**Day 305** **A Tier 10-a-day: Model Solutions**

## 1 Isosceles triangles and exterior angles

LMN is an isosceles triangle with LM = LN.
MNK is a straight line.
Angle LNK = 134°.
Work out the size of angle x.
The diagram is not drawn accurately.

Angles on a straight line add up to 180°
Angle LNM = 180 − 134 = 46°
Base angles are equal, so angle LMN = 46°
x = 180 − 46 − 46 = 88
**Answer: x = 88°**

## 2 Simultaneous equations

Solve the simultaneous equations
4x − 2y = −14
3x − y = −9

Multiply (2) by 2 to make the y coefficients match
4x − 2y = −14 (1)
6x − 2y = −18 (2)
The y terms have the same sign, so subtract equation (1) from equation (2)
2x = −4, so x = −2
Substitute x = −2 into equation (1) to find y = 3
**Answer: x = −2, y = 3**

## 3 Decimal calculations

(a) Work out 0.6 × 0.6
(b) Work out 4.0 ÷ 0.4

(a) 6 × 6 = 36, and there are 2 decimal places in total, so 0.36
(b) Multiply both numbers by 10: 40 ÷ 4 = 10
**Answer: (a) 0.36 (b) 10**

## 4 Circle theorems: angle at the centre

P, Q and R are points on a circle with centre O.
Angle POQ = 64°.
Work out the size of angle x.
Give a reason for your answer.

The angle at the centre is twice the angle at the circumference
x = 64 ÷ 2 = 32
**Answer: x = 32°**

## 5 Factorising

Factorise $2x^2 + 5x + 3$

Multiply 2 × 3 = 6. Find two numbers that multiply to 6 and add to 5: 2 and 3
$2x^2 + 5x + 3 = 2x^2 + 2x + 3x + 3$
Factorise in pairs to get (2x + 3)(x + 1)
**Answer: (2x + 3)(x + 1)**

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## 6 Similar shapes: area and volume

Two similar statues have heights 18 cm and 24 cm.
The surface area of the smaller one is 81 $cm^2$.
Work out the surface area of the larger one.

Length scale factor = $24 \div 18 = \frac{4}{3}$

Area scale factor = $(\frac{4}{3})^2 = \frac{16}{9}$

Area = $81 \times \frac{16}{9} = 144$

**Answer: 144 $cm^2$**

## 7 Bounds

A rectangle has length 6.1 m and width 6.4 m.
Each measurement is correct to the nearest 0.1 m.
Work out the lower bound for the perimeter of the rectangle.

Lower bound of length = 6.05 m, lower bound of width = 6.35 m
Perimeter = $2 \times (6.05 + 6.35) = 24.8$ m
**Answer: 24.8 m**

## 8 Reading a histogram

The histogram shows information about the age of some items.
(a) Work out the number of items with a age in the class 40 to 70 years.
(b) Work out an estimate for the number with a age greater than 55 years.

(a) Frequency = frequency density × class width
$0.4 \times 30 = 12$
(b) 55 to 70: $0.4 \times 15 = 6$
Class 70 to 100: $1 \times 30 = 30$
Total = $6 + 30 = 36$
**Answer: (a) 12 (b) 36**

## 9 Simultaneous equations (one quadratic)

Solve the simultaneous equations
$y = x^2 + 8x + 14$
$y = x + 4$

Set the y values equal: $x^2 + 8x + 14 = x + 4$
$x^2 + 7x + 10 = 0$
$(x + 5)(x + 2) = 0$
$x = -5$ or $x = -2$
Substitute into $y = x + 4$: $y = -1$ and $y = 2$
**Answer: $x = -5$, $y = -1$ and $x = -2$, $y = 2$**

## 10 Finding an interest rate

Ben invests £2000 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £2247.20 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $2000 \times m^2 = 2247.2$
$m^2 = 2247.2 \div 2000 = 1.1236$
$m = \sqrt{1.1236} = 1.06$
Rate = $(1.06 - 1) \times 100 = 6\%$
**Answer: 6%**