

π future: maThs π
infinite wisdom

Whole Number and Fractions

π maThs E1 E2 E3 π

π maThs Level 1 & 2 π

1 : 6

06 . Ratio and Scales

Course Content: Choose your topic ...

MATHS E3 to L2

Whole Number and Functions



place value



negative numbers



add and subtract



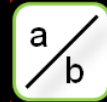
multiply divide



round numbers



ratio scale



fraction



decimal numbers

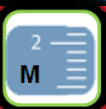


percent



percent decimal fraction

Parts of a whole



metric measure



imperial measure



perimeter



area



volume



formulae bodmas

Measure and Shape



charts data



averages



probability

Handling Data

Topic Introduction : Ratios and Scale



Ratios and Scale

Ratios allow you to relate quantities to each other. If you do something to one value then the same happens to the other the same number of times. This topic involves lots of multiplying and dividing as it often involves finding a value that relates the two quantities together and finding this amount usually starts by dividing.

This topic has many uses and other maths topics are combined with it. This can make this topic one to concentrate hard on, finding the relationships between seemingly separate topics that are in fact the same thing expressed differently.

Choose an icon to select where to start



Warm Up Exercises 1

1:6



1	x	9	=	
2	x	9	=	
3	x	9	=	
4	x	9	=	
5	x	9	=	
6	x	9	=	
7	x	9	=	
8	x	9	=	
9	x	9	=	
10	x	9	=	

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

Lets start today by revising ! Complete the above sums and multiplication grid



Warm up Exercises 2

Do-talk-record



Rounding

L1/L2

A

140,000 items were shipped on a container. This value is a rounded figure. The actual number of items that were shipped could have been...

L1

- A) 137,500 because....
- B) 135,000 because....
- C) 145,000 because....

L2

- A) 135,454 because....
- B) 144,912 because....
- C) 150K because....



Warm Up Exercises 3

Do-talk-record



Rounding

L1/L2

B

A shopping bill totals £135.55. This value could be rounded....

L1

- A) to £100 to nearest hundred because
 B) to £140 to nearest ten because
 C) to £200 to nearest hundred because

L2

- A) £135.60 because
 B) £136.00 because
 C) £130.00 because

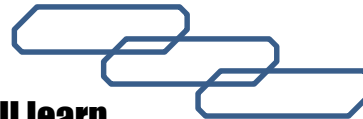


Progress Checker 1

What do you already know about ratios and scale ?

How would you rate your skills in using ratios and scale ?

- 1) Excellent ability
- 2) Good ability, but working to improve
- 3) Ok, making a start but I know I have lots to still learn



My aims for today **are...**

A To read and write quantities in ratio form

B Change ratio values to equivalent or simplest forms, keeping proportions correct

C Use ratios to solve problems, including splitting values up



1:10,000





Introductory Video and Discussion

What is the difference between 'ratio', 'scale' and 'proportion' ?

What is the 'Golden ratio' and what uses are there for it ?

Why does a map scale always start with a 1 eg. 1:25,000 ?

Are fractions and ratios just the same thing written differently ?

Can you relate more than two quantities together in ratio form ?

How are ratios used in mixtures ?













Watch the introductory video and then discuss the above

Your thoughts..



Vocabulary and Jobs

- Ratio** 
- Proportion** 
- Scale** 
- Enlarge/Enlargement** 
- Reduce/Reduction** 
- Equivalent** 
- Simplest form** 
- Golden ratio** 
- Mixture** 
- Composite** 

- Chef
- Hair dresser
- Architect
- Driver
- Currency Exchange
- Child Care
- Shareholders
- Building/Construction... Can you think of more?

These are the words you will be using in this topic





Lesson: Concept Activity

Draw Big Ben Clock Tower

Draw an 'Enlarged image' of the same picture

Draw a 'reduced sized image' of the same picture

- 1) Measure the size of the images
- 2) Can you find how much bigger and smaller the other images are to the original ??

