**Day 287** **A Tier 10-a-day: Model Solutions**

## 1 Area of parallelograms and kites

The diagram shows a kite.
The diagonals are 18 cm and 9 cm and cross at right angles.
Work out the area of the kite.
The diagram is not drawn accurately.

Area = $\frac{1}{2}$ × (diagonal 1) × (diagonal 2)

= $\frac{1}{2}$ × 18 × 9

= 81

**Answer: 81 cm$^2$**

## 2 nth term of a linear sequence

Here are the first four terms of a sequence.
8, 15, 22, 29
(a) Find an expression for the nth term.
(b) Is 177 a term of this sequence? You must show your working.

The terms go up by 7 each time, so the nth term starts with 7n
8 − 7 = 1, so the nth term is 7n + 1
(b) 7n + 1 = 177

7n = 176, so n = $\frac{176}{7}$

n is not a positive whole number, so 177 is not a term of the sequence
**Answer: (a) 7n + 1 (b) No**

## 3 Converting units of area and volume

A rectangular table top is 180 cm by 80 cm.
Work out its area in m$^2$.

Area = 180 × 80 = 14400 cm$^2$
1 m$^2$ = 10 000 cm$^2$
14400 ÷ 10 000 = 1.44
**Answer: 1.44 m$^2$**

## 4 Direct and inverse proportion

y is inversely proportional to the square of x.
When x = 2, y = 12.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 4.

(a) y = $\frac{k}{x^2}$. Substitute x = 2 and y = 12: 12 = $\frac{k}{4}$, so k = 12 × 4 = 48

y = $\frac{48}{x^2}$

(b) y = $\frac{48}{16}$ = 3

**Answer: (a) y = $\frac{48}{x^2}$ (b) 3**

## 5 Growth and decay

A house is worth £250000. (Calculator)
Its value increases by 20% each year.
Work out its value after 3 years., to the nearest pound.

Multiplier = 100% + 20% = 1.2
250000 × 1.2$^3$ = 432000.00
= £432000 to the nearest whole number
**Answer: £432000**

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## 6 Index equations

Solve $5^{2x+1} = 125$

$125 = 5^3$, so $2x + 1 = 3$
$2x = 3 - 1 = 2$
$x = 1$
**Answer: x = 1**

## 7 Circle theorems: cyclic quadrilaterals

A, B, C and D are points on a circle.
Angle A = $(2x + 20)°$ and angle C = $(3x - 35)°$.
(a) Work out the value of x.
(b) Work out the size of angle A.
The diagram is not drawn accurately.

(a) Opposite angles of a cyclic quadrilateral add up to 180°
$2x + 20 + 3x - 35 = 180$
$5x - 15 = 180$
$5x = 195$
$x = 39$
(b) $2 \times 39 + 20 = 98$
**Answer: (a) x = 39 (b) 98°**

## 8 Rationalising the denominator

Rationalise the denominator of $\frac{7}{\sqrt{7}}$

Give your answer in its simplest form.

Multiply top and bottom by $\sqrt{7}$: $\frac{7}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{7\sqrt{7}}{7}$

$= \sqrt{7}$
**Answer: $\sqrt{7}$**

## 9 Terminating and recurring decimals

Here are four fractions: $\frac{3}{8}$ $\frac{6}{9}$ $\frac{7}{8}$ $\frac{18}{40}$

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

Simplify each fraction: $\frac{3}{8}$, $\frac{6}{9} = \frac{2}{3}$, $\frac{7}{8}$, $\frac{18}{40} = \frac{9}{20}$

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

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

**Answer: $\frac{6}{9}$**

## 10 Probabilities adding to 1

The table shows the probabilities of the outcomes of a biased four-sided dice.
(a) Work out the value of x.
(b) The four-sided dice is rolled 300 times. Estimate the number of times it lands on 3.

(a) Probabilities add to 1: $0.2 + x + x + 0.3 = 1$
$0.5 + 2x = 1$, so $2x = 0.5$
$x = 0.25$
(b) P(3) = 0.25, so expected number = $0.25 \times 300 = 75$
**Answer: (a) x = 0.25 (b) 75**