Day 260 **A Tier 10-a-day: Model Solutions**

1 Time

(a) A train leaves London at 1115. The journey takes 2 hours 37 minutes. Work out the time it ends.
(b) Change 3.4 hours into hours and minutes.

(a) 1115 + 2 hours = 1315, then + 37 minutes = 1352
(b) 0.4 hours = 0.4 × 60 = 24 minutes, so 3.4 hours = 3 hours 24 minutes
Answer: (a) 1352 (b) 3 hours 24 minutes

2 Double inequalities

(a) Solve $-11 \leq 4x - 7 < 1$
(b) Write down all the integer values of x that satisfy this inequality.

(a) Add 7 to every part: $-4 \leq 4x < 8$
Divide every part by 4: $-1 \leq x < 2$
(b) The integers are −1, 0, 1
Answer: (a) $-1 \leq x < 2$ (b) −1, 0, 1

3 Percentage change

The price of a bicycle helmet changes from £60 to £45.60.
Work out the percentage decrease.

Decrease = £60.00 − £45.60 = £14.40
Percentage decrease = $\frac{£14.40}{£60.00} \times 100 = 24\%$
Answer: 24%

4 Is it a right-angled triangle?

A triangle has sides of length 21 cm, 29 cm and 20 cm.
Is the triangle right-angled?
You must show your working.

Longest side^2 = 29^2 = 841
Sum of the squares of the other two sides = $20^2 + 21^2 = 400 + 441 = 841$
841 = 841, so the triangle is right-angled
Answer: Yes, it is right-angled

5 Income tax

No tax is paid on the first £11,000 of income. Tax of 25% is paid on the next £30,000. Tax of 35% is paid on all income above £41,000. (Calculator)
Aisha earns £48,500 a year.
Work out the income tax paid.

Next £30,000 at 25%: £30,000 × 0.25 = £7,500
Above £41,000: £48,500 − £41,000 = £7,500, taxed at 35%: £7,500 × 0.35 = £2,625
Total tax = £7,500 + £2,625 = £10,125
Answer: £10,125

6 Sectors: finding an angle or radius

A sector of a circle has radius 8 cm and an arc length of 4π cm.
Work out the angle at the centre of the sector.

Arc length = $\frac{\theta}{360} \times 2 \times \pi \times 8$
$4\pi = \frac{\theta}{360} \times 16\pi$
$\theta = 4 \times 360 \div 16$
$\theta = 90$
Answer: 90°

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7 Inverse functions

$f(x) = \frac{x - 1}{3}$

(a) Find $f^{-1}(x)$

(b) Work out $f^{-1}(4)$

Let $y = \frac{x - 1}{3}$

$x = 3y + 1$

$f^{-1}(x) = 3x + 1$

(b) $f^{-1}(4) = 13$

Answer: (a) $f^{-1}(x) = 3x + 1$ (b) 13

8 Index equations

Solve $5^{4x - 1} = 125$

$125 = 5^3$, so $4x - 1 = 3$

$4x = 3 + 1 = 4$

$x = 1$

Answer: $x = 1$

9 Two-way tables

The table shows information about 61 people.

One person is chosen at random.

(a) Find the probability that the person studies French.

(b) The person is a girl. Find the probability that they studies Spanish.

(a) French total = 33 out of 61 = $\frac{33}{61}$

(b) Girls total = 14, of whom 7 are in the Spanish column: $\frac{1}{2}$

Answer: (a) $\frac{33}{61}$ (b) $\frac{1}{2}$

10 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{5x + 1}{-x + 2}$

Multiply both sides by $(-x + 2)$: $y(-x + 2) = 5x + 1$

Expand the bracket: $-xy + 2y = 5x + 1$

Collect the x terms on one side: $-xy - 5x = -2y + 1$

Factorise: $x(-y - 5) = -2y + 1$

Divide by $(-y - 5)$: $x = \frac{-2y + 1}{-y - 5}$

Multiply the top and bottom by -1: $x = \frac{2y - 1}{y + 5}$

Answer: $x = \frac{2y - 1}{y + 5}$