Contents

Challenging Maths

Contents

Introduction

This pack aims to support the teaching of the year 6 maths curriculum. It is organised into the six maths areas:

- Number

- Ratio and Proportion

- Algebra

- Measurement

- Geometry

- Statistics.

This pack is intended as a resource for the teacher to dip into as and when appropriate to support teaching and learning in the classroom, and all resources are accompanied by an answer sheet. Each area is supported by starter ideas, a selection of resources, taking it further suggestions to extend your children, and plenary ideas. Where possible, SAT style questions have also been included to help with revision. The pack is aimed at a mixed ability cohort but it is worth noting that some concepts and activities are designed to challenge your high achievers.

We hope you enjoy using this pack. If you have any questions, please get in touch: email support@teachitprimary.co.uk or call us on 01225 788851. Alternatively, you might like to give some feedback for other Teachit Primary members – you can do this by adding a comment on the Challenging Maths UKS2 page on Teachit Primary (please log in to access this).

Section 2: Ratio and proportion

Section 2: Ratio and proportion

Curriculum coverage

This section matches the requirements of the statutory guidance in the National Curriculum for maths as follows:

Year 6:

Pupils should be taught to:

- Solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts.

- Solve problems involving the calculation of percentage (for example, of measures, such as 15% of 360) and the use of percentages for comparison.

- Solve problems involving similar shapes where the scale factor is known or can be found.

- Solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.

Section 2: Ratio and proportion

Starters:

- **Sort the class!:** Your class makes the perfect visual introduction to ratio and proportion. Ask the children to group themselves according to a category, for example: boys and girls, skirts and trousers, siblings and no siblings, ways of travelling to school etc., and express as a ratio.

  For example, if exploring the ratio of boys and girls, you could generate the ratio14:16 which can then be simplified to 7:8.

- Using ratio to compare quantities (Resource 1): A fantastic PowerPoint which can be used as a starter or plenary. Questions are presented over two slides and follow a mastery approach. Can also be used as individual worksheets. Answers are displayed to allow for self-assessment.

Mains:

- Understanding scale factors (Resource 2): A helpful introduction to both finding the scale factor and enlarging a shape. Includes a detailed example of how to find each and opportunities for children to apply their skills and knowledge to new examples.

- Ratio code breaker (Resource 3): A fun resource to allow children to apply their knowledge of factors to simplify the ratios and crack the code!

Taking it further:

- **Ice cream problem:** Write up the following problem for the children to discuss and solve. Encourage them to show all workings out.

  Here are the ingredients for strawberry ice cream.

Strawberry ice cream recipe:	Question: George only has 300ml of cream to make strawberry ice cream. What weight of strawberries should he use?
• cream - 400ml • milk - 500ml • egg yolks - 4 • strawberries -120g • sugar - 100g	Answer: 90g, as he uses one quarter less of cream, so needs one quarter less of strawberries.

You can encourage more confident children to scale down all of the ingredients so that the new recipe will be:

Strawberry ice cream recipe:

- cream - 300ml
- milk - 375ml
- egg yolks - 3
- strawberries - 90g
- sugar - 75g

Plenary ideas:

- **Mental maths:** Strengthen mental maths skills by setting some 15 second type questions for children to respond to on their whiteboards. For example:

A. The scale on a map is one centimetre to five kilometres.

The distance between two houses is twenty kilometres. What is the distance between these two houses on the map?

Answer: 4cm

B. $\frac{1}{7} = \frac{\square}{21}$

Answer: $\frac{3}{21}$

C. 35% of 60

Answer: 21

D. 15% of £250

Answer: £37.50

E. 5% of 4200

Answer: 210

F. 70% of 80.

Answer: 56

Resource 1 – Using ratio to compare quantities

To download this PowerPoint, go to the following page:

Teachit Primary members:
https://www.teachitprimary.co.uk/challenging-maths-powerpoints

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Using ratio to compare quantities 1

Fluency

Tick the statements that are correct.

a. There are two burgers for every three fries.

b. The ratio of fries to burgers is 2:3

c. The ratio of fries to burgers is 3:2

d. There are three burgers for every two fries.

