Day 37 **A Tier 10-a-day: Model Solutions**

1 Simultaneous equations

Solve the simultaneous equations
$5x - 4y = 15$
$-2x + 2y = -6$

Multiply (2) by 2 to make the y coefficients match
$5x - 4y = 15$ (1)
$-4x + 4y = -12$ (2)
The y terms have opposite signs, so add the equations
$x = 3$
Substitute $x = 3$ into equation (1) to find $y = 0$
Answer: $x = 3$, $y = 0$

2 Area of a segment

The diagram shows a circle with centre O and radius 7 cm.
Angle AOB = 90°. (Calculator)
Work out the area of the shaded segment.
Give your answer to 3 significant figures.

Area of sector = $\frac{90}{360} \times \pi \times 7^2 = 38.485$

Area of triangle OAB = $\frac{1}{2} \times 7 \times 7 \times \sin 90° = 24.500$

Segment = $38.485 - 24.500 = 14.0$

Answer: 14.0 cm^2

3 Equations with fractions

Solve $\frac{2x - 2}{4} = \frac{3x - 1}{5}$

Multiply both sides by 20
$5(2x - 2) = 4(3x - 1)$
$10x - 10 = 12x - 4$
$-2x = 6$
$x = -3$
Answer: $x = -3$

4 Pie charts

The pie chart shows how some students travel to school.
35 students chose walk.
(a) Work out the angle for cycle.
(b) How many students chose cycle?

(a) $360 - 175 - 130 - 15 = 40°$
(b) 35 students is 175°, so 1 student is $175 \div 35 = 5°$
Cycle: $40 \div 5 = 8$
Answer: (a) 40° (b) 8

5 Income tax

No tax is paid on the first £11,000 of income. Tax of 15% is paid on the next £35,000. Tax of 35% is paid on all income above £46,000. (Calculator)
Jack earns £69,000 a year.
Work out the income tax paid.

Next £35,000 at 15%: £35,000 × 0.15 = £5,250
Above £46,000: £69,000 − £46,000 = £23,000, taxed at 35%: £23,000 × 0.35 = £8,050
Total tax = £5,250 + £8,050 = £13,300
Answer: £13,300

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6 Composite functions

$f(x) = 3x - 5$

$g(x) = x^2 - 3$

Solve $fg(x) = 94$

$fg(x) = 3(x^2 - 3) - 5 = 3x^2 - 14$

$3x^2 - 14 = 94$, so $3x^2 = 108$

$x^2 = 36$, so $x = \pm 6$

Answer: $x = 6$ or $x = -6$

7 Cumulative frequency graphs

The cumulative frequency graph shows information about the length of 40 leaves.

Use the graph to find an estimate for

(a) the median,

(b) the number of leaves with a length greater than 30 cm.

(a) Median at cumulative frequency $40 \div 2 = 20$

Read across from 20 to the graph, then down to the axis

Median = 60 cm

(b) At 30 cm the cumulative frequency is 8

$40 - 8 = 32$

Answer: (a) 60 cm (b) 32

8 Pythagoras in three dimensions

The diagram shows a cuboid.

Work out the length of the diagonal AG.

The diagram is not drawn accurately.

$AG^2 = 1^2 + 8^2 + 4^2$

$= 1 + 64 + 16 = 81$

$AG = \sqrt{81} = 9$

Answer: 9 cm

9 Bounds and accuracy

A cyclist travels 440 metres in 15.2 seconds. The distance is correct to the nearest 10 metres and the time to the nearest 0.1 second.

(a) Work out the upper bound and the lower bound of the speed in m/s.

(b) Write the speed to a suitable degree of accuracy. Give a reason for your answer.

(a) Upper bound $= 445 \div 15.15 = 29.3729$

Lower bound $= 435 \div 15.25 = 28.5246$

(b) Both bounds round to 29 to 2 s.f. but not to the same value to 3 s.f.

So the speed is 29 m/s to 2 significant figures.

Answer: (a) 29.3729, 28.5246 (b) 29 m/s (2 s.f.)

10 Bearings with the cosine rule

Ship A sails 6 km from a port on a bearing of 260°.

Ship B sails 11 km from the same port on a bearing of 145°. (Calculator)

Work out the distance between the two ships.

Give your answer to 3 significant figures.

The angle between the two paths $= |260° - 145°| = 115°$

$d^2 = 6^2 + 11^2 - 2 \times 6 \times 11 \times \cos 115°$

$d^2 = 212.79$

$d = 14.6$

Answer: 14.6 km