Day 266 **A Tier 10-a-day: Model Solutions**

1 Calculator and significant figures

Work out $\frac{29.2 + 0.82}{7.9 - 0.19}$ (Calculator)

Give your answer correct to 3 significant figures.

Numerator = 29.2 + 0.82 = 30.02
Denominator = 7.9 − 0.19 = 7.71
= 3.89364...
= 3.89 to 3 significant figures
Answer: 3.89

2 Reverse percentages

Nia's weekly pay is increased by 15%.
Her new weekly pay is £736.
Work out her weekly pay before the increase.

115% represents £736
1% = £736 ÷ 115 = £6.4
100% = £6.4 × 100 = £640.00
Answer: £640.00

3 Angles in regular polygons around a point

A regular octagon and a square share the side AB and are on opposite sides of it.
The two shapes meet at the point A.
Work out the size of the angle at A that is not inside either shape.

Interior angle of the regular octagon = 180 − 360 ÷ 8 = 135°
Interior angle of the square = 180 − 360 ÷ 4 = 90°
Angles round a point add up to 360°
360 − 135 − 90 = 135
Answer: 135°

4 Converting area and volume units

Change 450 mm^2 to cm^2.

1 cm^2 = 100 mm^2
450 ÷ 100 = 4.5
Answer: 4.5 cm^2

5 Equations with fractions

Solve $\frac{2x - 1}{5} = \frac{2x - 7}{3}$

Multiply both sides by 15
3(2x − 1) = 5(2x − 7)
6x − 3 = 10x − 35
−4x = −32
x = 8
Answer: x = 8

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6 Bearings and distances

A plane leaves an airport and travels 8 km on a bearing of 035°. (Calculator)
It then travels 15 km on a bearing of 305°.
(a) Work out how far it is now from the airport.
(b) Work out the bearing of its final position from the airport. Give your answer to the nearest degree.

The two bearings differ by 90°, so the path makes a right angle

(a) Distance^2 = $8^2 + 15^2 = 289$, so distance = 17 km

(b) The angle at the port between the first leg and the line to the end: $\tan^{-1}(\frac{15}{8}) = 61.9°$

Bearing = $35° - 61.9° = 333.1°$
Bearing = 333°
Answer: (a) 17 km (b) 333°

7 Rationalising the denominator

Rationalise the denominator of $\frac{18}{3\sqrt{3}}$
Give your answer in its simplest form.

Multiply top and bottom by $\sqrt{3}$: $\frac{18\sqrt{3}}{3 \times 3}$

$= \frac{18\sqrt{3}}{9} = 2\sqrt{3}$

Answer: $2\sqrt{3}$

8 Expanding three brackets

Expand and simplify
$(x - 3)(3x - 3)(x + 2)$

Expand the first two brackets: $(x - 3)(3x - 3) = 3x^2 - 12x + 9$
Multiply by the third bracket: $(3x^2 - 12x + 9)(x + 2)$
$= 3x^3 - 12x^2 + 9x + 6x^2 - 24x + 18$
$= 3x^3 - 6x^2 - 15x + 18$
Answer: $3x^3 - 6x^2 - 15x + 18$

9 Simultaneous equations (one quadratic)

Solve the simultaneous equations
$x^2 + y^2 = 25$
$y = 3x + 15$

Substitute $y = 3x + 15$ into $x^2 + y^2 = 25$
$x^2 + (3x + 15)^2 = 25$
$10x^2 + 90x + 200 = 0$
Divide by 10: $x^2 + 9x + 20 = 0$
$(x + 5)(x + 4) = 0$
$x = -5$ or $x = -4$
Use $y = 3x + 15$ to find y: when $x = -5$, $y = 0$; when $x = -4$, $y = 3$
Answer: $x = -5$, $y = 0$ and $x = -4$, $y = 3$

10 Simple and compound interest

Isla and Hugo each invest £1000 for 3 years. (Calculator)
Isla's account pays 3% simple interest per year.
Hugo's account pays 3% compound interest per year.
Work out how much more interest Hugo earns than Isla.

Simple interest = £1000 × 3% × 3 = £90
Compound: £1000 × 1.03^3 = £1092.727, so interest = £92.727
Difference = 92.727 − 90 = £2.73 (to the nearest penny)
Answer: £2.73