Problem solving

Complete the sentence.

There are _____ for every _____.

Reasoning

Burger Queen sells a number of set meals. A set meal contains two burgers and a portion of fries.

Burger Queen has an order for 10 set meals. They have 22 burgers and 8 portions of fries.
Is that enough to complete the order?
Explain your answer.

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Using ratio to compare quantities 1

Misconception

Burger Queen has a set menu containing three burgers and two fries.

Which of the following statements is correct?

a. If Burger Queen has 30 burgers they will need more than 25 fries.

b. If Burger Queen has 21 burgers they will need 14 portions of fries.

c. If Burger Queen has an order for 10 set meals they will need 10 burgers and 30 fries.

Explain your answer

Application

Burger Queen uses the following recipe to make four burgers.

1 egg
1 onion
1 clove of garlic
1 lb of ground beef

Burger Queen needs to make 20 burgers.

Calculate how much of each ingredient is needed to make 20 burgers.

Egg:

Onion:

Garlic:

Ground beef:

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Using ratio to compare quantities 2

Fluency

Write the ratio of burgers to fries.

a.

b.

Problem solving

Complete the sentence.

There are _____ for every _____.

Reasoning

Burger Queen sells a number of set meals. A set meal contains one burger and two portions of fries.

Burger Queen has an order for 10 set meals. They have 22 burgers and 18 portions of fries.
Is that enough to complete the order?
Explain your answer.

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Using ratio to compare quantities 2

Misconception

Burger Queen has a set menu containing three burgers and two fries.

Which of the following statements is correct?

a. If Burger Queen has 20 burgers they will need more than 20 fries.

b. If Burger Queen has 18 burgers they will need 12 portions of fries.

c. If Burger Queen has an order for 8 set meals they will need 11 burgers and 10 fries.

Explain your answer

Application

Burger Queen uses the following recipe to make four burgers.

1 egg
1 onion
1 clove of garlic
1 lb of ground beef

Burger Queen needs to make two burgers.

Calculate how much of each ingredient is needed to make two burgers.

Egg:

Onion:

Garlic:

Ground beef:

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Using ratio to compare quantities 3

Fluency

Write the ratio of circle beads to star beads.

a.

b.

Problem solving

Complete the sentence.

There are _____ for every _____.

Reasoning

Christy makes a necklace with circle and star beads. She makes a repeating pattern of 2 circles and 3 star beads.

If she has 14 circle beads and 25 star beads can she make a necklace without any being left over? Explain your answer.

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Using ratio to compare quantities 3

Misconception

Christy makes a necklace with a repeating pattern of two circle beads and five star beads.

Which of the following statements is correct?

1. If Christy uses 12 circle beads she will make more than 15 star beads

2. If Christy uses 12 circle beads she will use exactly 15 star beads

3. If Christy uses 12 circle beads she will make less than 15 star beads

Explain your answer

Application

Christy needs the following items to make one necklace:

5 circle beads
8 star beads
9 oval beads

She wants to make 30 necklaces for her friends.

How much of each item does she need?

Circle beads:

Star beads:

Oval beads:

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Using ratio to compare quantities 4

Fluency

Simplify fully the following ratios:

a) 6:4

b) 16:12

c) 9:15

d) 24:18

e) 24:66

f) 200:500

Problem solving

At a school, 560 students supported Bristol City, 490 Bristol Rovers and 140 Cardiff City.

Find the ratio of Bristol City to Bristol Rovers to Cardiff City supporters in school.

Reasoning

Christy makes a necklace with circle and star beads. She makes a repeating pattern of four circles and three star beads.

If she has 20 circle beads and 25 star beads how many necklaces can she make?

Will she have any leftover beads?

Using ratio to compare quantities 4

Misconception

Christy makes a necklace with a repeating pattern of three circle beads and two star beads.

Which of the following statements is correct?

