Day 248 **A Tier 10-a-day: Model Solutions**

1 Isosceles triangles and exterior angles

ABC is an isosceles triangle with AB = AC.
BCD is a straight line.
Angle BAC = 110°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle ABC = (180 − 110) ÷ 2 = 35°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 110 + 35 = 145
Answer: x = 145°

2 Algebraic formulae in context

A hall is hired for £40 plus £15 for each hour.
(a) Write a formula for the total cost, £C, after h hours.
(b) Omar pays £265 in total. Work out the number of hours.

(a) C = 40 + 15h
(b) 40 + 15h = 265
15h = 225
h = 15
Answer: (a) C = 40 + 15h (b) 15

3 Compound interest

Priya invests £4,500 in a bank account. (Calculator)
The account pays compound interest at 1.5% per year.
Work out the total interest earned after 4 years.

Multiplier = 1 + 1.5 ÷ 100 = 1.015
£4,500 × 1.015^4 = £4,776.14
Interest = £4,776.14 − £4,500 = £276.14
Answer: £276.14

4 Pressure

A table exerts a force of 375 N on the floor.
The area in contact with the floor is 1.5 m^2.
Work out the pressure on the floor in N/m^2.

Pressure = force ÷ area
= 375 ÷ 1.5 = 250
Answer: 250 N/m^2

5 Simplifying surds

(a) Simplify $\sqrt{75}$
(b) Simplify $\sqrt{75} - \sqrt{27}$

(a) $\sqrt{75} = \sqrt{25} \times \sqrt{3} = 5\sqrt{3}$
(b) $\sqrt{27} = 3\sqrt{3}$, so $5\sqrt{3} - 3\sqrt{3} = 2\sqrt{3}$
Answer: (a) $5\sqrt{3}$ (b) $2\sqrt{3}$

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6 Inverse functions

$f(x) = \frac{2}{x} - 7$

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

(b) Work out $f^{-1}(6)$

Let $y = \frac{2}{x} - 7$

$y + 7 = \frac{2}{x}$, so $x = \frac{2}{(y + 7)}$

Swap y for x: $f^{-1}(x) = \frac{2}{(x + 7)}$

(b) $f^{-1}(6) = \frac{2}{13}$

Answer: (a) $f^{-1}(x) = \frac{2}{(x + 7)}$ (b) $\frac{2}{13}$

7 Recurring decimals, show that

(a) Show that $0.\dot{6}\dot{8} = \frac{68}{99}$

(b) Hence write $4.\dot{6}\dot{8}$ as a mixed number in its simplest form.

(a) Let x = 0.686868..., so 100x = 68.6868...

$100x - x = 68$, so $99x = 68$ and $x = \frac{68}{99}$

(b) $4.\dot{6}\dot{8} = 4 + \frac{68}{99} = 4\frac{68}{99}$

Answer: (b) $4\frac{68}{99}$

8 Volume of composite solids

A solid is made from a cylinder and a hemisphere.
The cylinder has radius 9 cm and height 15 cm.
The hemisphere has the same radius as the cylinder and sits on top of it.
Work out the total volume. Give your answer in terms of π.

Cylinder = $\pi \times 9^2 \times 15 = 1215\pi$

Hemisphere = $\frac{2}{3} \times \pi \times 9^3 = 486\pi$

Total = $1215\pi + 486\pi = 1701\pi$

Answer: 1701π cm^3

9 Trigonometry: finding an angle

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

The sides given are the opposite (15) and the adjacent (10), so use tan

$\tan x = \frac{15}{10}$

$x = \tan^{-1}(\frac{15}{10})$

$x = 56.3°$

Answer: x = 56.3°

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10 Finding an interest rate

Owen invests £2500 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £2601 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $2500 \times m^2 = 2601$

$m^2 = 2601 \div 2500 = 1.0404$

$m = \sqrt{1.0404} = 1.02$

Rate = $(1.02 - 1) \times 100 = 2\%$

Answer: 2%