Day 331 **B Tier 10-a-day: Model Solutions**

1 Rates

A tap fills a tank at a rate of 6 litres per minute.
The tank holds 60 litres.
How long does it take to fill the empty tank?

Time = 60 ÷ 6 = 10 minutes
Answer: 10 minutes

2 Angles on a line and round a point

The diagram shows 2 angles on a straight line.
Work out the value of c.
The diagram is not drawn accurately.

Angles on a straight line add up to 180°
(3c + 30) + (3c + 78) = 180
6c + 108 = 180
6c = 72
c = 72 ÷ 6 = 12
Answer: c = 12°

3 Forming and solving equations

A triangle has sides of length x cm, (x + 3) cm and (2x − 1) cm.
The perimeter of the triangle is 38 cm.
(a) Work out the value of x.
(b) Work out the length of the longest side.

(a) x + (x + 3) + (2x − 1) = 38
4x + 2 = 38
4x = 36, so x = 9
(b) The sides are 9 cm, 12 cm and 17 cm
Answer: (a) x = 9 (b) 17 cm

4 Using a given calculation

Use the fact that 47 × 17 = 799
to work out
(a) 47 × 1.7
(b) 7.99 ÷ 47

(a) 47 is unchanged and 1.7 = 17 ÷ 10
So the answer is 799 ÷ 10 = 79.9
(b) 7.99 = 799 ÷ 100 and 47 is unchanged
799 ÷ 47 = 17, so the answer is 17 ÷ 100 = 0.17
Answer: (a) 79.9 (b) 0.17

5 Algebraic fractions

Write as a single fraction

$\frac{x}{3} + \frac{x}{5}$

Common denominator: 15

$\frac{5x}{15} + \frac{3x}{15}$

$\frac{8x}{15}$

Answer: $\frac{8x}{15}$

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6 Trigonometry: finding an angle

Calculate the size of angle b. (Calculator)
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

We know the opposite (9 cm) and the hypotenuse (15 cm), so use sin

$\sin b = \frac{9}{15}$

$b = \sin^{-1}(\frac{9}{15}) = 36.870...$

b = 36.9° (1 d.p.)

Answer: b = 36.9°

7 Standard form calculations

Work out $(21.5 \times 10^{10}) \div (5 \times 10^{5})$
Give your answer in standard form.

Divide the numbers: 21.5 ÷ 5 = 4.3
Subtract the powers: 10 − 5 = 5
4.3×10^{5}

Answer: 4.3×10^{5}

8 Venn diagram problems

22 pupils were asked.
10 of them study French and 13 of them study German.
5 of them did both.
(a) How many did neither?
(b) One is chosen at random. Find the probability that they study French but do not study German.

(a) Union = 10 + 13 − 5 = 18
Neither = 22 − 18 = 4
(b) Only study French = 10 − 5 = 5
P = 5 out of 22

Answer: (a) 4 (b) $\frac{5}{22}$

9 Ordering fractions

Write these in order of size.
Start with the smallest.
30%, $\frac{7}{8}$, 92.5%, $\frac{4}{5}$

Write each as a decimal:

30% = 0.3, $\frac{7}{8}$ = 0.875, 92.5% = 0.925, $\frac{4}{5}$ = 0.8

Order: 30%, $\frac{4}{5}$, $\frac{7}{8}$, 92.5%

Answer: 30%, $\frac{4}{5}$, $\frac{7}{8}$, 92.5%

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10 Bearings with Pythagoras and trigonometry

A boat sails 9 km on a bearing of 180° from P to Q, then 12 km on a bearing of 270° to R. (Calculator)
(a) Work out the distance PR.
(b) Work out the bearing of R from P.
Give your answers correct to 1 decimal place.

(a) Triangle PQR has a right angle at Q

$PR^2 = 9^2 + 12^2 = 225$

$PR = \sqrt{225} = 15$ km

(b) tan (angle QPR) = $\frac{12}{9}$, so angle QPR = 53.130° (to 3 d.p.)

PQ is on a bearing of 180°, and R is a further 53.130° clockwise from PQ
Bearing = 180 + 53.130 = 233.1°

Answer: (a) 15 km (b) 233.1°