Day 179 **A Tier 10-a-day: Model Solutions**

1 Expanding double brackets

Expand and simplify

$(4x - 1)^2$

Multiply every term in the first bracket by every term in the second

$= (4x - 1)(4x - 1) = 16x^2 - 4x - 4x + 1$

$= 16x^2 - 8x + 1$

Answer: $16x^2 - 8x + 1$

2 Circle area and circumference

A circular pond has diameter 26 m.
Work out, in terms of π,
(a) the circumference,
(b) the area.

(a) Circumference = $\pi d = \pi \times 26 = 26\pi$

(b) Area = $\pi r^2 = \pi \times 13^2 = 169\pi$

Answer: (a) 26π m (b) 169π m^2

3 Expanding and simplifying

Expand and simplify

$(3x - 4)(x + 4) + (x - 3)^2$

$(3x - 4)(x + 4) = 3x^2 + 8x - 16$

$(x - 3)^2 = x^2 - 6x + 9$

Add and collect like terms: $4x^2 + 2x - 7$

Answer: $4x^2 + 2x - 7$

4 Reverse percentages

The price of a train ticket increases by 8%.
The new price is £270.
Work out the price before the increase.

108% represents £270

1% = £270 ÷ 108 = £2.5

100% = £2.5 × 100 = £250.00

Answer: £250.00

5 Growth and decay

A colony has 11,000 and grows by 8% per day. (Calculator)
Work out the number of bacteria after 4 days.
Give your answer to the nearest whole number.

Multiplier = 1.08

$11{,}000 \times 1.08^4 = 14{,}965.38$

= 14,965 to the nearest whole number

Answer: 14,965

6 Compound shapes with circles

The diagram shows a shape made from a rectangle and a semicircle.
Work out the perimeter of the shape.
Give your answer in terms of π.
The diagram is not drawn accurately.

Curved edge: $\frac{1}{2} \times \pi \times 4 = 2\pi$

Straight edges: 4 + 14 + 14 = 32

Total = $32 + 2\pi$

Answer: $32 + 2\pi$ cm

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7 Simple and compound interest

Tara and Dev each invest £2500 for 3 years. (Calculator)
Tara's account pays 5% simple interest per year.
Dev's account pays 5% compound interest per year.
Work out how much more interest Dev earns than Tara.

Simple interest = £2500 × 5% × 3 = £375

Compound: £2500 × 1.05^3 = £2894.063, so interest = £394.063

Difference = 394.063 − 375 = £19.06 (to the nearest penny)

Answer: £19.06

8 Recurring decimals, show that

(a) Show that $0.\dot{2}\dot{6} = \frac{26}{99}$

(b) Hence write $3.\dot{2}\dot{6}$ as a mixed number in its simplest form.

(a) Let x = 0.262626..., so 100x = 26.2626...

100x − x = 26, so 99x = 26 and $x = \frac{26}{99}$

(b) $3.\dot{2}\dot{6} = 3 + \frac{26}{99} = 3\frac{26}{99}$

Answer: (b) $\mathbf{3\frac{26}{99}}$

9 Recurring decimals (mixed)

Write $0.6\dot{4}$ as a fraction in its simplest form.

Let x = 0.644...
Multiply by 10: 10x = 6.44...
Multiply by 100: 100x = 64.44...
Subtract: 90x = 64 − 6 = 58

$x = \frac{58}{90} = \frac{29}{45}$

Answer: $\mathbf{\frac{29}{45}}$

10 Sectors: finding an angle or radius

A pizza slice is a sector of a circle has angle 135° at the centre and arc length $\frac{21}{2}\pi$ cm.

Work out the radius of the sector.

Arc length = $\frac{135}{360} \times 2 \times \pi \times r$

$\frac{21}{2}\pi = \frac{3}{4} \times r \times \pi$

$r = 10.5 \div \frac{3}{4}$

r = 14

Answer: 14 cm