A0

A1

A2

A3

A4

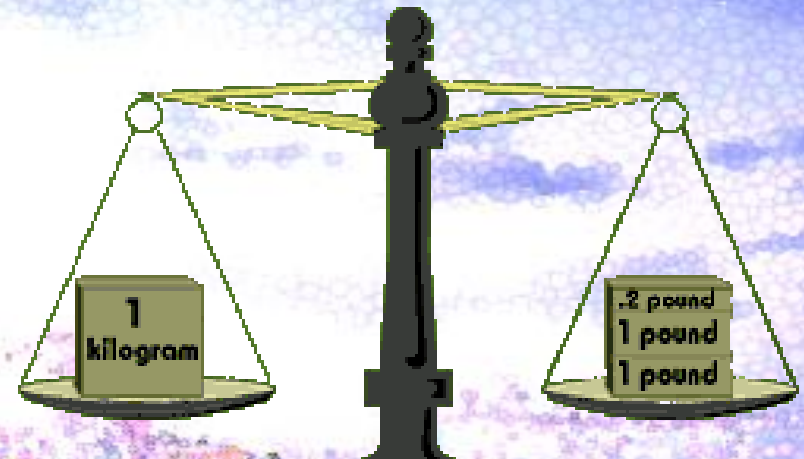




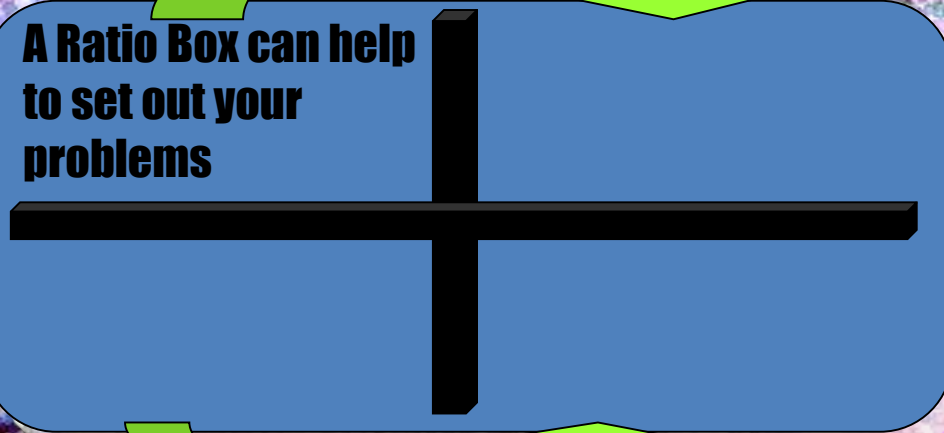
Lesson: Main Teach

A Ratio is a balancing of two values against each other.

When one value changes (gets larger or smaller by a number of times) the other value also changes by the same amount of times.



A Ratio Box can help to set out your problems



A	B
k A	k B
3	5
7 3	7 5
21	35

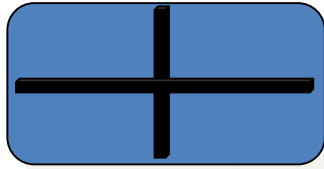


Lesson: Main Teach

Writing Ratios: an example..... "I have 10kg of sand and 15kg of cement"

1) To write a ratio find the two units that relate to each other
Eg Sand and Cement

2) Set up a box, writing the two units above the two columns
Eg Sand Cement



3) Place any original values that you know about the units (before they change) at the bottom of the box
Eg Sand Cement



(Setting up this box is a very good check that the values you are using are 'ORIGINAL' unchanged amounts)

4) Place a colon between the two values....from left to right this ratio now reads 10 kg : 15 kg
This is a ratio that means you for every 10kg of sand you need 15kg of cement.

IMPORTANT !! RATIOS ARE ALWAYS READ FROM LEFT TO RIGHT





Lesson: Main Teach

Changing Amounts: an example..... "A ticket costs £6. How many tickets can I buy for £24 ?"

- 1) Find the two units that relate to each other
Eg Tickets and Pounds
- 2) Set up a box, writing the two units above the two columns
Eg Tickets Pounds



- 3) Write the ORIGINAL values at the bottom in the correct columns, write any new CHANGED amounts above.
Eg Tickets Pounds



- 4) Find out by how much one of the values has changed by DIVIDING the NEW by the ORIGINAL



Ratio Change Formula: **Scale Factor** = New / Original

Eg $24 / 6 = 4$

(this means the cost of the tickets is 4 times larger)

- 5) MULTIPLY the other value by this scaling factor to find the other new value

Eg $1 \times 4 = 4$



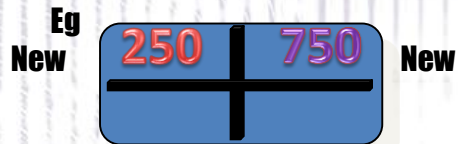
6) The answer is ... "you can buy 4 tickets (for £24)"



Lesson: Main Teach

Equivalent Ratios: an example..... “Simplify 250mm : 750mm”

- 1) Set up a box, writing the two values at the TOP



- 2) Find a ‘FACTOR’ of both numbers and divide them both by this factor

(reminder: the word ‘Factor’ means a number that another number can be divided by, eg 6 is a factor of 12 because 12 can be divided by 6)



New simplified ratio is 25 : 75.....this can continue to 5 : 15, then 1 : 3

- 3) Continue to find factors of the two numbers and dividing them both each time until one of the values becomes a PRIME number, the number ONE or both numbers can no longer be divided by a same value.



