

## Question 1

Maureen wants to buy a bag of bananas.

Core 1 - Bronze

Topic: Units/ Rates and Variations

Pack A

8 bananas  
£1.10

Pack B

14 bananas  
£1.70

Which pack is the best value for money?

$$\frac{\text{Price A}}{\text{Unit A}} = \frac{1.10}{8} = 0.1375 = \underline{14p}$$

$$\frac{\text{Price B}}{\text{Unit B}} = \frac{1.7}{14} = 0.1214 = \underline{12p}$$

## Question 2

Core 2 - Bronze

Topic: Units/ Rates and Variations

a) Here is a list of ingredients for making 12 chocolate cupcakes.

120 g butter

160 g flour

2 eggs

40 g chocolate chips

$$\frac{30}{12} = 2\frac{6}{12} = 2\frac{1}{2}$$

Scale factor = 2.5

James wants to make 30 chocolate cupcakes.

Work out how much of each ingredient he will need?

$$\begin{aligned} 120 \times 2.5 &= 300 \text{ g butter} \\ 160 \times 2.5 &= 400 \text{ g flour} \\ 2 \times 2.5 &= 5 \text{ eggs} \\ 40 \times 2.5 &= 100 \text{ g C.C.} \end{aligned}$$

## Core 3 - Bronze

Topic:

Units/ Rates  
and Variations

a) Massimo is on holiday in Thailand.

**The exchange rate is £1 = 38.25 Thai Bahts.**

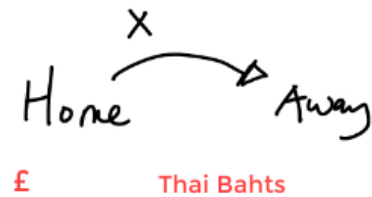
He set a budget of £3000 for the entire holiday.

He spent 32,000 Thai Bahts on flights.

He spent 45,000 Thai Bahts on accommodation.

How much spending money, in Thai Bahts, will Massimo have left to spend?  
(assuming full budget)

$$\begin{array}{r} £3000 \times 38.25 = 114,750 \text{ TB} \\ - 32,000 \\ \underline{45,000} \\ \hline 37,750 \end{array}$$



## Core 4 - Bronze

Topic:

Units/ Rates  
and Variations

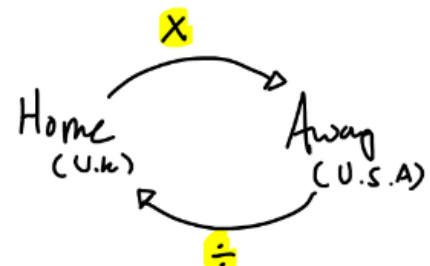
Nicole is travelling to the USA.

She has £250 in the UK.

**The exchange rate is £1 = \$1.41**

a) How many dollars can she exchange in London?

$$\begin{array}{r} 250 \times 1.41 = \$352.50 \\ £1 \Rightarrow £250 \end{array}$$



b) On her return she has \$48 left. How many pounds could she get from this amount?

(Assume same exchange rate as above)

$$\begin{array}{r} \$48 \\ \$1.41 \end{array} = \underline{\underline{\$34.04}}$$

c) If the Dollar strengthened on Nicole's return, what effect would this have on the amount that Nicole could exchange back in to pounds?

£ would ↓

## Core 5 - Silver

Topic: Units/ Rates and Variations

- a) It takes 4 men 12 days to complete a garden landscaping project.  
How many days would it take 6 men to complete the project?

$$\text{Time} = \frac{k}{\text{Labour}}$$

$$\frac{12}{4} = \frac{k}{1}$$

$$\therefore k = 48$$

$$\text{Time} = \frac{48}{\text{Labour}}$$

$$\frac{48}{6} = 8 \text{ days}$$

- b) State one assumption you made in working out your answer to part (a)

- Same weather conditions  
- Same health conditions



## Core 6 - Silver

Topic: Units/ Rates and Variations

y is directly proportional to the square of x. When y = 10, x = 2.

- a) Express y in terms of x

1. Proportion type  
 $y \propto x^2$   
 $y = kx^2$

2. Substitute values  
 $10 = k(2)^2$   
 $10 = 4k$

3. Find k. Write formula  
 $\frac{10}{4} = k \therefore k = 2.5$

$$y = 2.5x^2$$

- b) Find the value of y when x = 4

$$y = 2.5 \times (4)^2$$

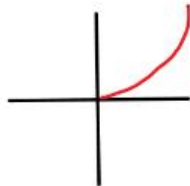
$$y = 40$$

- c) Find the value of x when y = 160

$$160 = 2.5x^2$$

$$64 = x^2 \therefore x^2 = 64, x = 8$$

- d) Sketch the graph



$$y = 2.5x^2$$

Question 7

$c$  is inversely proportional to  $m$ . When  $c = 40$ ,  $m = 5$ .

a) Express  $c$  in terms of  $m$

1. Proportion Type

$$c \propto \frac{1}{m} \therefore c = \frac{k}{m}$$

2. Substitute values

$$\frac{40}{1} = \frac{k}{5} \quad 40 \times 5 = 1 \times k$$

3. Find  $k$  formula

$$k = 200$$

$$c = \frac{200}{m}$$

b) Find the value of  $c$  when  $m = 10$

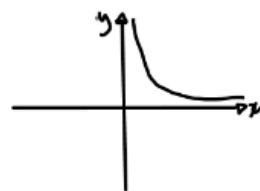
$$c = \frac{200}{10} \therefore c = 20$$

c) Find the value of  $m$  when  $c = 25$

$$\frac{25}{1} = \frac{200}{m} \therefore 25m = 1 \times 200$$

$$m = 8$$

d) Sketch the graph.



