Day 118 **A Tier 10-a-day: Model Solutions**

1 Bearings

The bearing of M from L is 115°.
Work out the bearing of L from M.
The diagram is not drawn accurately.

The north lines at L and M are parallel
Back bearing = 115° + 180° = 295°
Answer: 295°

2 Straight line graphs

A straight line has equation 3x + 2y = 6
(a) Find the gradient of the line.
(b) Find the coordinates of the point where the line crosses the x-axis.

(a) Rearrange into y = mx + c: $2y = -3x + 6$

$y = -\frac{3}{2}x + 3$

The gradient is $-\frac{3}{2}$

(b) On the x-axis, y = 0: 3x = 6, so x = 2

Answer: (a) $-\frac{3}{2}$ (b) (2, 0)

3 Converting area and volume units

Change 4000 cm^2 to m^2.

1 m^2 = 10 000 cm^2
4000 ÷ 10 000 = 0.4
Answer: 0.4 m^2

4 Recurring decimals to fractions

Write the recurring decimal $0.\dot{7}\dot{6}$ as a fraction in its simplest form.

Let x = 0.767676...
Multiply by 100: 100x = 76.7676...
Subtract: 99x = 76

$x = \frac{76}{99}$

Answer: $\frac{76}{99}$

5 Successive percentage changes

The population of a village is decreased by 25%.
The new population is then decreased by 10%.
Work out the overall percentage change.

First change: multiplier 0.75. Second change: multiplier 0.9
Overall multiplier = 0.75 × 0.9 = 0.675
0.675 − 1 = −0.325, so the overall change is 32.5%
Answer: 32.5% decrease

Day 118 **A Tier 10-a-day: Model Solutions**

6 Recurring decimals, show that

(a) Show that $0.\dot{8}\dot{5} = \frac{85}{99}$

(b) Hence write $5.\dot{8}\dot{5}$ as a mixed number in its simplest form.

(a) Let x = 0.858585..., so 100x = 85.8585...

$100x - x = 85$, so $99x = 85$ and $x = \frac{85}{99}$

(b) $5.\dot{8}\dot{5} = 5 + \frac{85}{99} = 5\frac{85}{99}$

Answer: (b) $5\frac{85}{99}$

7 Direct proportion formulae

y is directly proportional to the cube of x.
When x = 2, y = 48.
(a) Find a formula for y in terms of x.
(b) Work out the positive value of x when y = 750.

(a) $y = kx^3$. Substitute: $48 = k \times 8$, so $k = 6$

$y = 6x^3$

(b) $750 = 6x^3$, so $x^3 = 750 \div 6 = 125$, so $x = 5$

Answer: (a) $y = 6x^3$ (b) $x = 5$

8 Circles and tangents

The point P(−15, 8) lies on a circle with centre O(0, 0).
(a) Work out the equation of the circle, in the form $x^2 + y^2 = r^2$.
(b) Find the equation of the tangent to the circle at P.

(a) The circle is $x^2 + y^2 = r^2$, so $r^2 = (-15)^2 + 8^2 = 289$

(b) Gradient of the radius OP = $\frac{8}{-15} = -\frac{8}{15}$

The tangent is perpendicular to the radius, so its gradient = $-1 \div (-\frac{8}{15}) = \frac{15}{8}$

$y = \frac{15}{8}x + c$ through (−15, 8): $8 = \frac{15}{8} \times (-15) + c$, so $c = \frac{289}{8}$

$y = \frac{15}{8}x + \frac{289}{8}$

Answer: (a) $x^2 + y^2 = 289$ (b) $y = \frac{15}{8}x + \frac{289}{8}$

9 Describing transformations

Describe fully the single transformation that maps shape A onto shape B.

The shape has been turned, so this is a rotation
Compare the matching vertices to find the angle and direction: a quarter turn anticlockwise
The centre is the point that stays fixed: (−2, 1)
Answer: Rotation, 90° anticlockwise, centre (−2, 1)

10 Simultaneous equations (one quadratic)

Solve the simultaneous equations
$y = x^2 - 6x + 18$
$y = x + 8$

Set the y values equal: $x^2 - 6x + 18 = x + 8$
$x^2 - 7x + 10 = 0$
$(x - 2)(x - 5) = 0$
$x = 2$ or $x = 5$
Substitute into $y = x + 8$: $y = 10$ and $y = 13$
Answer: $x = 2, y = 10$ and $x = 5, y = 13$