1. If Christy uses 12 circle beads she will need more than 15 star beads

2. If Christy uses 12 circle beads she will use exactly 15 star beads

3. If Christy uses 12 circle beads she will need less than 15 star beads

Explain your answer

Application

Christy needs the following items to make ten necklaces:

90 circle beads
50 star beads
40 oval beads

She wants to make 1 necklace for her friend.

How much of each item does she need?

Circle beads:

Star beads:

Oval beads:

Using ratio to compare quantities 5

Fluency

Simplify fully the following ratios:

a) 2 : 4 : 10

b) 4 : 8 : 14

c) 10 : 20 : 25

d) 16 : 20 : 36

e) 7 : 28 : 77

f) 28 : 35 : 56

Problem solving

Divide £72 in the ratio 5 : 4

Reasoning

To make suet you need fat to flour in the ratio 1 : 3

Jane has 180g of flour and 60g of fat.

Does she have enough fat so there is no leftover flour? Explain your answer.

Using ratio to compare quantities 5

Misconception

Christy makes a necklace with a repeating pattern of four circle beads and two star beads.

Which of the following statements is correct?

1. If Christy uses 12 circle beads she will need more than 15 star beads

2. If Christy uses 12 circle beads she will use exactly 15 star beads

3. If Christy uses 12 circle beads she will need less than 15 star beads

Explain your answer

Application

To make a fruit crumble you need one part butter to two parts sugar to nine parts mixed fruit. The weight of the sugar is 120g.

Find the weight of

a) Butter needed

b) Mixed fruit

c) All the ingredients

Name: .... Date: ....

Resource 2 – Finding a scale factor and centre of enlargement

When looking at enlargements you need a **scale factor** and a **centre of enlargement**.

Be clear which is the original shape (object) and which is the enlarged shape (image) – don't confuse the two!

Points to consider:

- For it to be an enlargement, the shapes must look the same.

- Find the scale factor by comparing the lengths of the same sides.

- Find the centre of enlargement by drawing straight lines through similar points and seeing where they cross.

- Try with at least three different lengths and points to check for errors.

Example 1

Shape P has been enlarged to give shape Q.

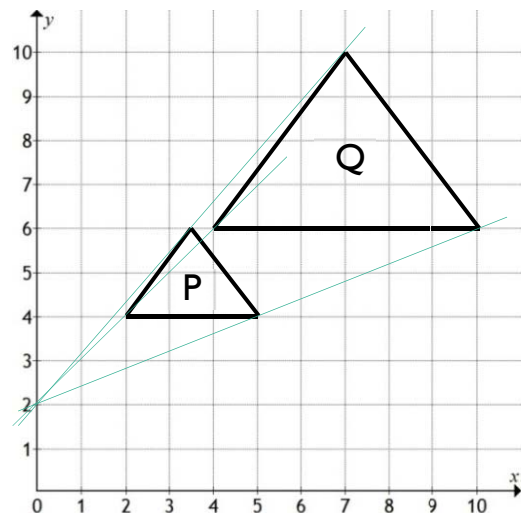Find the scale factor and centre of enlargement.

You should notice:

The base and height of shape Q are twice that of shape P.

The lines through three sets of similar points cross at (0, 2)

Answer:

