Day 357 **A Tier 10-a-day: Model Solutions**

1 Circle area and circumference

A circular pond has diameter 18 m.
Work out, in terms of π,
(a) the circumference,
(b) the area.

(a) Circumference = $\pi d = \pi \times 18 = 18\pi$

(b) Area = $\pi r^2 = \pi \times 9^2 = 81\pi$

Answer: (a) 18π m (b) 81π m^2

2 Percentage change

The price of a games console changes from £60 to £105.
Work out the percentage increase.

Increase = £105.00 − £60.00 = £45.00

Percentage increase = $\frac{£45.00}{£60.00} \times 100 = 75\%$

Answer: 75%

3 Reverse percentages

Chloe's salary increases by 10%. (Calculator)
Her new salary is £335.50.
Work out her salary before the increase.

The new salary is 110% of the old salary.
110% = £335.50, so 1% = £335.50 ÷ 110 = £3.05
100% = £3.05 × 100 = £305

Answer: £305

4 Percentages in context

A washing machine costs £120 plus VAT at 20%.
In a sale, the price including VAT is reduced by 25%.
Work out the sale price of the washing machine.

VAT = 20% of £120 = £24, so the price with VAT is £144
Reduction = 25% of £144 = £36
Sale price = £144 − £36 = £108

Answer: £108

5 Trigonometry: finding a side

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

x is the hypotenuse and 18 m is the opposite, so use sin

$\sin 57° = \frac{18}{x}$

$x = 18 \div \sin 57°$
$x = 21.5$

Answer: x = 21.5 m

6 Compound interest

Sam invests £5000 in a savings account. (Calculator)
The account pays 2% compound interest per year.
Work out the amount in the account after 2 years.

Multiplier = 100% + 2% = 1.02
£5000 × 1.02^2 = £5202.000
= £5202.00 to the nearest penny

Answer: £5202.00

Day 357 **A Tier 10-a-day: Model Solutions**

7 Percentages of percentages

40% of a number is 132. (Calculator)
Work out 15% of the same number.

40% = 132, so 1% = 132 ÷ 40 = 3.3
15% = 3.3 × 15 = 49.5
Answer: 49.5

8 Expanding three brackets

Expand and simplify
$(x - 2)(x - 1)(x + 3)$

Expand the first two brackets: $(x - 2)(x - 1) = x^2 - 3x + 2$
Multiply by the third bracket: $(x^2 - 3x + 2)(x + 3)$
$= x^3 - 3x^2 + 2x + 3x^2 - 9x + 6$
$= x^3 - 7x + 6$
Answer: $x^3 - 7x + 6$

9 Surd fractions

Show that $\frac{\sqrt{75} + \sqrt{27}}{\sqrt{3}}$ is an integer, and find its value.

$\sqrt{75} = 5\sqrt{3}$ and $\sqrt{27} = 3\sqrt{3}$
Numerator $= 5\sqrt{3} + 3\sqrt{3} = 8\sqrt{3}$
$\frac{8\sqrt{3}}{\sqrt{3}} = 8$
Answer: 8

10 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{3x + 2}{2x - 6}$

Multiply both sides by $(2x - 6)$: $y(2x - 6) = 3x + 2$
Expand the bracket: $2xy - 6y = 3x + 2$
Collect the x terms on one side: $2xy - 3x = 6y + 2$
Factorise: $x(2y - 3) = 6y + 2$
Divide by $(2y - 3)$: $x = \frac{6y + 2}{2y - 3}$
Answer: $x = \frac{6y + 2}{2y - 3}$