Chapelford Village Primary School

Learn · Achieve · Respect

Maths

Calculation Policy

Ratio and proportion

2024

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Year Six

https://www.ncetm.org.uk/media/bspfn3zj/ncetm_spine2_segment27_y6.pdf#page=4

I can describe the relationship between two factors

Using a bar model to support

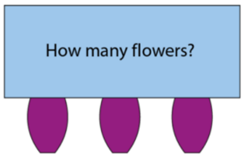
1. Linking with multiplication

'For every one vase, there are five flowers.'

number of vases: [ ]

number of flowers: [ ][ ][ ][ ][ ]

'If there are three vases, how many flowers are there?'



- *'For every one vase, there are five flowers.'*

  1 × **5** = 5

  number of vases: 1

  number of flowers: $\underbrace{1 \mid 1 \mid 1 \mid 1 \mid 1}_{5}$

- *'So for three vases, there are <u>fifteen</u> flowers.'*

  3 × **5** = 15

  number of vases: 3

  number of flowers: $\underbrace{3 \mid 3 \mid 3 \mid 3 \mid 3}_{15}$

- *'Three multiplied by five is equal to <u>fifteen</u>.'*
- *'<u>Fifteen</u> is five times the size of three.'*

2. Linking with division and fractions

'For every one vase, there are five flowers. If there are fifteen flowers, how many vases are there?'

- *'For every one vase, there are five flowers.'*
- *'For every five flowers, there is one vase.'*

$1 \times \mathbf{5} = 5 \quad 5 \div \mathbf{5} = 1 \quad 5 \times \frac{1}{5} = 1$

number of vases: $\boxed{1}$

number of flowers: $\underbrace{\boxed{1}\boxed{1}\boxed{1}\boxed{1}\boxed{1}}_{5}$

- *'So, for __three__ vases, there are fifteen flowers.'*
- *'For fifteen flowers, there are __three__ vases.'*

$3 \times \mathbf{5} = 15 \quad 15 \div \mathbf{5} = 3 \quad 15 \times \frac{1}{5} = 3$

number of vases: $\boxed{3}$

number of flowers: $\underbrace{\boxed{3}\boxed{3}\boxed{3}\boxed{3}\boxed{3}}_{15}$

- *'Three multiplied by five is equal to fifteen.'*
- *'Fifteen divided by five is equal to three.'*
- *'Fifteen multiplied by one-fifth is equal to three.'*
- *'Three is one-fifth times the size of fifteen.'*

3. Using appropriate language *'four every ____ _____, there are ____ ____'*

'For every ten grapes that Ralph eats, Lily eats one.'

number of grapes that Lily eats: $\boxed{}$

number of grapes that Ralph eats: $\boxed{}\boxed{}\boxed{}\boxed{}\boxed{}\boxed{}\boxed{}\boxed{}\boxed{}\boxed{}$

- *'Ralph eats ten times as many grapes as Lily.'*
- *'Lily eats one-tenth as many grapes as Ralph.'*
- *'For every one grape that Lily eats, Ralph eats ten'*
- *'For every ten grapes that Ralph eats, Lily eats one.'*

- *'If Ralph eats twenty grapes, how many does Lily eat?'*
- *'If Lily eats three grapes, how many does Ralph eat?'*

Number of grapes that Lily eats	Number of grapes that Ralph eats
1	10
?	20
3	?

I can use multiplication and division to calculate unknown values (two variables)

'Bijan has some marbles. For every five blue marbles, he has three red marbles. If Bijan has fifteen blue marbles, how many red marbles does he have? How many marbles does he have altogether?'

Method 1 – bar modelling:

- *'For every five blue marbles, there are three red marbles.'*

number of red marbles:					
number of blue marbles:					

- *'There are fifteen blue marbles.'*

number of red marbles:					
number of blue marbles:					

$\underbrace{\hspace{5em}}_{15}$

- *'Fifteen is divided into five units, so each unit has a value of <u>three</u>.'*

15 ÷ 5 = **3** (and 5 × **3** = 15)

number of red marbles:					
number of blue marbles:	3	3	3	3	3

$\underbrace{\hspace{5em}}_{15}$

- *'There are three units of red marbles and each unit has a value of <u>three</u>, so Bijan has nine red marbles.'*

3 × **3** = 9

$\overbrace{\hspace{3em}}^{9}$

number of red marbles:	3	3	3		
number of blue marbles:	3	3	3	3	3

$\underbrace{\hspace{5em}}_{15}$

- *'Bijan has twenty-four marbles altogether.'*

15 + 9 = 24

Method 2 – ratio grid:

