**Day 85** **A Tier 10-a-day: Model Solutions**

## 1 Exchange rates

£1 = €1.35.
(a) Change £400 to euros.
(b) Change €135 to pounds.

(a) 400 × 1.35 = 540
(b) 135 ÷ 1.35 = 100
**Answer: (a) €540 (b) £100**

## 2 Surface area of a cuboid

A closed block is a cuboid measuring 4 cm by 2 cm by 3 cm.
Work out the total surface area.

Faces: 4 × 2, 4 × 3 and 2 × 3 each appear twice
2 × (8 + 12 + 6)
= 2 × 26 = 52
**Answer: 52 cm$^2$**

## 3 Expanding double brackets

Expand and simplify
$(2x - 4)(2x - 6)$

Multiply every term in the first bracket by every term in the second
$= 4x^2 - 12x - 8x + 24$
$= 4x^2 - 20x + 24$
**Answer: $4x^2 - 20x + 24$**

## 4 Pythagoras' theorem

Work out the length of x. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

$9^2 = x^2 + 7^2$
$x^2 = 81 - 49 = 32$
$x = \sqrt{32} = 5.66$
**Answer: x = 5.66 cm**

## 5 Negative and fractional indices

Work out the value of
(a) $100^{\frac{-3}{2}}$
(b) $(\frac{2}{5})^{-2}$

(a) $100^{\frac{-3}{2}} = \frac{1}{100^{\frac{3}{2}}} = \frac{1}{(\sqrt{100})^3} = \frac{1}{10^3} = \frac{1}{1000}$
(b) $(\frac{2}{5})^{-2} = (\frac{5}{2})^2 = \frac{5^2}{2^2} = \frac{25}{4}$
**Answer: (a) $\frac{1}{1000}$ (b) $\frac{25}{4}$**

## 6 Average speed

A cyclist travels for 1 hour 30 minutes at 70 km/h,
then for 3 hours at 55 km/h.
Work out the average speed for the whole journey.

Distance 1 = 70 × 1.5 = 105 km
Distance 2 = 55 × 3 = 165 km
Total distance = 270 km and total time = 4.5 hours
Average speed = 270 ÷ 4.5 = 60 km/h
**Answer: 60 km/h**

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## 7 Quadratic sequences

Here are the first five terms of a quadratic sequence.
$-3, -3, 1, 9, 21$
(a) Find an expression for the nth term.
(b) Work out the 20th term.

First differences: 0, 4, 8
Second differences: 4, 4, so a = 4 ÷ 2 = 2
Subtract $2n^2$ from each term (2, 8, 18, 32): $-5, -11, -17, -23$
This is linear: $-6n + 1$
nth term = $2n^2 - 6n + 1$
(b) Substitute n = 20: $2 \times 20^2 - 6 \times 20 + 1 = 681$
**Answer: (a) $2n^2 - 6n + 1$ (b) 681**

## 8 HCF and LCM in index form

A = $5^3 \times 7^3$
B = $2^2 \times 5^4 \times 7^4$
Find the highest common factor (HCF) and the lowest common multiple (LCM) of A and B.
Give your answers as products of prime factors.

HCF: for each prime take the lower power (a missing prime has power 0): $5^3 \times 7^3$
LCM: for each prime take the higher power: $2^2 \times 5^4 \times 7^4$
**Answer: HCF = $5^3 \times 7^3$, LCM = $2^2 \times 5^4 \times 7^4$**

## 9 Reverse percentages

In a sale, all prices are reduced by 12%.
A watch costs £220 in the sale.
Work out the original price of the watch.

88% represents £220
1% = £220 ÷ 88 = £2.5
100% = £2.5 × 100 = £250.00
**Answer: £250.00**

## 10 Similar shapes: area and volume

Two similar models are 15 cm and 20 cm tall.
The surface area of the smaller model is 180 $cm^2$.
Work out the surface area of the larger model.

Length scale factor = 20 ÷ 15 = $\frac{4}{3}$

Area scale factor = $(\frac{4}{3})^2 = \frac{16}{9}$

Area = $180 \times \frac{16}{9} = 320$

**Answer: 320 $cm^2$**