Day 116 **A Tier 10-a-day: Model Solutions**

1 Expanding double brackets

Expand and simplify

$(2x - 7)(4x + 1)$

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

$= 8x^2 + 2x - 28x - 7$

$= 8x^2 - 26x - 7$

Answer: $8x^2 - 26x - 7$

2 Isosceles triangles and exterior angles

ABC is an isosceles triangle with AB = AC.
BCD is a straight line.
Angle ACD = 121°.
Work out the size of angle x.
The diagram is not drawn accurately.

Angles on a straight line add up to 180°
Angle ACB = 180 − 121 = 59°
Base angles are equal, so angle ABC = 59°
x = 180 − 59 − 59 = 62
Answer: x = 62°

3 Laws of indices

Simplify fully

(a) $\frac{16x^5y^5}{8x^4y^4}$

(b) $(3x^3y^4)^4$

(a) Divide the numbers: 16 ÷ 8 = 2
Subtract the powers: $x^5 \div x^4 = x$ and $y^5 \div y^4 = y$
$= 2xy$

(b) Raise every part to the power 4: $3^4 = 81$, $(x^3)^4 = x^{12}$, $(y^4)^4 = y^{16}$
$= 81x^{12}y^{16}$

Answer: (a) 2xy (b) $81x^{12}y^{16}$

4 Rounding

(a) Write 0.68435 correct to 3 significant figures.
(b) Write 8.4219 correct to 1 decimal place.

(a) Count 3 significant figures and look at the next digit: 0.68435 rounds to 0.684
(b) Look at the digit after decimal place 1: 8.4219 rounds to 8.4
Answer: (a) 0.684 (b) 8.4

5 Distance-time graphs

The graph shows the distance travelled by a van driver.
(a) For how many minutes did the van driver stop?
(b) Work out the speed during the first part of the journey. Give your answer in km/h.

(a) The graph is horizontal from 20 to 35 minutes, so the stop is 35 − 20 = 15 minutes
(b) First part: distance 20 km in 20 minutes

Speed = distance ÷ time = $20 \div \frac{20}{60}$ = 60 km/h

Answer: (a) 15 minutes (b) 60 km/h

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6 Fraction calculations

Work out $(4\frac{1}{2} - 3\frac{1}{4}) \div 1\frac{1}{2}$

Give your answer as a mixed number in its simplest form.

Brackets first, as improper fractions: $\frac{9}{2} - \frac{13}{4} = \frac{5}{4}$

Then divide by multiplying by the reciprocal: $\frac{5}{4} \times \frac{2}{3} = \frac{5}{6}$

$= \frac{5}{6}$

Answer: $\frac{5}{6}$

7 Similar shapes: area and volume

Two similar models are 4 cm and 12 cm tall.

The surface area of the smaller model is 20 cm^2.

Work out the surface area of the larger model.

Length scale factor = 12 ÷ 4 = 3

Area scale factor = $(3)^2 = 9$

Area = 20 × 9 = 180

Answer: 180 cm^2

8 Mixing in a ratio

Jug A contains 15 litres of a mixture of red paint and white paint in the ratio 2 : 1.

Jug B contains 5 litres of a mixture of red paint and white paint in the ratio 4 : 1.

The contents of both jugs are mixed together.

Work out the ratio of red paint to white paint in the mixture. Give your answer in its simplest form.

Jug A: red paint = 2 × 15 ÷ 3 = 10 litres, white paint = 5 litres

Jug B: red paint = 4 litres, white paint = 1 litres

Total: red paint = 14 litres, white paint = 6 litres

Ratio = 14 : 6 = 7 : 3

Answer: 7 : 3

9 Quadratic inequalities

Solve $x^2 \geq 4$

$x^2 = 4$ at $x = \pm 2$

The curve $y = x^2$ is above 4 outside the roots

$x \leq -2$ or $x \geq 2$

Answer: $x \leq -2$ or $x \geq 2$

10 Combined means

The mean mark of 5 boys in a test is 59.

The mean mark of 7 girls in the same test is 41.

Work out the mean mark of all 12 people.

Total for boys = 5 × 59 = 295

Total for girls = 7 × 41 = 287

Total = 582, and number of students = 12

Mean = 582 ÷ 12 = 48.5

Answer: 48.5