- *'For every five blue marbles, there are three red marbles.'*

number of red marbles:	3	
number of blue marbles:	5	

- *'There are fifteen blue marbles.'*

number of red marbles:	3	
number of blue marbles:	5	15

- *'To get from five to fifteen, I must <u>multiply by three</u>.'*

5 × **3** = 15 (and 15 ÷ 5 = **3**)

number of red marbles:	3	
number of blue marbles:	5	15

$5 \xrightarrow{\times 3} 15$

- *'To get from three to the missing number, I must also <u>multiply by three</u>. Bijan has nine red marbles.'*

3 × **3** = 9

number of red marbles:	3	9
number of blue marbles:	5	15

$3 \xrightarrow{\times 3} 9$, $5 \xrightarrow{\times 3} 15$

- *'Bijan has twenty-four marbles altogether.'*

15 + 9 = 24

I can use a ratio grid for two variables

number of red beads	1	2	3	4	→ 5
number of blue beads	3	6	9	12	→ 15
total number of beads	**4**	**8**	**12**	**16**	→ **20**

× 5

- Use cubes to recreate the pattern shown.
- How many blue cubes are there for every red cube?

For every 1 red cube, there are 3 blue cubes.

- How many red cubes are there for every three blue cubes?

For every 3 blue cubes, there is 1 red cube.

- Is the relationship within the new representation the same or different? Why?
- How many cubes would be used altogether if there were 5 red cubes? Make it.

I can use multiplication and division to calculate unknown values (three variables)

Same as previous (https://www.ncetm.org.uk/media/bspfn3zj/ncetm_spine2_segment27_y6.pdf#page=4)

I can use a ratio grid for three variables

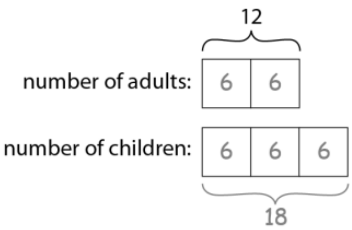
Same as previous (https://www.ncetm.org.uk/media/bspfn3zj/ncetm_spine2_segment27_y6.pdf#page=4)

I can use multiplication and division to calculate unknown values (two variables) where an absolute value is given

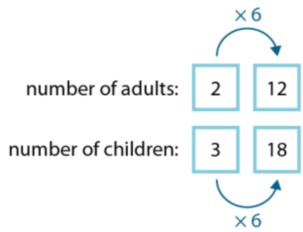
'Each team in a family quiz is made up of two adults and three children. If there are twelve adults in the competition:

- *how many children are there?*
- *how many people are there altogether (adults and children)?'*

Method 1 – bar modelling:



Method 2 – ratio grid:



Summary:

- *'There are eighteen children.'*

  12 ÷ 2 × 3 = 6 × 3 = 18

- *'There are thirty people altogether.'*

  18 + 12 = 30

Method 3 – ratio grid with division:

What do you need to make 1 smoothie?

	$\div 2$	
number of smoothies:	2	1
number of strawberries:	20	10
number of bananas:	1	$\frac{1}{2}$
amount of yoghurt (ml):	200	100

I can multiplication to solve correspondence problems

1. *'If Megan has one coat and one hat, how many different outfits can she make?'*

One possibility

2.

One coat, two hats:	One coat, three hats:
Coats: 1 	Coats: 1 
Hats: 2 	Hats: 3 
Combinations/outfits: 2 	Combinations/outfits: 3 
• *'For every one coat, there are two possible hats.'* • *'There is one coat, so there are two outfits.'* 1 × 2 = 2	• *'For every one coat, there are three possible hats.'* • *'There is one coat, so there are three outfits.'* 1 × 3 = 3

Summary table:

Number of coats	Number of hats	Combinations
1	1	1
1	2	2
1	3	3

1 x 1 = 1
1 x 2 = 2
1 x 3 = 3

Number of coats x number of hats

= number of outfits

3. Try different combinations eg) 2 coats, 3 hats

I can understand how and why scaling is used to make and interpret maps

1cm:2km

See guidance 3:1 on NCETM for more support

1. Using a map like the one provided and exploring/answering different questions
2. Apply to real-world maps and distances

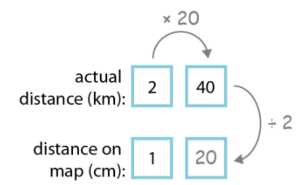
I can draw different scale lines

Eg: 1cm:4km
2cm:3km

I can draw a scaled map using centimetre squared paper

I can use multiplication and division to solve a range of scaling problems

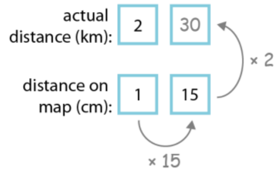
- *'Rocky Island is 40 km west of Sandy Island. What would this distance be on the map?'*



