Day 62 **B Tier 10-a-day: Model Solutions**

1 Expanding brackets

Expand
(a) 9(5x + 7)
(b) 5(3y + 8)

(a) 9 × 5x = 45x and 9 × 7 = 63
(b) 5 × 3y = 15y and 5 × 8 = 40
Answer: (a) 45x + 63 (b) 15y + 40

2 Symmetry

(a) Write down the number of lines of symmetry of a rhombus.
(b) Write down the order of rotational symmetry of a rhombus.

A rhombus has 2 lines of symmetry (its diagonals)
A rhombus looks the same 2 times in a full turn, so the order is 2
Answer: (a) 2 (b) 2

3 Prime factors

Write 44 as a product of its prime factors.
Give your answer in index form.

Divide by prime numbers, smallest first:
44 ÷ 2 = 22, 22 ÷ 2 = 11, 11 is prime
44 = 2 × 2 × 11
In index form: $44 = 2^2 \times 11$
Answer: $2^2 \times 11$

4 Congruent triangles

Triangle PQR has a right angle, a hypotenuse of 11 mm and another side of 4 mm.
Triangle XYZ has a right angle, a hypotenuse of 11 mm and another side of 4 mm.
Are the two triangles congruent?
Give a reason for your answer.

Both are right-angled with equal hypotenuses and one other equal side
So the triangles are congruent (RHS)
Answer: Yes, RHS (right angle, hypotenuse, side)

5 Tables of values for quadratics

Complete the table of values for $y = x^2 - 2x + 4$

$x = -1$: $y = (-1)^2 + (-2) \times (-1) + 4 = 7$
$x = 0$: $y = 0^2 + (-2) \times 0 + 4 = 4$
$x = 2$: $y = 2^2 + (-2) \times 2 + 4 = 4$
$x = 3$: $y = 3^2 + (-2) \times 3 + 4 = 7$
Answer: $x = -1$: 7, $x = 0$: 4, $x = 2$: 4, $x = 3$: 7

6 LCM problems

Two lights flash at 10:30.
One light flashes every 18 minutes.
The other light flashes every 16 minutes.
At what time do both lights next flash together?

Multiples of 18: 18, 36, 54, 72, 90, 108, 126, 144
Multiples of 16: 16, 32, 48, 64, 80, 96, 112, 128, 144
The first common multiple is 144, so the LCM is 144 minutes
10:30 + 144 minutes = 12:54
Answer: 12:54

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7 Independent events

A fair 4-sided dice and a fair 6-sided dice are each rolled once.
Each dice is numbered from 1.
Work out the probability that both dice show a number greater than 1.

P(first greater than 1) = $\frac{3}{4}$

P(second greater than 1) = $\frac{5}{6}$

Multiply: $\frac{3}{4} \times \frac{5}{6} = \frac{5}{8}$

Answer: $\mathbf{\frac{5}{8}}$

8 Sequences from patterns

Matchsticks are used to make a row of pentagons.
1 pentagon needs 5 matchsticks, 2 pentagons need 9 and 3 pentagons need 13.
(a) Find an expression, in terms of n, for the number of matchsticks needed for n pentagons.
(b) Dan uses 97 matchsticks to make a row. How many pentagons are in his row?

(a) The number of matchsticks goes up by 4 each time, so the rule starts with 4n
When n = 1 we need 5, and 4 × 1 = 4, so add 1: 4n + 1
(b) 4n + 1 = 97
4n = 96
n = 96 ÷ 4 = 24
Answer: (a) 4n + 1 (b) 24

9 Bearings with Pythagoras and trigonometry

A boat sails 5 km on a bearing of 270° from P to Q, then 12 km on a bearing of 000° 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
$PR^2 = 5^2 + 12^2 = 169$
PR = $\sqrt{169}$ = 13 km
(b) tan (angle QPR) = $\frac{12}{5}$, so angle QPR = 67.380° (to 3 d.p.)
PQ is on a bearing of 270°, and R is a further 67.380° clockwise from PQ
Bearing = 270 + 67.380 = 337.4°
Answer: (a) 13 km (b) 337.4°

10 Stem and leaf diagrams

The stem and leaf diagram shows 12 values.
(a) Find the median.
(b) Work out the range.

(a) 12 values, so the median is the mean of the 6th and 7th values
Reading in order: 10, 14, 17, 18, 22, 24, 27, 28, 30, 33, 34, 37
Median = 25.5
(b) Range = 37 − 10 = 27
Answer: (a) 25.5 (b) 27