Day 192 **A Tier 10-a-day: Model Solutions**

1 Ordering numbers

Write these numbers in order of size, starting with the smallest.

$\frac{5}{8}$ 0.4 0.12 66%

Change each to a decimal: $\frac{5}{8}$ = 0.625, 0.4 = 0.4, 0.12 = 0.12, 66% = 0.66

Order the decimals: 0.12 < 0.4 < 0.625 < 0.66

Answer: 0.12, 0.4, $\frac{5}{8}$, 66%

2 Successive percentage changes

The number of members of a gym is increased by 10%.
The new number is then decreased by 50%.
Work out the overall percentage change.

First change: multiplier 1.1. Second change: multiplier 0.5
Overall multiplier = 1.1 × 0.5 = 0.55
0.55 − 1 = −0.45, so the overall change is 45%
Answer: 45% decrease

3 Double inequalities

(a) Solve $-6 < 3x - 6 \leq 9$
(b) Write down all the integer values of x that satisfy this inequality.

(a) Add 6 to every part: $0 < 3x \leq 15$
Divide every part by 3: $0 < x \leq 5$
(b) The integers are 1, 2, 3, 4, 5
Answer: (a) $0 < x \leq 5$ (b) 1, 2, 3, 4, 5

4 Terminating and recurring decimals

Here are four fractions: $\frac{14}{40}$ $\frac{7}{8}$ $\frac{12}{15}$ $\frac{7}{12}$

Which one of these fractions is equal to a recurring decimal?

Simplify each fraction: $\frac{14}{40} = \frac{7}{20}$, $\frac{7}{8}$, $\frac{12}{15} = \frac{4}{5}$, $\frac{7}{12}$

A fraction in simplest form is a terminating decimal only if its denominator has no prime factors other than 2 and 5.

$\frac{7}{12}$ has denominator 12 = 2 × 2 × 3, which includes a factor other than 2 and 5.

Answer: $\frac{7}{12}$

5 Tree diagrams

The tree diagram shows probabilities for two events.
(a) Work out the values of x and y.
(b) Work out the probability of sunny and walks.

(a) Probabilities on pairs of branches add up to 1.
x = 1 − 0.5 = 0.5 and y = 1 − 0.7 = 0.3
(b) 0.5 × 0.7 = 0.35
Answer: (a) x = 0.5, y = 0.3 (b) 0.35

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6 Fraction calculations

Work out $(2\frac{1}{4} + 3\frac{1}{6}) \div 2\frac{3}{5}$

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

Brackets first, as improper fractions: $\frac{9}{4} + \frac{19}{6} = \frac{65}{12}$

Then divide by multiplying by the reciprocal: $\frac{65}{12} \times \frac{5}{13} = \frac{25}{12}$

$= 2\frac{1}{12}$

Answer: $2\frac{1}{12}$

7 Circle theorems: isosceles triangles with radii

A, B and C are points on a circle with centre O.
Angle OAB = 36°.
(a) Work out angle AOB.
(b) Work out the size of angle x.
Give reasons for your answers.

(a) OA = OB (radii), so triangle OAB is isosceles and angle OBA = 36°
Angle AOB = 180 − 36 − 36 = 108°
(b) The angle at the centre is twice the angle at the circumference
x = 108 ÷ 2 = 54
Answer: (a) 108° (b) x = 54°

8 Direct and inverse proportion

y is inversely proportional to x.
When x = 1, y = 10.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 10.

(a) $y = \frac{k}{x}$. Substitute x = 1 and y = 10: $10 = \frac{k}{1}$, so k = 10 × 1 = 10

$y = \frac{10}{x}$

(b) $y = \frac{10}{10} = 1$

Answer: (a) $y = \frac{10}{x}$ (b) 1

9 Probabilities adding to 1

The table shows the probabilities of the outcomes of a biased spinner.
(a) Work out the value of x.
(b) The spinner is spun 200 times. Estimate the number of times it lands on green.

(a) Probabilities add to 1: 0.15 + x + x + 0.05 = 1
0.2 + 2x = 1, so 2x = 0.8
x = 0.4
(b) P(green) = 0.4, so expected number = 0.4 × 200 = 80
Answer: (a) x = 0.4 (b) 80

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10 Exact trigonometric values

PQR is a right-angled triangle with the right angle at Q.
PR = 12 cm and angle QPR = 60°.
Work out the exact length of PQ.
Do not use a calculator.

PQ is next to the 60° angle and PR is the hypotenuse, so use cos

$\cos 60° = \frac{1}{2}$

$PQ = 12 \times \frac{1}{2} = 6$

Answer: 6 cm