**Day 319** **A Tier 10-a-day: Model Solutions**

## 1 Profit and loss

Hassan buys a guitar for £200 and sells it for £176.
Work out Hassan's percentage loss.

Loss = £200 − £176 = £24

Percentage loss = $\frac{24}{200} \times 100 = 12\%$

**Answer: 12%**

## 2 Pythagoras in context

A ladder reaches 3 m up a vertical wall.
The ladder is 5 m long.
Work out how far the foot of the ladder is from the wall.

$d^2 + 3^2 = 5^2$

$d^2 = 25 - 9 = 16$

$d = 4$

**Answer: 4 m**

## 3 Rearranging to solve quadratics

Solve $2x^2 + 7x = -5$

Move everything to one side: $2x^2 + 7x + 5 = 0$

Factorise: $(2x + 5)(x + 1) = 0$

$x = -\frac{5}{2}$ or $x = -1$

**Answer: $x = -\frac{5}{2}$ or $x = -1$**

## 4 Circle theorems: angle at the centre

X, Y and Z are points on a circle with centre O.
Angle XOY = 102°.
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

$x = 102 \div 2 = 51$

**Answer: $x = 51°$**

## 5 Powers and roots in standard form

Work out $\sqrt{9 \times 10^6}$
Give your answer in standard form.

$\sqrt{9 \times 10^6} = \sqrt{9} \times \sqrt{10^6}$

$= 3 \times 10^3$

**Answer: $3 \times 10^3$**

## 6 Simple and compound interest

Tara and Lena each invest £1000 for 2 years. (Calculator)
Tara's account pays 10% simple interest per year.
Lena's account pays 10% compound interest per year.
Work out how much more interest Lena earns than Tara.

Simple interest = £1000 × 10% × 2 = £200

Compound: £1000 × $1.1^2$ = £1210.00, so interest = £210.00

Difference = 210.00 − 200 = £10.00 (to the nearest penny)

**Answer: £10.00**

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## 7 Rearranging formulae (powers and roots)

Make x the subject of $y = (x + 3)^2 + 1$

Subtract 1 from both sides: $y - 1 = (x + 3)^2$

Square root both sides (positive and negative roots): $x + 3 = \pm\sqrt{y - 1}$

Subtract 3 from both sides

**Answer: $x = -3 \pm \sqrt{y - 1}$**

## 8 Bounds of a speed or density

A runner travels 390 m in 18.1 s. The distance is measured to the nearest 10 metres and the time to the nearest 0.1 second. (Calculator)

Work out the lower bound for the runner's speed in m/s.

Give your answer correct to 3 significant figures.

speed = distance ÷ time

For the lower bound of speed use the lower bound of distance and the upper bound of time.

385 ÷ 18.15 = 21.21212

= 21.2 m/s (3 s.f.)

**Answer: 21.2 m/s**

## 9 Simultaneous equations (one quadratic)

Solve the simultaneous equations

$y = x^2 - 5x + 5$

$y = x$

Set the y values equal: $x^2 - 5x + 5 = x$

$x^2 - 6x + 5 = 0$

$(x - 1)(x - 5) = 0$

$x = 1$ or $x = 5$

Substitute into $y = x$: $y = 1$ and $y = 5$

**Answer: $x = 1, y = 1$ and $x = 5, y = 5$**

## 10 Inverse proportion formulae

y is inversely proportional to x.

When x = 25, y = 3.

(a) Find a formula for y in terms of x.

(b) Work out the value of y when x = 10.

(a) $y = \frac{k}{x}$. Substitute: $3 = \frac{k}{25}$, so $k = 3 \times 25 = 75$

$y = \frac{75}{x}$

(b) $y = \frac{75}{10} = 7.5$

**Answer: (a) $y = \frac{75}{x}$ (b) 7.5**