Day 365 **A Tier 10-a-day: Model Solutions**

1 Wages and overtime

Oscar is paid £13.80 per hour for a basic week of 38 hours. (Calculator)
Overtime is paid at double time.
Last week Oscar worked 7 hours of overtime.
Work out Oscar's total pay for the week.

Basic pay = 38 × £13.80 = £524.40
Overtime rate = £13.80 × 2 = £27.60 per hour
Overtime pay = 7 × £27.60 = £193.20
Total = £524.40 + £193.20 = £717.60
Answer: £717.60

2 Angles in parallel lines

The diagram shows two parallel lines crossed by a straight line.
(a) Work out the value of x.
(b) Work out the size of the angle marked (x + 5)°.
The diagram is not drawn accurately.

(a) Co-interior angles add up to 180°
x + 5 + 5x + 49 = 180
6x + 54 = 180
6x = 126
x = 21
(b) 1 × 21 + 5 = 26
Answer: (a) x = 21 (b) 26°

3 Laws of indices

Simplify fully

(a) $\frac{10x^3y^2}{6x^2y^6}$

(b) $\frac{(5x^2)^2}{2x^3}$

(a) Divide the numbers: $10 \div 6 = \frac{5}{3}$

Subtract the powers: $x^3 \div x^2 = x$ and $y^2 \div y^6 = y^{-4}$

$= \frac{5x}{3y^4}$

(b) Square the top: $(5x^2)^2 = 25x^4$

Divide the numbers: $25 \div 2 = \frac{25}{2}$. Subtract the powers of x: $4 - 3 = 1$

$= \frac{25x}{2}$

Answer: (a) $\frac{5x}{3y^4}$ (b) $\frac{25x}{2}$

4 Trigonometry: finding an angle

Work out the size of angle x. (Calculator)
Give your answer to 1 decimal place.
The diagram is not drawn accurately.

The sides given are the opposite (6) and the adjacent (10), so use tan

$\tan x = \frac{6}{10}$

$x = \tan^{-1}(\frac{6}{10})$

x = 31.0°
Answer: x = 31.0°

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5 Growth and decay

A new car is worth £5000. (Calculator)
Its value falls by 12% each year.
Work out its value after 2 years.

Multiplier = 100% − 12% = 0.88

$5000 \times 0.88^2 = 3872.00$

= £3872 to the nearest whole number

Answer: £3872

6 Area of a triangle using sine

The area of triangle ABC is 55.1 cm^2. (Calculator)
Angle x is acute.
Work out the size of angle x. Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\frac{1}{2} \times 7 \times 16 \times \sin x = 55.1$

$56 \sin x = 55.1$

$\sin x = 0.9839$

$x = 79.7°$

Answer: x = 79.7°

7 Algebraic rearrangement and change of sign

$f(x) = x^3 + 4x^2 + 6x - 5$
Show that the equation f(x) = 0 has a solution between x = 0 and x = 1.

f(0) = −5

f(1) = 6

There is a change of sign and f is continuous, so there is a solution between x = 0 and x = 1

Answer: f(0) = −5 and f(1) = 6 (change of sign)

8 Recurring decimals (mixed)

Write $0.7\dot{2}$ as a fraction in its simplest form.

Let x = 0.722...

Multiply by 10: 10x = 7.22...

Multiply by 100: 100x = 72.22...

Subtract: 90x = 72 − 7 = 65

$x = \frac{65}{90} = \frac{13}{18}$

Answer: $\frac{13}{18}$

9 Equations with fractions

Solve $\frac{4x - 4}{2} = \frac{5x + 2}{3}$

Multiply both sides by 6

$3(4x - 4) = 2(5x + 2)$

$12x - 12 = 10x + 4$

$2x = 16$

$x = 8$

Answer: x = 8

10 Direct proportion formulae

y is directly proportional to the square root of x.
When x = 36, y = 54.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 64.

(a) $y = k\sqrt{x}$. Substitute: $54 = k \times 6$, so $k = 9$
$y = 9\sqrt{x}$
(b) $y = 9 \times 8 = 72$

Answer: (a) $y = 9\sqrt{x}$ (b) 72