Day 58 **B Tier 10-a-day: Model Solutions**

1 Factors and multiples

(a) Write down all the prime numbers between 18 and 29.
(b) Explain why 21 is not a prime number.

(a) A prime number has exactly two factors. Check each number: 19, 20, 21, 22, 23, 24, 25, 26, 27, 28
(b) 21 is divisible by 3 ($3 \times 7 = 21$), so it has more than two factors
Answer: (a) 19, 23 (b) $3 \times 7 = 21$

2 Symmetry

How many lines of symmetry does a regular decagon have?

A regular decagon has 10 lines of symmetry
Answer: 10

3 Prime factors

Write 420 as a product of its prime factors.
Give your answer in index form.

Divide by prime numbers, smallest first:
$420 \div 2 = 210$, $210 \div 2 = 105$, $105 \div 3 = 35$, $35 \div 5 = 7$, 7 is prime
$420 = 2 \times 2 \times 3 \times 5 \times 7$
In index form: $420 = 2^2 \times 3 \times 5 \times 7$
Answer: $2^2 \times 3 \times 5 \times 7$

4 Pay and overtime

Zain earns £12 per hour for the first 36 hours worked each week.
Any extra hours are paid at time and a half.
Last week Zain worked 42 hours.
Work out Zain's total pay for last week.

Normal pay: $36 \times £12 = £432$
Overtime rate: $1.5 \times £12 = £18$ per hour
Overtime pay: $6 \times £18 = £108$
Total = £432 + £108 = £540
Answer: £540

5 Mixed numbers

Work out $3\frac{3}{4} + 1\frac{3}{5}$

Give your answer as a mixed number.

Whole numbers: 3 + 1 = 4

Fractions: $\frac{3}{4} + \frac{3}{5} = \frac{27}{20} = 1\frac{7}{20}$

Total = $5\frac{7}{20}$

Answer: $5\frac{7}{20}$

6 Pythagoras in context

A rectangle is 11 cm long and 3 cm wide. (Calculator)
Work out the length of a diagonal of the rectangle. Give your answer correct to 1 decimal place.

The diagonal is the hypotenuse of a right-angled triangle
$d^2 = 11^2 + 3^2 = 130$
$d = \sqrt{130} = 11.402...$
Answer: 11.4 cm

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7 Changing the subject

Make m the subject of the formula

$y = mx + c$

Subtract c from both sides: $y - c = mx$

Divide both sides by x

Answer: $\mathbf{m = \frac{y - c}{x}}$

8 Independent events

The probability that Amy is late for school on any day is 0.5.

The probability that Ben is late on any day is 0.3.

Whether each is late is independent of the other.

Work out the probability that at least one of them is late on Monday.

P(neither late) = $(1 - 0.5) \times (1 - 0.3) = 0.5 \times 0.7 = 0.35$

P(at least one late) = $1 - 0.35 = 0.65$

Answer: 0.65

9 Chords and the centre of a circle

A circle has centre O and radius 10 m.

AB is a chord and M is the midpoint of AB. OM is perpendicular to AB.

Work out the value of x.

The diagram is not drawn accurately.

AM = $16 \div 2 = 8$

Triangle OMA has a right angle at M, and OA is the hypotenuse

$x^2 = 10^2 - 8^2 = 100 - 64 = 36$

$x = \sqrt{36} = 6$

Answer: x = 6 m

10 Quadratic equation problem

A rectangle has length $(x + 5)$ cm and width $(x - 1)$ cm.

The area of the rectangle is 16 cm^2.

(a) Show that $x^2 + 4x - 21 = 0$

(b) Hence work out the length of the rectangle.

(a) Area = length × width: $(x + 5)(x - 1) = 16$

Expand: $x^2 + 4x - 5 = 16$

Subtract 16 from both sides: $x^2 + 4x - 21 = 0$

(b) Factorise: $(x - 3)(x + 7) = 0$, so $x = 3$ or $x = -7$

A length cannot be negative, so x = 3. Length = 3 + 5 = 8

Answer: (b) 8 cm