Day 262 **A Tier 10-a-day: Model Solutions**

1 Straight line graphs

A straight line has equation $-x + 3y = 2$
(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: $3y = x + 2$

$y = \frac{1}{3}x + \frac{2}{3}$

The gradient is $\frac{1}{3}$

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

Answer: (a) $\frac{1}{3}$ (b) $(-2, 0)$

2 Midpoints and length of a line segment

M is the midpoint of AB.
A is the point $(-4, -6)$ and M is the point $(-5, 1)$.
Work out the coordinates of B.

From A to M: x changes by -1 and y changes by 7
Do the same again from M to get B
$B = (-5 + (-1), 1 + 7) = (-6, 8)$
Answer: $(-6, 8)$

3 LCM in context

On a stage, a yellow beacon flashes every 12 seconds.
A boat's lamp flashes every 10 seconds.
They flash together at the start.
After how many seconds will they next flash together?

Find the LCM of 12 and 10.
$12 = 2^2 \times 3$ and $10 = 2 \times 5$
LCM = 60
They flash together again after 60 seconds.
Answer: 60 seconds

4 Area of a sector

The diagram shows a sector of a circle of radius 5 cm.
Work out the area of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Area $= \frac{240}{360} \times \pi \times 5^2$

$= \frac{2}{3} \times 25\,\pi$

$= \frac{50}{3}\pi$

Answer: $\frac{50}{3}\pi$ cm^2

5 Parallel and perpendicular lines

The line L has equation $y = 2x + 4$
Find the equation of the line that is parallel to L and passes through the point (2, 9).

Parallel lines have the same gradient, so the gradient is 2
$y = 2x + c$, so $9 = 2 \times 2 + c$
$c = 5$
$y = 2x + 5$
Answer: $y = 2x + 5$

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6 Probability without replacement

A bag contains 5 mint and 7 fruit sweets.
Two sweets are taken at random without replacement.
Work out the probability that the two sweets are different colours.

P(same colour) = $\frac{5}{12} \times \frac{4}{11} + \frac{7}{12} \times \frac{6}{11} = \frac{31}{66}$

P(different) = $1 - \frac{31}{66} = \frac{35}{66}$

Answer: $\mathbf{\frac{35}{66}}$

7 Bounds

A triangle has base 37 cm and perpendicular height 10 cm.
Each measurement is correct to the nearest cm.
Work out the lower bound for the area of the triangle.

Lower bounds: base = 36.5 cm, height = 9.5 cm

Area = ½ × 36.5 × 9.5 = 173.375 cm^2

Answer: 173.375 cm^2

8 The cosine rule: finding an angle

Work out the size of angle x. (Calculator)
Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\cos x = \frac{13^2 + 9^2 - 7^2}{2 \times 13 \times 9}$

$\cos x = \frac{201}{234}$

$x = \cos^{-1}(0.8590)$

$x = 30.8°$

Answer: x = 30.8°

9 Perpendicular bisector

A is the point (−5, 3) and B is the point (1, −5).
Find the equation of the perpendicular bisector of AB.

Midpoint of AB = $(\frac{(-5) + 1}{2}, \frac{3 + (-5)}{2}) = (-2, -1)$

Gradient of AB = $\frac{-8}{6} = -\frac{4}{3}$

Perpendicular gradient = $-1 \div (-\frac{4}{3}) = \frac{3}{4}$

$y = \frac{3}{4}x + c$ through $(-2, -1)$: $-1 = \frac{3}{4} \times (-2) + c$, so $c = \frac{1}{2}$

$y = \frac{3}{4}x + \frac{1}{2}$

Answer: $\mathbf{y = \frac{3}{4}x + \frac{1}{2}}$

10 Probability with three selections

A bag contains 5 black pens and 2 blue pens.
Three pens are taken at random without replacement.
Work out the probability that all three pens are black.

P(all black) = $\frac{5}{7} \times \frac{4}{6} \times \frac{3}{5}$

$= \frac{60}{210} = \frac{2}{7}$

Answer: $\mathbf{\frac{2}{7}}$