Day 138 **B Tier 10-a-day: Model Solutions**

1 Factors and multiples

(a) Write down all the prime numbers between 46 and 55.
(b) Explain why 51 is not a prime number.

(a) A prime number has exactly two factors. Check each number: 47, 48, 49, 50, 51, 52, 53, 54
(b) 51 is divisible by 3 ($3 \times 17 = 51$), so it has more than two factors
Answer: (a) 47, 53 (b) $3 \times 17 = 51$

2 Collecting like terms

Simplify $9a + 7b + 8a + 5b$

Collect the a terms: $9a + 8a = 17a$
Collect the b terms: $7b + 5b = 12b$
Answer: $17a + 12b$

3 Bar charts

The bar chart shows some information.
(a) Write down the mode.
(b) What fraction of the total is Mon? Give your answer in its simplest form.

(a) The tallest bar is Fri
(b) Total = 8 + 4 + 10 + 10 + 12 = 44
Mon = 8, so the fraction is 8 out of 44
Answer: (a) Fri (b) $\frac{2}{11}$

4 Cost formulae

A plumber charges a call-out fee of £19 plus £4 for each hour of work.
(a) Work out the total cost for 7 hours.
(b) The total cost is £51. Work out the number of hours.

(a) $4 \times 7 = 28$, then $19 + 28 = 47$
(b) Take off the fixed charge: $51 - 19 = 32$
Divide by the cost for each: $32 \div 4 = 8$
Answer: (a) £47 (b) 8

5 Perimeter with algebra

A rectangle has length $(2x + 2)$ cm and width $(x + 1)$ cm.
The perimeter of the rectangle is 18 cm.
(a) Work out the value of x.
(b) Work out the area of the rectangle.

(a) $2(2x + 2) + 2(x + 1) = 18$
$6x + 6 = 18$
$6x = 12$
$x = 2$
(b) Length = 6, width = 3, area $= 6 \times 3 = 18$
Answer: (a) $x = 2$ (b) 18 cm^2

6 LCM problems

Two buses leave a bus station at 11:30.
One bus leaves every 12 minutes.
The other bus leaves every 8 minutes.
At what time do both buses next leave together?

Multiples of 12: 12, 24
Multiples of 8: 8, 16, 24
The first common multiple is 24, so the LCM is 24 minutes
11:30 + 24 minutes = 11:54
Answer: 11:54

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7 Compound areas

Two rectangles are joined to make a shape.
The first is 9 cm by 5 cm.
The second is 10 cm by 4 cm.
Work out the total area of the shape.

First rectangle: 9 × 5 = 45
Second rectangle: 10 × 4 = 40
45 + 40 = 85
Answer: 85 cm^2

8 Using a given calculation

Use the fact that 47 × 39 = 1833
to work out
(a) 470 × 390
(b) 18,330 ÷ 4.7

(a) 470 = 47 × 10 and 390 = 39 × 10
So the answer is 1833 × 100 = 183,300
(b) 18,330 = 1833 × 10 and 4.7 = 47 ÷ 10
1833 ÷ 47 = 39, so the answer is 39 × 100 = 3900
Answer: (a) 183,300 (b) 3900

9 Algebraic proof

Show that $(2n + 11)^2 - (2n - 11)^2$ is a multiple of 88 for any whole number n.

Expand: $(2n + 11)^2 = 4n^2 + 44n + 121$ and $(2n - 11)^2 = 4n^2 - 44n + 121$
Subtract: the $4n^2$ terms and the 121s cancel, leaving 88n
88n is a multiple of 88
Answer: 88n is a multiple of 88

10 Combining ratios

In a bag of counters, the ratio of red to white is 1 : 7.
The ratio of white to yellow is 2 : 7.
Write down the ratio red : white : yellow.

Make the white part the same in both ratios: lowest common multiple of 7 and 2 is 14
red : white = 2 : 14
white : yellow = 14 : 49
red : white : yellow = 2 : 14 : 49
Answer: 2 : 14 : 49