$$y = \frac{200}{x} \text{ or } c = \frac{200}{m}$$

Question 8

The table shows a set of values for  $x$  and  $y$ .  $y$  is directly proportional to  $x$ .

|     |   |   |    |    |
|-----|---|---|----|----|
| $x$ | 1 | 2 | 3  | 4  |
| $y$ | 4 | 8 | 12 | 16 |

$$y = kx \quad 4 = k \times 1 \therefore k = 4$$

$$y = 4x$$

a) Find an equation for  $y$  in terms of  $x$ .



b) Find the value of  $x$  when  $y = 24$ .

$$24 = 4x \therefore x = \frac{24}{4} \therefore x = 6$$

The table shows a set of values for  $x$  and  $y$ .  $y$  is inversely proportional to the square of  $x$ .

|     |   |               |               |               |
|-----|---|---------------|---------------|---------------|
| $x$ | 1 | 2             | 3             | 4             |
| $y$ | 6 | $\frac{3}{2}$ | $\frac{2}{3}$ | $\frac{3}{8}$ |

$$y = \frac{k}{x^2} \quad \frac{6}{1} = \frac{k}{(1)^2} \therefore k = 6 \times 1^2 = 6$$

$$y = \frac{6}{x^2}$$

c) Find an equation for  $y$  in terms of  $x$

d) Find the positive value of  $x$  when  $y = 54$ .

$$\frac{54}{1} = \frac{6}{x^2} \quad 54x^2 = 6 \therefore x^2 = \frac{6}{54}$$

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

Question 9

$y$  is directly proportional to  $d^2$ .  $d$  is inversely proportional to  $x$ .

Given that  $y = 12$ ,  $x = 1$  and  $d = 2$ , find a formula for  $y$  in terms of  $x$ .

Multiple

$$① y = kd^2$$

$$12 = k(2)^2$$

$$12 = 4k$$

$$\frac{12}{4} = k \therefore k = 3$$

$$y = 3d^2$$

$$② d = \frac{k}{x}$$

$$\frac{2}{1} = \frac{k}{1} \therefore 2 \times 1 = 1k$$

$$k = 2$$

$$d = \frac{2}{x}$$

$$y = 3\left(\frac{2}{x}\right)^2$$

$$y = \frac{3\left(\frac{4}{x^2}\right)}{1}$$

$$y = \frac{12}{x^2}$$

Question 10

$y$  is inversely proportional to the square of  $x$ .

$y = 20$  and  $x = 2a$

Show that  $y = 5$ , when  $x = 4a$ .

Step 1: Proportion type

$$y \propto \frac{1}{x^2}$$

$$y = \frac{k}{x^2}$$

Step 2: Substitute values

$$y = 20, x = 2a$$

$$20 = \frac{k}{(2a)^2} \therefore \frac{20 = k}{1} \frac{1}{4a^2}$$

Step 3: Find  $k$ . Write formula

$$k = 20 \times 4a^2$$

$$k = 80a^2 \text{ so } \therefore$$

$$y = \frac{80a^2}{x^2}$$

$$\text{If } x = 4a, \text{ then } \Rightarrow y = \frac{80a^2}{(4a)^2}$$

$$y = \frac{80a^2}{16a^2} = 5 \therefore \underline{y = 5}$$



Question 11

This sketch shows part of a graph with equation  $y = pq^x$

- a) The points with coordinates (2,3) and (5,24) lie on the line. Find the value of p and q.

Step 1: Create Two separate equations Step 2: Substitute

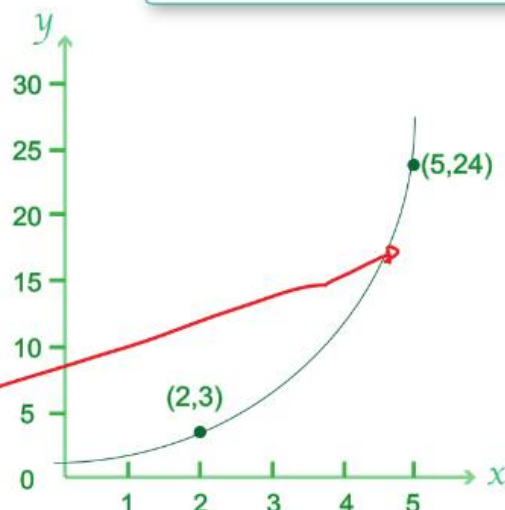
$$\begin{aligned} (1) \quad 3 &= pq^2 \\ (2) \quad 24 &= pq^5 \end{aligned}$$

$$\begin{aligned} (2) \div (1) \quad 8 &= q^3 \\ 2 &= q \end{aligned}$$

Divide

$$\begin{aligned} (1) \quad 3 &= p(2)^2 \\ 3 &= 4p \\ \frac{3}{4} &= p \end{aligned}$$

$$y = \left(\frac{3}{4}\right)(2)^x$$



- b) Another coordinate which lies on the line is (k, 12). Find the value of k.

$$\begin{aligned} (x, y) \\ x &= k \\ y &= 12 \end{aligned}$$

$$\begin{aligned} 12 &= \frac{3}{4}(2)^x \\ \frac{12}{3/4} &= 2^x \quad \left| \frac{12 \div \frac{3}{4}}{1} = 2^x \right| \quad \left| \frac{48}{1} = 2^x \right| \quad \left| \frac{48}{2} = 2^x \right| \quad x=4 \\ \frac{12}{3/4} &= 2^x \quad \left| \frac{12 \times \frac{4}{3}}{1} = 2^x \right| \quad \left| \frac{48}{1} = 2^x \right| \quad \left| \frac{48}{2} = 2^x \right| \quad x=4 \end{aligned}$$