Day 140 **A Tier 10-a-day: Model Solutions**

1 Exchange rates

£1 = €1.12.
(a) Change £260 to euros.
(b) Change €112 to pounds.

(a) 260 × 1.12 = 291.2
(b) 112 ÷ 1.12 = 100
Answer: (a) €291.2 (b) £100

2 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 (14) and the adjacent (20), so use tan

$\tan x = \frac{14}{20}$

$x = \tan^{-1}(\frac{14}{20})$

$x = 35.0°$

Answer: x = 35.0°

3 Standard form notation

(a) Write 0.0022 in standard form.
(b) Write 6.2×10^4 as an ordinary number.

(a) Move the decimal point 3 places to get 2.2: 2.2×10^{-3}
(b) Move the decimal point 4 places to the right: 62,000
Answer: (a) 2.2×10^{-3} (b) 62,000

4 Difference of two squares

(a) Factorise $9x^2 - 36$
(b) Use the same idea to work out $163^2 - 37^2$ without a calculator.

(a) $9x^2 - 36 = (3x)^2 - 6^2$
$(3x - 6)(3x + 6)$
(b) $a^2 - b^2 = (a + b)(a - b)$, so $163^2 - 37^2 = (163 + 37)(163 - 37)$
$= 200 \times 126 = 25200$
Answer: (a) (3x − 6)(3x + 6) (b) 25200

5 Similar shapes: finding a length

The two triangles are similar.
Work out the value of x.
The diagrams are not drawn accurately.

Scale factor from the large triangle to the small triangle = 28 ÷ 35 = $\frac{4}{5}$

$x = 25 \times \frac{4}{5} = 20$

Answer: x = 20 m

6 Reverse compound change

The value of an investment grows by 10% each year. (Calculator)
After 2 years it is worth £12,705.
Work out its value at the start.

Yearly multiplier = 1.1
Overall multiplier = $1.1^2 = 1.21$
Original value = £12,705 ÷ 1.21 = £10,500
Answer: £10,500

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7 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.

$\cos x = \frac{14^2 + 19^2 - 16^2}{2 \times 14 \times 19}$

$\cos x = \frac{301}{532}$

$x = \cos^{-1}(0.5658)$

$x = 55.5°$

Answer: x = 55.5°

8 Adding algebraic fractions

Write as a single fraction

$\frac{4}{(x + 5)} - \frac{1}{(x - 1)}$

Common denominator is $(x + 5)(x - 1)$

$= \frac{4(x - 1) - 1(x + 5)}{(x + 5)(x - 1)}$

$= \frac{3x - 9}{(x + 5)(x - 1)}$

Answer: $\mathbf{\frac{3x - 9}{(x + 5)(x - 1)}}$

9 Inverse proportion

8 machines take 6 hours to make a batch of bottles.
All the machines work at the same rate.
How long would it take 12 machines to make a batch of bottles?

Total work = 8 × 6 = 48 machine-hour
Time for 12 machines = 48 ÷ 12 = 4 hours

Answer: 4 hours

10 Forming quadratic equations

A rectangle has width x cm and length (x + 2) cm.
The area of the rectangle is 24 cm^2.
(a) Show that $x^2 + 2x - 24 = 0$
(b) Work out the value of x.

(a) Area = length × width, so $x(x + 2) = 24$

$x^2 + 2x = 24$

$x^2 + 2x - 24 = 0$

(b) Factorise: $(x - 4)(x + 6) = 0$

$x = 4$ or $x = -6$

A length cannot be negative, so $x = 4$

Answer: (a) Shown (b) x = 4