**Day 234** **A Tier 10-a-day: Model Solutions**

## 1 Functions

f(x) = 4x + 4

$g(x) = x^2 - 6$

Find fg(−6)

$g(-6) = (-6)^2 - 6 = 30$

f(30) = 4 × 30 + 4 = 124

**Answer: 124**

## 2 Median from a frequency table

The frequency table shows data for 25 matches.

(a) Find the median.

(b) Work out the range.

(a) The median is the 13th value (25 + 1) ÷ 2 = 13

Cumulative frequencies: 8, 9, 13, 18, 25

The 13th value is 2

(b) Range = 4 − 0 = 4

**Answer: (a) 2 (b) 4**

## 3 Bounds of a speed or density

A runner travels 270 m in 14.9 s. The distance is measured to the nearest 10 metres and the time to the nearest 0.1 second. (Calculator)

Work out the upper bound for the runner's speed in m/s.

Give your answer correct to 3 significant figures.

speed = distance ÷ time

For the upper bound of speed use the upper bound of distance and the lower bound of time.

275 ÷ 14.85 = 18.51852

= 18.5 m/s (3 s.f.)

**Answer: 18.5 m/s**

## 4 Inverse functions

$f(x) = \frac{2}{x} + 5$

(a) Find $f^{-1}(x)$

(b) Work out $f^{-1}(8)$

Let $y = \frac{2}{x} + 5$

$y - 5 = \frac{2}{x}$, so $x = \frac{2}{(y-5)}$

Swap y for x: $f^{-1}(x) = \frac{2}{(x-5)}$

(b) $f^{-1}(8) = \frac{2}{3}$

**Answer: (a) $f^{-1}(x) = \frac{2}{(x-5)}$ (b) $\frac{2}{3}$**

## 5 Fraction calculations

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

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

Brackets first, as improper fractions: $\frac{14}{5} + \frac{7}{2} = \frac{63}{10}$

Then divide by multiplying by the reciprocal: $\frac{63}{10} \times \frac{5}{18} = \frac{7}{4}$

$= 1\frac{3}{4}$

**Answer: $1\frac{3}{4}$**

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## 6 Interior angles of polygons

The size of each angle of a pentagon is shown as an expression:
(3x + 20)°, (2x + 60)°, (x + 20)°, (3x + 55)°, (2x + 44)°
Work out the value of x.

Sum of angles = (5 − 2) × 180 = 540°
3x + 20 + 2x + 60 + x + 20 + 3x + 55 + 2x + 44 = 540
11x + 199 = 540
11x = 341
x = 31
**Answer: x = 31**

## 7 Finding a missing value from an average

The mean of the five numbers 7, 24, 21, x, 14 is 16.
Work out the value of x.

Total = 5 × 16 = 80
Known numbers add to 66
x = 80 − 66 = 14
**Answer: x = 14**

## 8 Rationalising with conjugates

Rationalise the denominator of $\frac{52}{4+\sqrt{3}}$

Give your answer in the form $a + b\sqrt{c}$ where a and b are integers.

Multiply top and bottom by the conjugate $4 - \sqrt{3}$: $\frac{52(4-\sqrt{3})}{(4+\sqrt{3})(4-\sqrt{3})}$

Denominator: 16 − 3 = 13
$\frac{52(4-\sqrt{3})}{13} = 4(4-\sqrt{3})$
$= 16 - 4\sqrt{3}$
**Answer: $16 - 4\sqrt{3}$**

## 9 Density

A piece of plastic has a volume of 190 $cm^3$.
The density of the material is 4.2 $g/cm^3$.
Work out the mass of the piece of plastic.

Mass = density × volume
= 4.2 × 190 = 798 g
**Answer: 798 g**

## 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 = 55°.
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 = 55°
In triangle ABE: angle BAE = 42° and angle ABE = 55°
x = 180 − 42 − 55 = 83
**Answer: x = 83°**