**Day 346** **A Tier 10-a-day: Model Solutions**

## 1 Surface area of a prism

The diagram shows a triangular prism.
The cross-section is a right-angled triangle.
Work out the total surface area of the prism.
The diagram is not drawn accurately.

Hypotenuse = $\sqrt{12^2 + 5^2}$ = 13 cm

Two triangular ends: $2 \times \frac{1}{2} \times 12 \times 5 = 60$

Three rectangles: (12 + 5 + 13) × 20 = 600
Total = 60 + 600 = 660

**Answer: 660 cm$^2$**

## 2 Sharing in a ratio

Isla, Ella and Jack share 63 marbles in the ratio 4 : 9 : 8.
How many more marbles does Ella get than Isla?

Total number of parts = 4 + 9 + 8 = 21
One part = 63 ÷ 21 = 3
Ella gets 9 × 3 = 27 and Isla gets 4 × 3 = 12
Difference = 27 − 12 = 15
**Answer: 15**

## 3 Calculator and significant figures

Work out $\sqrt{7.2^2 + 9.4^2}$ (Calculator)
Give your answer correct to 3 significant figures.

$7.2^2 + 9.4^2 = 51.84 + 88.36 = 140.20$
= 11.84061...
= 11.8 to 3 significant figures
**Answer: 11.8**

## 4 Solving quadratic equations

Solve $12x^2 + 7x - 10 = 0$

Factorise: (3x − 2)(4x + 5) = 0
3x − 2 = 0 or 4x + 5 = 0
$x = \frac{2}{3}$ or $x = -\frac{5}{4}$

**Answer: $x = \frac{2}{3}$ or $x = -\frac{5}{4}$**

## 5 Finding a missing value from an average

The mean of the five numbers x, 16, 22, 2, 20 is 15.
Work out the value of x.

Total = 5 × 15 = 75
Known numbers add to 60
x = 75 − 60 = 15
**Answer: x = 15**

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## 6 Volume of a prism

The diagram shows a prism.
The cross-section of the prism is a right-angled triangle.
Work out the volume of the prism.
The diagram is not drawn accurately.

Area of cross-section = $\frac{1}{2} \times 12 \times 6 = 36$

Volume = area of cross-section × length
= 36 × 18
= 648

**Answer: 648 cm$^3$**

## 7 Adding algebraic fractions

Write as a single fraction

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

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

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

$= \frac{3x + 19}{(x+5)(x+1)}$

**Answer:** $\frac{\mathbf{3x + 19}}{\mathbf{(x+5)(x+1)}}$

## 8 Rationalising the denominator

Rationalise the denominator of $\frac{15}{\sqrt{5}}$

Give your answer in its simplest form.

Multiply top and bottom by $\sqrt{5}$: $\frac{15}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{15\sqrt{5}}{5}$

$= 3\sqrt{5}$

**Answer: $3\sqrt{5}$**

## 9 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{3x - 4}{3x + 1}$

Multiply both sides by (3x + 1): $y(3x + 1) = 3x - 4$
Expand the bracket: $3xy + y = 3x - 4$
Collect the x terms on one side: $3xy - 3x = -y - 4$
Factorise: $x(3y - 3) = -y - 4$
Divide by (3y − 3): $x = \frac{-y - 4}{3y - 3}$

**Answer:** $\mathbf{x = \frac{-y - 4}{3y - 3}}$

## 10 Probability with three selections

A bag contains 6 black pens and 2 blue pens.
Three pens are taken at random without replacement.
Work out the probability that all three pens are black.

P(all black) = $\frac{6}{8} \times \frac{5}{7} \times \frac{4}{6}$

$= \frac{120}{336} = \frac{5}{14}$

**Answer:** $\frac{\mathbf{5}}{\mathbf{14}}$