Day 133 **A Tier 10-a-day: Model Solutions**

1 Ordering numbers

Write these numbers in order of size, starting with the smallest.

30% $\frac{4}{20}$ 0.94 0.87

Change each to a decimal: 30% = 0.3, $\frac{4}{20}$ = 0.2, 0.94 = 0.94, 0.87 = 0.87

Order the decimals: 0.2 < 0.3 < 0.87 < 0.94

Answer: $\frac{4}{20}$, 30%, 0.87, 0.94

2 Trigonometry: finding a side

Work out the value of x. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

x is the adjacent and 24 cm is the opposite, so use tan

$\tan 35° = \frac{24}{x}$

$x = 24 \div \tan 35°$

$x = 34.3$

Answer: x = 34.3 cm

3 Difference of two squares

(a) Factorise $x^2 - 64$

(b) Use the same idea to work out $43^2 - 7^2$ without a calculator.

(a) Difference of two squares: $x^2 - 64 = x^2 - 8^2$

$(x - 8)(x + 8)$

(b) $a^2 - b^2 = (a + b)(a - b)$, so $43^2 - 7^2 = (43 + 7)(43 - 7)$

$= 50 \times 36 = 1800$

Answer: (a) (x − 8)(x + 8) (b) 1800

4 Column vectors

$\mathbf{a} = \begin{pmatrix}1\\2\end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix}1\\0\end{pmatrix}$.

Work out $3\mathbf{a} + 2\mathbf{b}$.

$3\mathbf{a} = \begin{pmatrix}3\\6\end{pmatrix}$ and $2\mathbf{b} = \begin{pmatrix}2\\0\end{pmatrix}$

$3\mathbf{a} + 2\mathbf{b} = \begin{pmatrix}3 + 2\\6 + 0\end{pmatrix}$

$= \begin{pmatrix}5\\6\end{pmatrix}$

Answer: $\begin{pmatrix}5\\6\end{pmatrix}$

5 Growth and decay

A new car is worth £15000. (Calculator)
Its value falls by 15% each year.
Work out its value after 3 years.

Multiplier = 100% − 15% = 0.85

$15000 \times 0.85^3 = 9211.88$

= £9212 to the nearest whole number

Answer: £9212

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6 Successive percentage changes

The number of followers of a channel is increased by 15% and then the new amount is decreased by 30%.
Work out the overall percentage decrease.

Multipliers: increase of 15% is 1.15, decrease of 30% is 0.7
Overall multiplier = 1.15 × 0.7 = 0.805
0.805 means a percentage decrease of 19.5%
Answer: 19.5% decrease

7 Simple and compound interest

Ben and Leah each invest £2000 for 3 years. (Calculator)
Ben's account pays 6% simple interest per year.
Leah's account pays 6% compound interest per year.
Work out how much more interest Leah earns than Ben.

Simple interest = £2000 × 6% × 3 = £360
Compound: £2000 × 1.06^3 = £2382.032, so interest = £382.032
Difference = 382.032 − 360 = £22.03 (to the nearest penny)
Answer: £22.03

8 The cosine rule: finding an angle

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

$$\cos x = \frac{15^2 + 20^2 - 14^2}{2 \times 15 \times 20}$$

$$\cos x = \frac{429}{600}$$

$x = \cos^{-1}(0.7150)$
$x = 44.4°$
Answer: x = 44.4°

9 Fraction calculations

Work out $(3\frac{1}{4} + 2\frac{2}{3}) \times 1\frac{1}{2}$

Give your answer as a mixed number in its simplest form.

Brackets first, as improper fractions: $\frac{13}{4} + \frac{8}{3} = \frac{71}{12}$

Then multiply: $\frac{71}{12} \times \frac{3}{2} = \frac{71}{8}$

$= 8\frac{7}{8}$

Answer: $8\frac{7}{8}$

10 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{2x - 2}{3x + 6}$

Multiply both sides by (3x + 6): y(3x + 6) = 2x − 2
Expand the bracket: 3xy + 6y = 2x − 2
Collect the x terms on one side: 3xy − 2x = −6y − 2
Factorise: x(3y − 2) = −6y − 2

Divide by (3y − 2): $x = \frac{-6y - 2}{3y - 2}$

Answer: $x = \frac{-6y - 2}{3y - 2}$