**Day 284** **A Tier 10-a-day: Model Solutions**

## 1 Reverse percentages

In a sale, all prices are reduced by 15%.
A coat costs £34 in the sale.
Work out the original price of the coat.

85% represents £34
1% = £34 ÷ 85 = £0.4
100% = £0.4 × 100 = £40.00
**Answer: £40.00**

## 2 Equations with brackets

Solve $-3(x - 7) = -4(x - 3) + 10$

Expand the brackets: $-3x + 21 = -4x + 12 + 10$
Simplify: $-3x + 21 = -4x + 22$
Collect x terms on one side and numbers on the other: $x = 1$
$x = 1$
**Answer: $x = 1$**

## 3 Time

(a) A train leaves London at 8:55 am. The journey takes 2 hours 28 minutes. Work out the time it ends.
(b) Change 2.25 hours into hours and minutes.

(a) 8:55 am + 2 hours = 10:55 am, then + 28 minutes = 11:23 am
(b) 0.25 hours = 0.25 × 60 = 15 minutes, so 2.25 hours = 2 hours 15 minutes
**Answer: (a) 11:23 am (b) 2 hours 15 minutes**

## 4 Simultaneous equations

Solve the simultaneous equations
$6x - 4y = 14$
$-5x - 2y = -1$

Multiply (2) by 2 to make the y coefficients match
$6x - 4y = 14$ (1)
$-10x - 4y = -2$ (2)
The y terms have the same sign, so subtract equation (2) from equation (1)
$16x = 16$, so $x = 1$
Substitute $x = 1$ into equation (1) to find $y = -2$
**Answer: $x = 1$, $y = -2$**

## 5 Index equations

Solve $9^x = 81$

Write both sides as powers of 3: $9 = 3^2$, so $9^x = 3^{2x}$
$81 = 3^4$, so $2x = 4$
$x = 2$
**Answer: $x = 2$**

## 6 Area of a triangle using sine

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

Area = $\frac{1}{2} \times a \times b \times \sin C$

$= \frac{1}{2} \times 11 \times 7 \times \sin 71°$

$= 36.4$

**Answer: 36.4 $m^2$**

**Day 284** **A Tier 10-a-day: Model Solutions**

## 7 Surd fractions

Show that $\frac{\sqrt{8}+\sqrt{18}}{\sqrt{2}}$ is an integer, and find its value.

$\sqrt{8} = 2\sqrt{2}$ and $\sqrt{18} = 3\sqrt{2}$

Numerator $= 2\sqrt{2} + 3\sqrt{2} = 5\sqrt{2}$

$\frac{5\sqrt{2}}{\sqrt{2}} = 5$

**Answer: 5**

## 8 Volume of cones and spheres

A sphere has radius 12 cm.

Work out the volume of the sphere. Give your answer in terms of $\pi$.

Volume $= \frac{4}{3} \times \pi \times r^3$

$= \frac{4}{3} \times \pi \times 12^3$

$= \frac{4}{3} \times 1728\ \pi$

$= 2304\pi$

**Answer: $2304\pi$ cm$^3$**

## 9 Pie charts

The pie chart shows how some students chose a sport.

20 students chose rugby.

(a) Work out the angle for hockey.

(b) How many students chose hockey?

(a) $360 - 45 - 180 - 81 = 54°$

(b) 20 students is 180°, so 1 student is $180 \div 20 = 9°$

Hockey: $54 \div 9 = 6$

**Answer: (a) 54° (b) 6**

## 10 Equations with algebraic fractions

Solve $\frac{2}{(x+5)} + \frac{3}{(x+1)} = 1$

Multiply every term by $(x + 5)(x + 1)$

$2(x + 1) + 3(x + 5) = (x + 5)(x + 1)$

$5x + 17 = x^2 + 6x + 5$

$x^2 + x - 12 = 0$

$(x + 4)(x - 3) = 0$

$x = -4$ or $x = 3$

**Answer: $x = -4$ or $x = 3$**