Day 67 **A Tier 10-a-day: Model Solutions**

1 Expanding double brackets

Expand and simplify

$(4x + 4)^2$

Multiply every term in the first bracket by every term in the second

$= (4x + 4)(4x + 4) = 16x^2 + 16x + 16x + 16$

$= 16x^2 + 32x + 16$

Answer: $16x^2 + 32x + 16$

2 Mixed number addition and subtraction

Work out $5\frac{1}{2} + 2\frac{5}{6}$

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

Write as improper fractions: $5\frac{1}{2} = \frac{11}{2}$ and $2\frac{5}{6} = \frac{17}{6}$

Common denominator 6: $\frac{33}{6} + \frac{17}{6}$

$= \frac{50}{6}$

$= 8\frac{1}{3}$

Answer: $8\frac{1}{3}$

3 Bearings

The bearing of M from L is 220°.

Work out the bearing of L from M.

The diagram is not drawn accurately.

The north lines at L and M are parallel

Back bearing = 220° − 180° = 40°

Answer: 040°

4 Laws of indices

Simplify fully

(a) $\frac{15x^2y^5}{2x^4y}$

(b) $(3x^4y^4)^4$

(a) Divide the numbers: $15 \div 2 = \frac{15}{2}$

Subtract the powers: $x^2 \div x^4 = x^{-2}$ and $y^5 \div y = y^4$

$= \frac{15y^4}{2x^2}$

(b) Raise every part to the power 4: $3^4 = 81$, $(x^4)^4 = x^{16}$, $(y^4)^4 = y^{16}$

$= 81x^{16}y^{16}$

Answer: (a) $\frac{15y^4}{2x^2}$ (b) $81x^{16}y^{16}$

5 Trigonometry in context

A flagpole stands on horizontal ground. (Calculator)

From a point 20 m from the base of the flagpole, the angle of elevation of the top is 38°.

Work out the height of the flagpole. Give your answer to 3 significant figures.

$\tan 38° = \frac{\text{height}}{20}$

height = $20 \times \tan 38°$

= 15.6

Answer: 15.6 m

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6 Venn diagram probability

The Venn diagram shows information about 35 people.
One person is chosen at random.
(a) The person is in set Netball. Find the probability that they are also in set Hockey.
(b) The person is not in set Hockey. Find the probability that they are in set Netball.

(a) In Netball: 14 + 6 = 20 people, of whom 6 are also in Hockey: $\frac{3}{10}$

(b) Not in Hockey: 14 + 5 = 19 people, of whom 14 are in Netball: $\frac{14}{19}$

Answer: (a) $\frac{3}{10}$ (b) $\frac{14}{19}$

7 Recurring decimals, show that

(a) Show that $0.\dot{9}\dot{0} = \frac{10}{11}$

(b) Hence write $3.\dot{9}\dot{0}$ as a mixed number in its simplest form.

(a) Let x = 0.909090..., so 100x = 90.9090...

100x − x = 90, so 99x = 90 and $x = \frac{90}{99} = \frac{10}{11}$

(b) $3.\dot{9}\dot{0} = 3 + \frac{10}{11} = 3\frac{10}{11}$

Answer: (b) $3\frac{10}{11}$

8 Direct proportion formulae

y is directly proportional to the cube of x.
When x = 4, y = 512.
(a) Find a formula for y in terms of x.
(b) Work out the positive value of x when y = 216.

(a) $y = kx^3$. Substitute: 512 = k × 64, so k = 8

$y = 8x^3$

(b) $216 = 8x^3$, so $x^3 = 216 \div 8 = 27$, so x = 3

Answer: (a) $y = 8x^3$ (b) x = 3

9 Changing a ratio

A bag contains red counters and blue counters in the ratio 1 : 4.
2 more red counters are added to the bag.
The ratio of red counters to blue counters is now 2 : 7.
How many counters were in the bag at the start?

Let red = 1x and blue = 4x. After adding: (1x + 2) : 4x = 2 : 7

$\frac{1x + 2}{4x} = \frac{2}{7}$, so 7(1x + 2) = 2 × 4x

7x + 14 = 8x, so 1x = 14, x = 14

Start: 1x + 4x = 5 × 14 = 70 counters

Answer: 70

10 Circle theorems: angles in the same segment

A, B, C and D are points on a circle. AC and BD meet at E.
Angle BAC = 32° and angle ACD = 54°.
Work out the size of angle x (angle AEB).
Give reasons for your working.

Angles in the same segment are equal, so angle ABD = angle ACD = 54°
In triangle ABE: angle BAE = 32° and angle ABE = 54°
x = 180 − 32 − 54 = 94

Answer: x = 94°