Day 94 **B Tier 10-a-day: Model Solutions**

1 Laws of indices

Simplify fully

(a) $(y^4)^4$

(b) $x^8 \div x^4$

(a) Multiply the powers: $4 \times 4 = 16$

(b) Subtract the powers: $8 - 4 = 4$

Answer: (a) y^{16} (b) x^4

2 Exterior angles of polygons

Each exterior angle of a regular polygon is 24°.

Work out the number of sides of the polygon.

Exterior angles add up to 360°

Number of sides = $360 \div 24 = 15$

Answer: 15 sides

3 Gradient and intercept

A straight line has equation $y = -6x - 1$

(a) Write down the gradient of the line.

(b) Write down the equation of a line that is parallel to this line and passes through the point (0, 5).

(a) The line is in the form $y = mx + c$, so the gradient m is the number in front of x

(b) Parallel lines have the same gradient, -6

It crosses the y-axis at 5, so $c = 5$

Answer: (a) -6 (b) $y = -6x + 5$

4 Stem and leaf diagrams

The stem and leaf diagram shows 15 values.

(a) Find the median.

(b) Work out the range.

(a) 15 values, so the median is the 8th value

Reading in order: 11, 15, 16, 17, 18, 19, 20, 26, 27, 29, 30, 31, 33, 35, 38

Median = 26

(b) Range = $38 - 11 = 27$

Answer: (a) 26 (b) 27

5 Congruent triangles

Triangle PQR has angles of 40° and 80°, and a side of 7 mm between them.

Triangle XYZ has angles of 80° and 40°, and a side of 7 mm between them.

Are the two triangles congruent?

Give a reason for your answer.

Two pairs of equal angles, with the same side between them

So the triangles are congruent (ASA)

Answer: Yes, ASA (two angles and the included side)

6 Pressure

A block causes a pressure of 12 N/m^2 on the floor.

The area in contact with the floor is 4 m^2.

Work out the force exerted on the floor.

Force = pressure × area

$12 \times 4 = 48$

Answer: 48 N

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7 Fractions and decimals

(a) Write $\frac{3}{16}$ as a decimal.

(b) Write $\frac{2}{9}$ as a recurring decimal.

For part (b), write down the first 8 decimal places and say which digits repeat.

(a) 3 ÷ 16 = 0.1875
(b) 2 ÷ 9: use short division, adding zeros
2 ÷ 9 = 0.22222222...
The digit 2 repeats
Answer: (a) 0.1875 (b) 0.22222222... (2 repeats)

8 Sequences from patterns

Matchsticks are used to make a row of squares.
1 square needs 4 matchsticks, 2 squares need 7 and 3 squares need 10.
(a) Find an expression, in terms of n, for the number of matchsticks needed for n squares.
(b) Dan uses 49 matchsticks to make a row. How many squares are in his row?

(a) The number of matchsticks goes up by 3 each time, so the rule starts with 3n
When n = 1 we need 4, and 3 × 1 = 3, so add 1: 3n + 1
(b) 3n + 1 = 49
3n = 48
n = 48 ÷ 3 = 16
Answer: (a) 3n + 1 (b) 16

9 Trigonometry in isosceles triangles

Triangle ABC is isosceles with AB = AC = 19 m. (Calculator)
The base BC = 26 m.
Work out the size of angle ABC.
Give your answer correct to 1 decimal place.

Split the triangle into two right-angled triangles. Half the base = 26 ÷ 2 = 13

cos B = $\frac{13}{19}$

Angle ABC = $\cos^{-1}(\frac{13}{19})$ = 46.826...

= 46.8° (1 d.p.)
Answer: 46.8°

10 Negative and zero indices

Work out
(a) 2^{-1}
(b) $3^0 + \sqrt{49}$

(a) A negative power means the reciprocal: $2^{-1} = \frac{1}{2^1} = \frac{1}{2}$

(b) Anything to the power 0 is 1, so $3^0 = 1$
$\sqrt{49} = 7$, so 1 + 7 = 8
Answer: (a) $\frac{1}{2}$ (b) 8