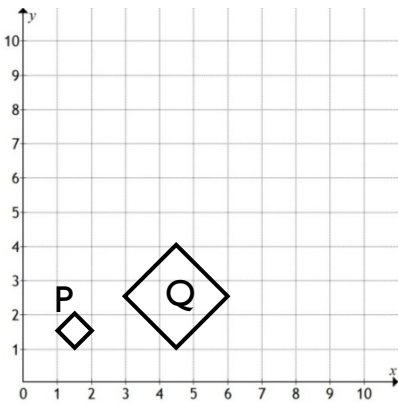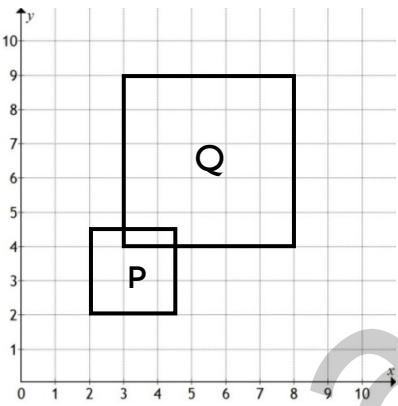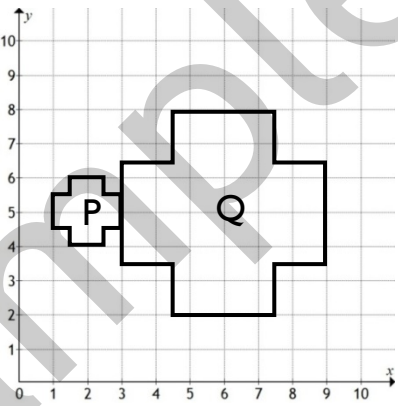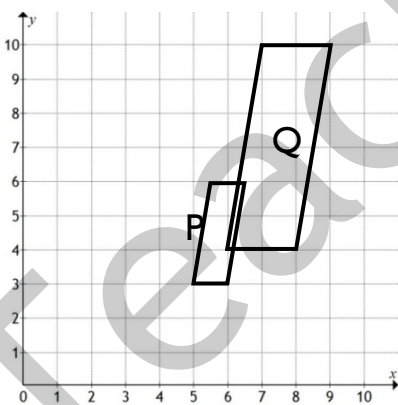P has been enlarged by scale factor 2, centre of enlargement (0, 2)
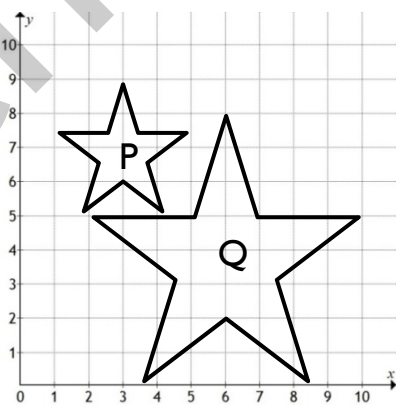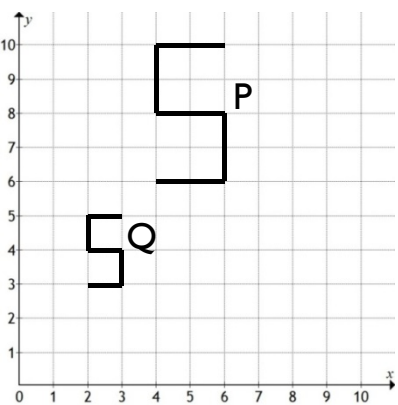
Name: .... Date: ....

Resource 2 – Finding a scale factor and centre of enlargement

In each diagram, shape P has been enlarged to give shape Q. Find the scale factor and centre of enlargement for each.

a. scale factor .... centre of .... enlargement	b. scale factor .... centre of .... enlargement	c. scale factor .... centre of .... enlargement

d. scale factor .... centre of .... enlargement	e. scale factor .... centre of .... enlargement	f. scale factor .... centre of .... enlargement

Name: .... Date: ....

Resource 2 – Enlarging a shape by a given scale factor and centre of enlargement

When looking at enlargements you need a **scale factor** and a **centre of enlargement**.

Be clear which is the original shape (object) and which is the enlarged shape (image) – don't confuse the two!

Points to consider:

- Diagrams must always be drawn with a sharp pencil, and straight lines must be drawn with a ruler.

- Leave your construction lines visible as part of your answer.

- Some questions will tell you how to label your image:

  - 'Enlarge shape P and label the image Q.'

- If you are not told how to label your image, use the same letter(s) as the object followed by an apostrophe:

  - the image of A is labelled A'
 - the image of triangle ABC is labelled A'B'C'.

Example 1

Enlarge shape A by scale factor 2, centre of enlargement (0, 0).

You should:

1. Plot the centre of enlargement.

2. Draw a line from the centre of enlargement to one corner of the shape. Extend this line beyond the shape until it is **twice** as long (as we are using **scale factor 2**).

