Day 307 **A Tier 10-a-day: Model Solutions**

1 Mixed number addition and subtraction

Work out $5\frac{1}{2} + 2\frac{1}{5}$

Give your answer as a mixed number in its simplest form.

Write as improper fractions: $5\frac{1}{2} = \frac{11}{2}$ and $2\frac{1}{5} = \frac{11}{5}$

Common denominator 10: $\frac{55}{10} + \frac{22}{10}$

$= \frac{77}{10}$

$= 7\frac{7}{10}$

Answer: $7\frac{7}{10}$

2 Map scales

The scale of a map is 1 : 20000.
Two towns are 15 cm apart on the map.
Work out the real distance between the towns in kilometres.

Real distance = 15 × 20000 = 300000 cm
300000 cm = 3000 m = 3 km
Answer: 3 km

3 Powers and roots in standard form

Work out $\sqrt{1.69 \times 10^{-10}}$

Give your answer in standard form.

$\sqrt{1.69 \times 10^{-10}} = \sqrt{1.69} \times \sqrt{10^{-10}}$

$= 1.3 \times 10^{-5}$

Answer: 1.3×10^{-5}

4 Rearranging formulae

Make p the subject of q = 6p + 2

Subtract 2 from both sides: 6p = q − 2
Divide both sides by 6

$p = \frac{q - 2}{6}$

Answer: $p = \frac{q - 2}{6}$

5 Recurring decimals to fractions

Write the recurring decimal $0.\dot{8}\dot{1}$ as a fraction in its simplest form.

Let x = 0.818181...
Multiply by 100: 100x = 81.8181...
Subtract: 99x = 81

$x = \frac{81}{99} = \frac{9}{11}$

Answer: $\frac{9}{11}$

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6 Area of a triangle using sine

The area of triangle ABC is 29.9 m^2. (Calculator)
Angle x is acute.
Work out the size of angle x. Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\frac{1}{2} \times 7 \times 11 \times \sin x = 29.9$

$38.5 \sin x = 29.9$
$\sin x = 0.7766$
$x = 51.0°$
Answer: x = 51.0°

7 Transformations of graphs

The graph of y = f(x) has a maximum point at (4, 3).
Write down the coordinates of the turning point of the graph of
(a) y = f(x) + 4
(b) y = f(x − 1)

(a) Adding 4 to f(x) moves the graph 4 units up
The maximum point is (4, 7)
(b) Replacing x by (x − 1) moves the graph 1 unit right
The maximum point is (5, 3)
Answer: (a) (4, 7) (b) (5, 3)

8 Combining ratios

a : b = 5 : 2
b : c = 2 : 5
(a) Work out the ratio a : b : c
(b) a, b and c add up to 60. Work out the value of c.

(a) Make the b parts equal: lowest common multiple of 2 and 2 is 2
a : b = 5 : 2 and b : c = 2 : 5
a : b : c = 5 : 2 : 5
(b) 5 + 2 + 5 = 12 parts, so 1 part = 60 ÷ 12 = 5
c = 5 × 5 = 25
Answer: (a) 5 : 2 : 5 (b) 25

9 Probability with three selections

A bag contains 3 black pens and 5 blue pens.
Three pens are taken at random without replacement.
Work out the probability that exactly one of the three pens is blue.

One order, for example blue, black, black: $\frac{5}{8} \times \frac{3}{7} \times \frac{2}{6} = \frac{5}{56}$
There are 3 possible orders, each with the same probability
$3 \times \frac{5}{56} = \frac{15}{56}$
Answer: $\frac{15}{56}$

10 Circle theorems: angles in the same segment

A, B, C and D are points on a circle. AC and BD meet at E.
Angle BAC = 42° and angle ACD = 34°.
Work out the size of angle x (angle AEB).
Give reasons for your working.

Angles in the same segment are equal, so angle ABD = angle ACD = 34°
In triangle ABE: angle BAE = 42° and angle ABE = 34°
x = 180 − 42 − 34 = 104
Answer: x = 104°