £200.
He sells it for £168.
Work out his percentage loss.

Loss = £200.00 − £168.00 = £32.00

Percentage loss = $\frac{£32.00}{£200.00} \times 100 = 16\%$

Answer: 16%

3 Standard form calculations

Work out $(9 \times 10^2) \div (3 \times 10^{-3})$
Give your answer in standard form.

Divide the numbers and subtract the powers of 10: $9 \div 3 = 3$ and $10^2 \div 10^{-3} = 10^5$
3×10^5
Answer: 3×10^5

4 Reverse percentages

The price of a season ticket increases by 25%.
The new price is £100.
Work out the price before the increase.

125% represents £100
1% = £100 ÷ 125 = £0.8
100% = £0.8 × 100 = £80.00
Answer: £80.00

5 Surd fractions

Show that $\frac{\sqrt{175} - \sqrt{63}}{\sqrt{7}}$ is an integer, and find its value.

$\sqrt{175} = 5\sqrt{7}$ and $\sqrt{63} = 3\sqrt{7}$
Numerator = $5\sqrt{7} - 3\sqrt{7} = 2\sqrt{7}$
$\frac{2\sqrt{7}}{\sqrt{7}} = 2$
Answer: 2

6 Quadratic sequences

Here are the first five terms of a quadratic sequence.
0, −3, −4, −3, 0
(a) Find an expression for the nth term.
(b) Work out the 15th term.

First differences: −3, −1, 1
Second differences: 2, 2, so a = 2 ÷ 2 = 1
Subtract n^2 from each term (1, 4, 9, 16): −1, −7, −13, −19
This is linear: −6n + 5
nth term = $n^2 - 6n + 5$
(b) Substitute n = 15: $1 \times 15^2 - 6 \times 15 + 5 = 140$
Answer: (a) $n^2 - 6n + 5$ (b) 140

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7 Combining ratios

p : q = 7 : 3
q : r = 2 : 5
(a) Work out the ratio p : q : r
(b) p, q and r add up to 280. Work out the value of r.

(a) Make the q parts equal: lowest common multiple of 3 and 2 is 6
p : q = 14 : 6 and q : r = 6 : 15
p : q : r = 14 : 6 : 15
(b) 14 + 6 + 15 = 35 parts, so 1 part = 280 ÷ 35 = 8
r = 15 × 8 = 120
Answer: (a) 14 : 6 : 15 (b) 120

8 Bounds in measurement

The length and width of a rectangular poster are 6.1 cm and 6.3 cm.
Each measurement is correct to 1 decimal place.
Work out the lower bound for the area.

Lower bound of length = 6.0 cm, lower bound of width = 6.2 cm
Lower bound of area = 6.05 × 6.25 = 37.8125
Answer: 37.8125 cm^2

9 Reverse fractions

$\frac{2}{5}$ of the books in a library are fiction.
There are 56 fiction books.
Work out the total number of books in the library.

$\frac{2}{5}$ of the total = 56
$\frac{1}{5}$ of the total = 56 ÷ 2 = 28
Whole = 28 × 5 = 140
Answer: 140

10 Direct and inverse proportion

y is inversely proportional to x.
When x = 2, y = 6.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 4.

(a) $y = \frac{k}{x}$. Substitute x = 2 and y = 6: $6 = \frac{k}{2}$, so k = 6 × 2 = 12
$y = \frac{12}{x}$
(b) $y = \frac{12}{4} = 3$
Answer: (a) $y = \frac{12}{x}$ (b) 3