Day 259 **A Tier 10-a-day: Model Solutions**

1 Converting speeds

A sprinter travels at 35 m/s.
Work out this speed in kilometres per hour.

In 1 hour there are 3600 seconds, so 35 m/s = 35 × 3600 m/h
= 126000 m/h = 126000 ÷ 1000 km/h
= 126
Answer: 126 km/h

2 Estimation

By rounding each number to 1 significant figure, estimate the value of
$\frac{34.8 + 9.5}{0.99}$

Round each number to 1 significant figure: 30, 10, 1.0
$\frac{30 + 10}{1.0} = 40$
Answer: 40

3 Solving quadratic equations

Solve $2x^2 - 3x - 5 = 0$

Factorise: $(x + 1)(2x - 5) = 0$
$x + 1 = 0$ or $2x - 5 = 0$
$x = -1$ or $x = \frac{5}{2}$
Answer: $x = -1$ or $x = \frac{5}{2}$

4 Is it a right-angled triangle?

A triangle has sides of length 15 m, 16 m and 8 m.
Is the triangle right-angled?
You must show your working.

Longest side$^2 = 16^2 = 256$
Sum of the squares of the other two sides $= 8^2 + 15^2 = 64 + 225 = 289$
$256 \neq 289$, so the triangle is not right-angled
Answer: No, it is not right-angled

5 Simplifying surds

(a) Simplify $\sqrt{396}$
(b) Simplify $\sqrt{396} - \sqrt{176}$

(a) $\sqrt{396} = \sqrt{36} \times \sqrt{11} = 6\sqrt{11}$
(b) $\sqrt{176} = 4\sqrt{11}$, so $6\sqrt{11} - 4\sqrt{11} = 2\sqrt{11}$
Answer: (a) $6\sqrt{11}$ (b) $2\sqrt{11}$

6 Completing the square

Solve $x^2 - 6x - 11 = 0$ by completing the square.
Give your answers in surd form.

$x^2 - 6x - 11 = (x - 3)^2 - 20$
$(x - 3)^2 = 20$
$x - 3 = \pm\sqrt{20}$
$x = 3 \pm \sqrt{20} = 3 \pm 2\sqrt{5}$
Answer: $x = 3 \pm 2\sqrt{5}$

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7 Compound interest

Maya invests £2000 in a savings account. (Calculator)
The account pays 6% compound interest per year.
Work out the amount in the account after 3 years.

Multiplier = 100% + 6% = 1.06

£2000 × 1.06^3 = £2382.032

= £2382.03 to the nearest penny

Answer: £2382.03

8 Area of a trapezium

The diagram shows a trapezium.
Work out the area of the trapezium.
The diagram is not drawn accurately.

Area = $\frac{1}{2}$ × (8 + 20) × 11

= $\frac{1}{2}$ × 28 × 11

= 154

Answer: 154 cm^2

9 Circle theorems: isosceles triangles with radii

A, B and C are points on a circle with centre O.
Angle OAB = 28°.
(a) Work out angle AOB.
(b) Work out the size of angle x.
Give reasons for your answers.

(a) OA = OB (radii), so triangle OAB is isosceles and angle OBA = 28°

Angle AOB = 180 − 28 − 28 = 124°

(b) The angle at the centre is twice the angle at the circumference

x = 124 ÷ 2 = 62

Answer: (a) 124° (b) x = 62°

10 Simultaneous equations (one quadratic)

Solve the simultaneous equations

$y = x^2 - 5x + 16$
$y = 2x + 6$

Set the y values equal: $x^2 - 5x + 16 = 2x + 6$

$x^2 - 7x + 10 = 0$

$(x - 2)(x - 5) = 0$

x = 2 or x = 5

Substitute into y = 2x + 6: y = 10 and y = 16

Answer: x = 2, y = 10 and x = 5, y = 16