Day 121 **A Tier 10-a-day: Model Solutions**

1 Time

(a) A film starts at 6:40 am. The film lasts 1 hours 37 minutes. Work out the time it ends.
(b) Change 150 minutes into hours. Give your answer as a decimal.

(a) 6:40 am + 1 hours 37 minutes = 8:17 am
(b) 150 ÷ 60 = 2.5 hours
Answer: (a) 8:17 am (b) 2.5 hours

2 Percentage change

The price of a games console changes from £50 to £48.
Work out the percentage decrease.

Decrease = £50.00 − £48.00 = £2.00

Percentage decrease = $\frac{£2.00}{£50.00} \times 100 = 4\%$

Answer: 4%

3 The quadratic formula

Solve $2x^2 + 9x + 6 = 0$
Give your solutions correct to 2 decimal places. (Calculator)

Use $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ with a = 2, b = 9, c = 6

$x = \frac{-9 \pm \sqrt{9^2 - 4 \times 2 \times 6}}{4}$

$x = \frac{-9 \pm \sqrt{33}}{4}$

x = −0.81 or x = −3.69
Answer: x = −0.81 or x = −3.69

4 Circle theorems: angle at the centre

X, Y and Z are points on a circle with centre O.
Angle XZY = 40°.
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 = 2 × 40 = 80
Answer: x = 80°

5 Tree diagrams

The tree diagram shows probabilities for two events.
(a) Work out the values of a and b.
(b) Work out the probability that a part is rejected at the final check.

(a) Probabilities on pairs of branches add up to 1.
a = 1 − 0.5 = 0.5 and b = 1 − 0.7 = 0.3
(b) P(rejected) = 0.5 × 0.7 + 0.5 × 0.1
= 0.35 + 0.05 = 0.4
Answer: (a) a = 0.5, b = 0.3 (b) 0.4

6 Percentages of percentages

75% of a number is 75. (Calculator)
Work out 50% of the same number.

75% = 75, so 1% = 75 ÷ 75 = 1
50% = 1 × 50 = 50
Answer: 50

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7 Circle theorems: isosceles triangles with radii

A, B and C are points on a circle with centre O.
Angle OAB = 39°.
(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 = 39°
Angle AOB = 180 − 39 − 39 = 102°
(b) The angle at the centre is twice the angle at the circumference
x = 102 ÷ 2 = 51
Answer: (a) 102° (b) x = 51°

8 Completing the square

Solve $x^2 - 10x + 7 = 0$ by completing the square.
Give your answers in surd form.

$x^2 - 10x + 7 = (x - 5)^2 - 18$
$(x - 5)^2 = 18$
$x - 5 = \pm\sqrt{18}$
$x = 5 \pm \sqrt{18} = 5 \pm 3\sqrt{2}$
Answer: $x = 5 \pm 3\sqrt{2}$

9 Perpendicular bisector

A is the point (3, 2) and B is the point (7, 6).
Find the equation of the perpendicular bisector of AB.

Midpoint of AB = $(\frac{3+7}{2}, \frac{2+6}{2}) = (5, 4)$

Gradient of AB = $\frac{4}{4} = 1$

Perpendicular gradient = $-1 \div 1 = -1$
$y = -x + c$ through (5, 4): $4 = -1 \times 5 + c$, so $c = 9$
$y = -x + 9$
Answer: $y = -x + 9$

10 Inverse proportion formulae

y is inversely proportional to x^2.
When x = 8, y = 12.
(a) Find a formula for y in terms of x.
(b) Work out the positive value of x when y = 30.72.

(a) $y = \frac{k}{x^2}$. Substitute: $12 = \frac{k}{64}$, so $k = 12 \times 64 = 768$

$y = \frac{768}{x^2}$

(b) $30.72 = \frac{768}{x^2}$, so $x^2 = 768 \div 30.72 = 25$, so $x = 5$

Answer: (a) $y = \frac{768}{x^2}$ (b) $x = 5$