Day 251 **A Tier 10-a-day: Model Solutions**

1 nth term of a linear sequence

Here are the first four terms of a sequence.
8, 2, −4, −10
(a) Find an expression for the nth term.
(b) Find the first term in the sequence that is less than −150.

The terms change by −6 each time, so the nth term starts with −6n
8 − (−6) = 14, so the nth term is −6n + 14
(b) −6n + 14 < −150
−6n < −164

Divide by −6 and reverse the inequality sign: $n > \frac{82}{3}$

The smallest whole number is n = 28, and the term is −154
Answer: (a) −6n + 14 (b) −154

2 Mixed number addition and subtraction

Work out $3\frac{2}{7} + 2\frac{2}{3}$
Give your answer as a mixed number in its simplest form.

Write as improper fractions: $3\frac{2}{7} = \frac{23}{7}$ and $2\frac{2}{3} = \frac{8}{3}$

Common denominator 21: $\frac{69}{21} + \frac{56}{21}$

$= \frac{125}{21}$

$= 5\frac{20}{21}$

Answer: $\mathbf{5\frac{20}{21}}$

3 Iteration

$x_{n+1} = \frac{8}{(x_n + 3)}$
$x_0 = 3$
Work out the values of x_1, x_2 and x_3.
Give your answers correct to 3 decimal places. (Calculator)

Substitute $x_0 = 3$ into the formula, then use each answer in the next step (keep the full calculator display)
$x_1 = 1.33333$
$x_2 = 1.84615$
$x_3 = 1.65079$
Answer: $x_1 = 1.333$, $x_2 = 1.846$, $x_3 = 1.651$

4 Area of a trapezium

The area of this trapezium is 90 cm^2.
Work out the value of x.
The diagram is not drawn accurately.

$\frac{1}{2} \times (x + 17) \times 6 = 90$
$(x + 17) \times 6 = 180$
$x + 17 = 180 \div 6 = 30$
$x = 13$
Answer: x = 13

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5 Double inequalities

(a) Solve $-17 < 3x - 5 \leq -2$

(b) Write down all the integer values of x that satisfy this inequality.

(a) Add 5 to every part: $-12 < 3x \leq 3$

Divide every part by 3: $-4 < x \leq 1$

(b) The integers are $-3, -2, -1, 0, 1$

Answer: (a) $-4 < x \leq 1$ (b) $-3, -2, -1, 0, 1$

6 Scatter graphs

The scatter graph shows the hours of revision and the test scores of some students.

A line of best fit is drawn.

(a) Describe the correlation.

(b) Estimate the test score of a student who revised for 5 hours.

(a) As hours of revision increases, test score increases, so there is positive correlation

(b) Draw a line up from 5 on the horizontal axis to the line of best fit, then across to the vertical axis

The line gives a value of 30

Answer: (a) Positive correlation (b) 30

7 Enlargements and coordinates

Triangle LMN has vertices L(4, 0), M(4, 2), N(−4, 4).

The triangle is enlarged with scale factor $\frac{1}{2}$ and centre (0, 2).

Write down the coordinates of the vertices of the image.

Each vertex moves to: centre + scale factor × (vertex − centre)

L: (4, 0) → (2, 1)

M: (4, 2) → (2, 2)

N: (−4, 4) → (−2, 3)

Answer: L'(2, 1), M'(2, 2), N'(−2, 3)

8 Recurring decimals, show that

(a) Show that $0.\dot{5}\dot{2} = \frac{52}{99}$

(b) Hence write $5.\dot{5}\dot{2}$ as a mixed number in its simplest form.

(a) Let x = 0.525252..., so 100x = 52.5252...

100x − x = 52, so 99x = 52 and $x = \frac{52}{99}$

(b) $5.\dot{5}\dot{2} = 5 + \frac{52}{99} = 5\frac{52}{99}$

Answer: (b) $5\frac{52}{99}$

9 Inverse proportion formulae

y is inversely proportional to x.

When x = 10, y = 8.

(a) Find a formula for y in terms of x.

(b) Work out the positive value of x when y = 10.

(a) $y = \frac{k}{x}$. Substitute: $8 = \frac{k}{10}$, so k = 8 × 10 = 80

$y = \frac{80}{x}$

(b) $10 = \frac{80}{x}$, so x = 80 ÷ 10 = 8

Answer: (a) $y = \frac{80}{x}$ (b) x = 8

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10 Successive percentage changes

The price of a ticket is increased by 50% and then the new amount is decreased by 40%.
Work out the overall percentage decrease.

Multipliers: increase of 50% is 1.5, decrease of 40% is 0.6
Overall multiplier = 1.5 × 0.6 = 0.9
0.9 means a percentage decrease of 10%
Answer: 10% decrease