Day 278 **A Tier 10-a-day: Model Solutions**

1 Functions

f(x) = 5x − 7
g(x) = x^2 + 7
Find fg(−3)

g(−3) = $(-3)^2$ + 7 = 16
f(16) = 5 × 16 − 7 = 73
Answer: 73

2 Mixed number addition and subtraction

Work out $3\frac{4}{9} + 1\frac{1}{2}$

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

Write as improper fractions: $3\frac{4}{9} = \frac{31}{9}$ and $1\frac{1}{2} = \frac{3}{2}$

Common denominator 18: $\frac{62}{18} + \frac{27}{18}$

$= \frac{89}{18}$

$= 4\frac{17}{18}$

Answer: $4\frac{17}{18}$

3 Inverse proportion

8 painters take 14 days to paint a hall.
All the painters work at the same rate.
How many painters are needed to paint a hall in 7 days?

Total work = 8 × 14 = 112 painter-day
Number needed = 112 ÷ 7 = 16
Answer: 16

4 Rearranging to solve quadratics

Solve $x^2 = 1$

Move everything to one side: $x^2 - 1 = 0$
Factorise: (x − 1)(x + 1) = 0
x = −1 or x = 1
Answer: x = −1 or x = 1

5 Circle theorems: isosceles triangles with radii

A, B and C are points on a circle with centre O.
Angle OAB = 60°.
(a) Work out angle AOB.
(b) Work out the size of angle x.
Give reasons for your answers.

(a) OA = OB (radii), so triangle OAB is isosceles and angle OBA = 60°
Angle AOB = 180 − 60 − 60 = 60°
(b) The angle at the centre is twice the angle at the circumference
x = 60 ÷ 2 = 30
Answer: (a) 60° (b) x = 30°

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6 Expanding three brackets

Expand and simplify
$(x - 5)(x + 2)(x + 5)$

Expand the first two brackets: $(x - 5)(x + 2) = x^2 - 3x - 10$
Multiply by the third bracket: $(x^2 - 3x - 10)(x + 5)$
$= x^3 - 3x^2 - 10x + 5x^2 - 15x - 50$
$= x^3 + 2x^2 - 25x - 50$
Answer: $x^3 + 2x^2 - 25x - 50$

7 Box plots

The box plot shows the masses, in kg, of the parcels in delivery A.
(a) Write down the median and the interquartile range.
For delivery B the median is 80 and the interquartile range is 25.
(b) Compare the distributions of the two deliveries.

(a) Median = 75
Interquartile range = 80 − 60 = 20
(b) The median for Delivery B is higher (80 compared with 75), so it has the higher values on average
The IQR for Delivery A is smaller (20 compared with 25), so its values are more consistent
Answer: (a) Median 75, IQR 20 (b) Delivery B has the higher median; Delivery A has the smaller IQR so is more consistent

8 Bounds of a speed or density

A metal block has mass 190 g and volume 88 cm^3. The mass is measured to the nearest 10 grams and the volume to the nearest cm^3. (Calculator)
Work out the upper bound for the density of the metal in g/cm^3.
Give your answer correct to 3 significant figures.

density = mass ÷ volume
For the upper bound of density use the upper bound of mass and the lower bound of volume.
195 ÷ 87.5 = 2.22857
= 2.23 g/cm^3 (3 s.f.)
Answer: 2.23 g/cm^3

9 Addition and multiplication rules

A spinner can land on red, blue or green.
P(red) = 0.3 and P(blue) = 0.55.
(a) Work out the probability that it lands on red or blue.
(b) Work out the probability that it lands on green.

(a) Mutually exclusive, so add: 0.3 + 0.55 = 0.85
(b) 1 − 0.85 = 0.15
Answer: (a) 0.85 (b) 0.15

10 Describing transformations

Describe fully the single transformation that maps shape A onto shape B.

The shape has been turned, so this is a rotation
Compare the matching vertices to find the angle and direction: a half turn
The centre is the point that stays fixed: (1, 0)
Answer: Rotation, 180°, centre (1, 0)