Day 219 **B Tier 10-a-day: Model Solutions**

1 Circle theorems

A, B, C and D are points on a circle.
Angle ADC = 56°.
Work out the size of angle ABC, marked b.
Give a reason for your answer.
The diagram is not drawn accurately.

ABCD is a cyclic quadrilateral
Opposite angles of a cyclic quadrilateral add up to 180°
b = 180 − 56 = 124°
Answer: b = 124°

2 Order of operations

Work out
(a) $41 - 40 \div 8 + 2 \times 4$
(b) $7^2 - (10 - 4) \times 3$

(a) Divide and multiply first: 40 ÷ 8 = 5 and 2 × 4 = 8
Then from left to right: 41 − 5 + 8 = 44
(b) Brackets: 10 − 4 = 6
Powers: $7^2 = 49$
Multiply: 6 × 3 = 18
Subtract: 49 − 18 = 31
Answer: (a) 44 (b) 31

3 Equations with fractions

Solve $\frac{5x - 19}{4} = 4$

Multiply both sides by 4: 5x − 19 = 16
Add 19 to both sides: 5x = 35
Divide both sides by 5
Answer: x = 7

4 Pay and overtime

Zain earns £18 per hour for the first 30 hours worked each week.
Any extra hours are paid at time and a half.
Last week Zain worked 38 hours.
Work out Zain's total pay for last week.

Normal pay: 30 × £18 = £540
Overtime rate: 1.5 × £18 = £27 per hour
Overtime pay: 8 × £27 = £216
Total = £540 + £216 = £756
Answer: £756

5 Mixed numbers

Work out $2\frac{3}{4} + 3\frac{2}{3}$

Give your answer as a mixed number.

Whole numbers: 2 + 3 = 5

Fractions: $\frac{3}{4} + \frac{2}{3} = \frac{17}{12} = 1\frac{5}{12}$

Total = $6\frac{5}{12}$

Answer: $6\frac{5}{12}$

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6 Growth and decay

Tom invests £1,000 for 2 years at 4% simple interest per year.
Work out the total interest he earns.

Interest each year = 4% of £1,000 = £40
Over 2 years: 2 × £40 = £80
Answer: £80

7 Trial and improvement

The equation $x^3 - 2x = 11$ has a solution between 2 and 3. (Calculator)
Use trial and improvement to find this solution.
Give your answer correct to 1 decimal place.

$x = 2.5$: $2.5^3 - 2 \times 2.5 = 10.625$ (too small)
$x = 2.7$: $2.7^3 - 2 \times 2.7 = 14.283$ (too big)
$x = 2.6$: $2.6^3 - 2 \times 2.6 = 12.376$ (too big)
$x = 2.55$: value = 11.481 (too big), so the solution is below 2.55
So x = 2.5 to 1 decimal place
Answer: x = 2.5

8 Simple interest

Nina invests £4000 for 3 years.
The account pays 4% simple interest per year.
(a) Work out the interest earned each year.
(b) Work out the total amount in the account after 3 years.

(a) 4% of £4000 = 4000 ÷ 100 × 4 = £160
(b) Interest over 3 years: 3 × £160 = £480
Total = £4000 + £480 = £4480
Answer: (a) £160 (b) £4480

9 Arc length and sector area

The diagram shows a sector of a circle with radius 4 cm and angle 30°. (Calculator)
Work out the length of the arc of the sector.
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Arc length = $\frac{30}{360} \times 2 \times \pi \times 4$
= 2.094... = 2.1 cm (1 d.p.)
Answer: 2.1 cm

10 Expanding and simplifying

Expand and simplify 6(x − 2) + 6(x − 3)

Expand each bracket: 6x − 12 + 6x − 18
Collect like terms: 12x − 30
Answer: 12x − 30