Reasoning 'horizontally'	Reasoning 'vertically'
• *'To get from two to forty, I must multiply by twenty.'* 2 × **20** = 40 (and 40 ÷ 2 = **20**) • *'To get from one to the missing number, I must also multiply by twenty.'* 1 × **20** = 20	• *'To get from two to one, I must divide by two.'* 2 ÷ **2** = 1 • *'To get from forty to the missing number, I must also divide by two.'* 40 ÷ **2** = 20

- *'On the map, Rocky Island would be 20 cm away from Sandy Island.'*

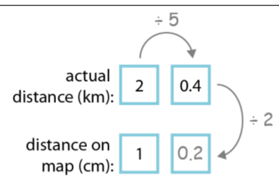
- *'What would 15 cm on the map represent in real life?'*



Reasoning 'horizontally'	Reasoning 'vertically'
• *'To get from one to fifteen, I must multiply by fifteen.'* 1 × **15** = 15 (and 15 ÷ 1 = **15**) • *'To get from two to the missing number, I must also multiply by fifteen.'* 2 × **15** = 30	• *'To get from one to two, I must multiply by two.'* 1 × **2** = 2 (and 2 ÷ 1 = **2**) • *'To get from fifteen to the missing number, I must also multiply by two.'* 15 × **2** = 30

- *'Fifteen centimetres on the map would represent thirty kilometres in real life.'*

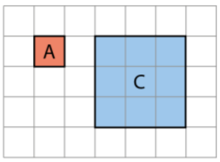
- *'There is a pond 0.4 km away from the camp. How far would this be on the map?'*



Reasoning 'horizontally'	Reasoning 'vertically'
• *'To get from two to zero-point-four, I must divide by five.'* 2 ÷ **5** = 0.4 • *'To get from one to the missing number, I must also divide by five.'* 1 ÷ **5** = 0.2	• *'To get from two to one, I must divide by two.'* 2 ÷ **2** = 1 • *'To get from zero-point-four to the missing number, I must also divide by two.'* 0.4 ÷ **2** = 0.2

- *'On the map, the pond would be 0.2 cm away from the camp.'*

I can identify and describe the relationship between two shapes using scale factors (square)



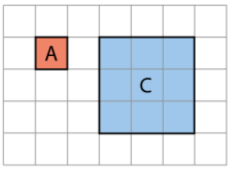
- *'To change shape A into shape C, scale the side-lengths by a scale factor of three.'*

  side-length of C = side-length of A × **3**

- *'To change shape C into shape A, scale the side-lengths by a scale factor of one-third.'*

  side-length of A = side-length of C × $\frac{1}{3}$

I can identify and describe the relationship between two shapes using scale factors and ratios (regular polygons)



- *'To change shape A into shape C, scale the side-lengths by a scale factor of three.'*
- *'The ratio of the dimensions of shape A to the dimensions of shape C is equal to <u>one-to-three</u>.'*
- *'We can write this as:'*

dimensions of A : dimensions of C = 1 : 3

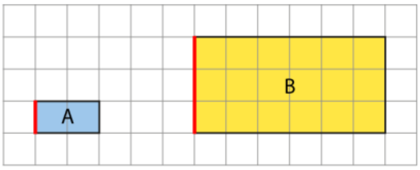
- *'To change shape C into shape A, scale the side-lengths by a scale factor of one third.'*
- *'The ratio of the dimensions of shape C to the dimensions of shape A is equal to <u>three-to-one</u>.'*
- *'We can write this as:'*

dimensions of C : dimensions of A = 3 : 1

I can identify and describe the relationship between two shapes using scale factors and ratios (irregular polygons)

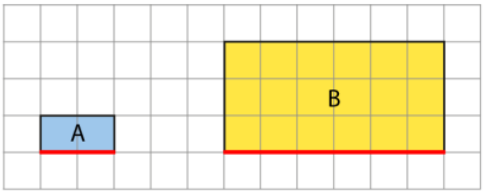
Example 1:

- Comparing the short sides (heights)



3 = 1 × **3**
height of B = height of A × **3**

- Comparing the long sides (widths)



6 = 2 × **3**
width of B = width of A × **3**

- Comparing rectangles A and B
  - *'The rectangles are similar because both side-lengths have been scaled by the same scale factor.'*
  - *'To change rectangle A into rectangle B, scale the dimensions by a scale factor of <u>three</u>.'*
  - *'The ratio of the dimensions of rectangle A to the dimensions of rectangle B is equal to one-to-three.'*

  dimensions of A : dimensions of B = 1 : 3

  - *'To change rectangle B into rectangle A, scale the dimensions by a scale factor of <u>one-third</u>.'*
  - *'The ratio of the dimensions of rectangle B to the dimensions of rectangle A is equal to three-to-one.'*

  dimensions of B : dimensions of A = 3 : 1