3. Repeat for two other corners on the shape.

4. Join up the corners to create the image and label it as **A'**.

5. Check your work by comparing the lengths of the sides. Is the height of the new shape twice the height of the original? Are the angles unchanged?
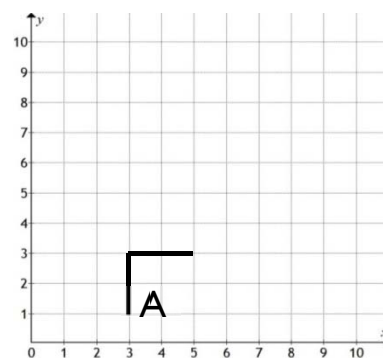
Answer:

Resource 2 – Finding a scale factor and centre of enlargement

Name: ....   Date: ....

Resource 2 – Enlarging a shape by a given scale factor and centre of enlargement

a. Use centre of enlargement (0, 0) and scale factor 2 to enlarge square ABCD.	b. Enlarge shape H using centre of enlargement (0, 5) and scale factor 2.	c. Use centre of enlargement (0, 2) to enlarge the letter M by a scale factor of 3. Label the image as P.

d. Use centre of enlargement (2, 0) and scale factor 3 to enlarge arrow Q, to give image R.	e. Use centre of enlargement (0, 4) and scale factor 3 to enlarge triangle ABC.	f. Use centre of enlargement (2, 2) to enlarge hexagon T by a scale factor ½.

Resource 2 – Answers

Finding a scale factor and centre of enlargement:

a.   scale factor: **3**

   centre of enlargement: **(0, 1)**

b.   scale factor: **2**

   centre of enlargement: **(1, 0)**

c.   scale factor: **3**

   centre of enlargement: (0, 5)

d.   scale factor: **2**

   centre of enlargement: (4, 2)

e.   scale factor: **2**

   centre of enlargement: **(0, 10)**

f.   scale factor: **½**

   centre of enlargement: **(0, 0)**

Enlarging a shape by a given scale factor and centre of enlargement:

a.

b.

c.

d.
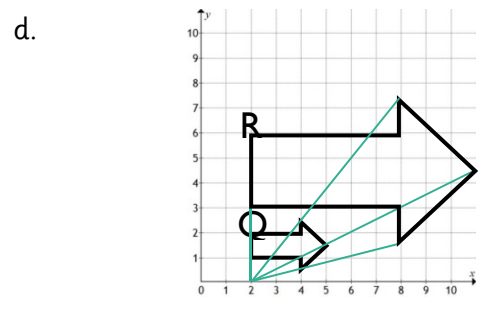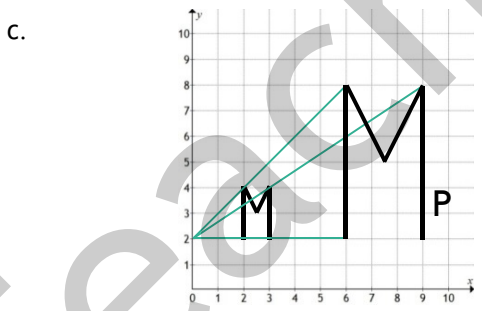
e.

