**Day 230** **A Tier 10-a-day: Model Solutions**

## 1 Inverse functions

$f(x) = \frac{x + 4}{2}$

(a) Find $f^{-1}(x)$

(b) Work out $f^{-1}(1)$

Let $y = \frac{x + 4}{2}$

$x = 2y - 4$

$f^{-1}(x) = 2x - 4$

(b) $f^{-1}(1) = -2$

**Answer: (a) $f^{-1}(x) = 2x - 4$ (b) $-2$**

## 2 Area of parallelograms and kites

The diagram shows a parallelogram.
Work out its area.
The diagram is not drawn accurately.

Area = base × perpendicular height
= 14 × 3 = 42
(the slanted side, 5 cm, is not used)

**Answer: 42 cm$^2$**

## 3 Standard form notation

(a) Write 0.00083 in standard form.

(b) Write $6.2 \times 10^6$ as an ordinary number.

(a) Move the decimal point 4 places to get 8.3: $8.3 \times 10^{-4}$

(b) Move the decimal point 6 places to the right: 6,200,000

**Answer: (a) $8.3 \times 10^{-4}$ (b) 6,200,000**

## 4 Rearranging formulae

Make t the subject of $s = \frac{t - 7}{9}$

Multiply both sides by 9: $9s = t - 7$
Add 7 to both sides
$t = 9s + 7$

**Answer: $t = 9s + 7$**

## 5 Circle theorems: angle at the centre

X, Y and Z are points on a circle with centre O.
Angle XOY = 72°.
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
$x = 72 \div 2 = 36$

**Answer: $x = 36°$**

## 6 Probability without replacement

A bag contains 4 yellow, 5 white and 3 black balls.
Two balls are taken at random without replacement.
Work out the probability that the two balls are different colours.

$P(\text{same colour}) = \frac{4}{12} \times \frac{3}{11} + \frac{5}{12} \times \frac{4}{11} + \frac{3}{12} \times \frac{2}{11} = \frac{19}{66}$

$P(\text{different}) = 1 - \frac{19}{66} = \frac{47}{66}$

**Answer: $\frac{47}{66}$**

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## 7 Arc length and perimeter of a sector

The diagram shows a sector of a circle of radius 12 cm.
Work out the length of the arc of the sector.
Give your answer in terms of $\pi$.
The diagram is not drawn accurately.

Arc length = $\frac{270}{360} \times 2 \times \pi \times 12$

$= 18\pi$

**Answer: $18\pi$ cm**

## 8 Adding algebraic fractions

Write as a single fraction

$\frac{-1}{(x+2)} - \frac{4}{(x-2)}$

Common denominator is $(x+2)(x-2)$

$= \frac{-1(x-2) - 4(x+2)}{(x+2)(x-2)}$

$= \frac{-5x-6}{(x+2)(x-2)}$

**Answer: $\frac{-5x-6}{(x+2)(x-2)}$**

## 9 Recurring decimals, show that

(a) Show that $0.\dot{2}\dot{1} = \frac{7}{33}$

(b) Hence write $3.\dot{2}\dot{1}$ as a mixed number in its simplest form.

(a) Let $x = 0.212121...$, so $100x = 21.2121...$

$100x - x = 21$, so $99x = 21$ and $x = \frac{21}{99} = \frac{7}{33}$

(b) $3.\dot{2}\dot{1} = 3 + \frac{7}{33} = 3\frac{7}{33}$

**Answer: (b) $3\frac{7}{33}$**

## 10 Percentages in context

Kai earns £26000 a year.
She pays no tax on the first £12000.
She pays 30% tax on the rest.
Work out how much tax she pays in a year.

Taxable amount = £26000 − £12000 = £14000
Tax = 30% of £14000 = £4200

**Answer: £4200**