f.
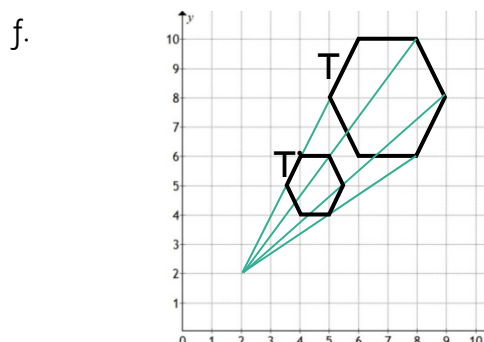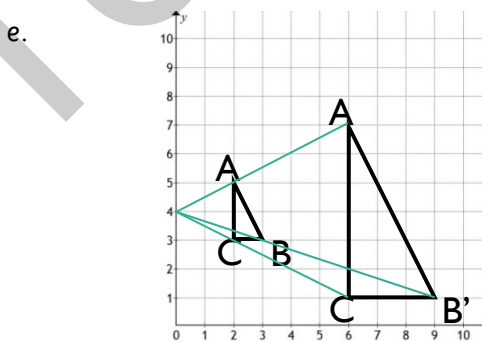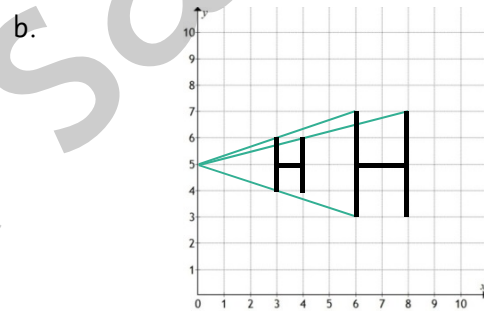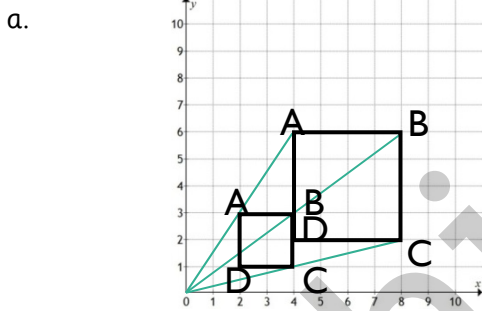
Name: .... Date:..

Resource 3 – Ratio code breaker

Find the highest common factor of the numbers in each ratio to find the ratio in its simplest form.

A	8 : 10	
B	24 : 3	
C	21 : 9	
D	6 : 16	
E	12 : 20	
I	4 : 6	
J	14 : 7	
K	30 : 3	
L	4 : 36	

M	21 : 15	
N	5 : 15	
O	6 : 12	
P	12 : 28	
R	18 : 3	
S	40 : 24	
T	8 : 6	
U	15 : 10	
Y	25 : 35	

Swap each simplified ratio in the code for its corresponding number to give the names of four singers.

.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2 : 1	3 : 2	5 : 3	4 : 3	2 : 3	1 : 3	4 : 3	2 : 3	7 : 5	8 : 1
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3 : 5	6 : 1	1 : 9	4 : 5	10 : 1	3 : 5	7 : 5	4 : 5	3 : 8	1 : 2
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1 : 3	1 : 3	4 : 5	8 : 1	1 : 2	8 : 1	7 : 5	4 : 5	6 : 1	1 : 9
	.....	.....	.....	.....	.....	.....	.....	
	3 : 5	5 : 7	3 : 7	6 : 1	2 : 3	1 : 3	7 : 3	3 : 5	

Who are the four singers?

Resource 3 – Answers

A	8 : 10	4 : 5	M	21 : 15	7 : 5
B	24 : 3	8 : 1	N	5 : 15	1 : 3
C	21 : 9	7 : 3	O	6 : 12	1 : 2
D	6 : 16	3 : 8	P	12 : 28	3 : 7
E	12 : 20	3 : 5	R	18 : 3	6 : 1
I	4 : 6	2 : 3	S	40 : 24	5 : 3
J	14 : 7	2 : 1	T	8 : 6	4 : 3
K	30 : 3	10 : 1	U	15 : 10	3 : 2
L	4 : 36	1 : 9	Y	25 : 35	5 : 7

J	U	S	T	I	N	T	I	M	B
2 : 1	3 : 2	5 : 3	4 : 3	2 : 3	1 : 3	4 : 3	2 : 3	7 : 5	8 : 1
E	R	L	A	K	E	M	A	D	O
3 : 5	6 : 1	1 : 9	4 : 5	10 : 1	3 : 5	7 : 5	4 : 5	3 : 8	1 : 2
N	N	A	B	O	B	M	A	R	L
1 : 3	1 : 3	4 : 5	8 : 1	1 : 2	8 : 1	7 : 5	4 : 5	6 : 1	1 : 9
E	Y	P	R	I	N	C	E		
3 : 5	5 : 7	3 : 7	6 : 1	2 : 3	1 : 3	7 : 3	3 : 5		

Justin Timberlake
Madonna
Bob Marley
Prince