Now watch the tutor video





Lesson: Try out

Block 1 : Watch tutor led demo (in class or on video)

- Try these,
- 1) Write "five people have ten pounds" as a ratio
 - 2) Write "picture width is 10cm and length 30cm" as a ratio
 - 3) Write "three companies have £1M" as a ratio
 - 4) Write "five pounds is worth seven dollars" as a ratio
 - 5) Write "one and a half hours per movie" as a ratio
 - 6) Write "an equal share between two" as a ratio !!

Block 2 : Watch tutor led demo (in class or on video)

- Try these,
- 7) Use a ratio of 1 : 2 to increase £600
 - 8) Use a ratio of 3 : 2 to decrease 150g
 - 9) Use a ratio of 10 : 7 to decrease 1000ml
 - 10) Write a ratio that increases a score from 60% to 70%

Find the missing values 11)

10	
5	20

12)

9	
18	6

13)

1	20
4	

14)

12	240
	20

Block 3 : Watch tutor led demo (in class or on video)

- Try these,
- 15) Simplify 8 : 10 to its lowest terms
 - 16) Reduce to its simplest form 20 : 5
 - 17) Simplify 10% : 15%
 - 18) Make a 1 : ?? ratio from... 0.2 : 3
 - 19) Share £400 in a ratio 3 : 1
 - 20) $\frac{1}{3} : 2$ can be come 1 : ??
 - 21) A map scale is 1 : 400,000, how far is 6cm on the map?



Lesson: Websites and links

Ratio Fruit Machine practice, hold and nudge ratios to score points

<http://www.mymaths.co.uk/samples/sampleGameFruitRatio.swf>

Divide numbers up into their factors to help practice find simplified ratios

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=64>

Blast equivalent ratios in this fun game

http://www.mathplayground.com/ASB_RatioBlaster.html

Motor bike race while practicing equivalent ratios

<http://www.arcademics.com/games/ratio-stadium/ratio-stadium.html>

Bitesize website video and ratio instructions, examples and visuals

<http://www.bbc.co.uk/schools/gcsebitesize/maths/number/ratiosact.shtml>

Variety of word problems with visuals and guidance on solving

http://www.thinkingblocks.com/ThinkingBlocks_Ratios/TB_Ratio_Main.html

BBC bitesize website's help with methods, activities and practice

<http://www.bbc.co.uk/bitesize/ks3/maths/number/ratio/revision/4/>

Wiki's simple guide to the basics of ratios, stating methods and video instruction

<http://www.wikihow.com/Calculate-Ratios>

Examples of splitting up values into ratios

http://www.mathsteacher.com.au/year10/ch17_variation/03_dividing/25div.htm



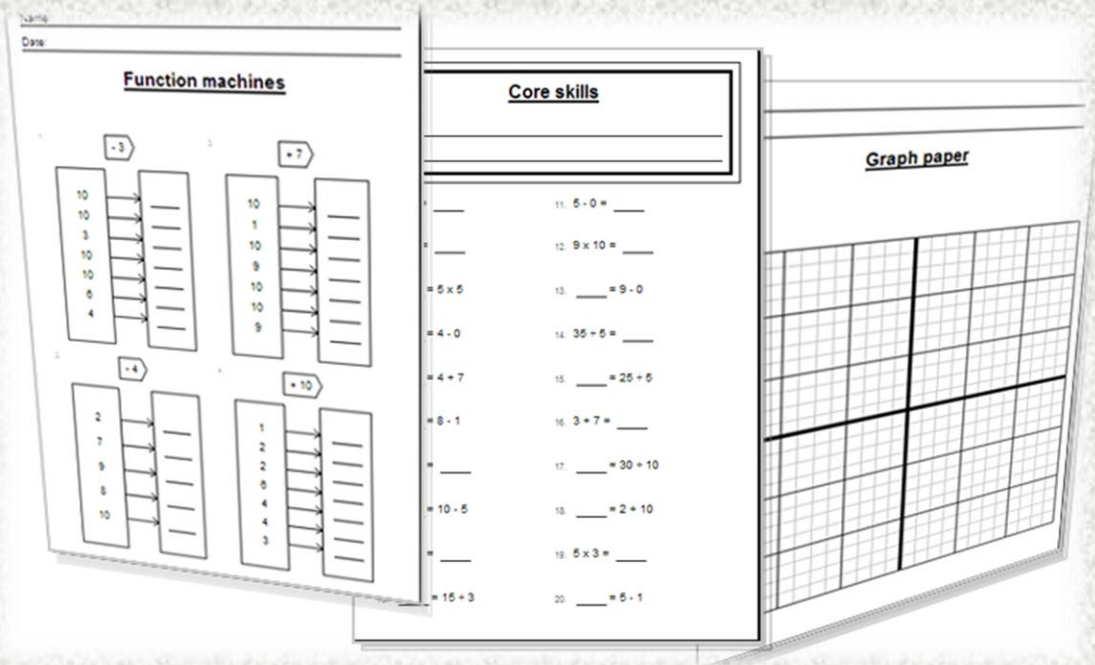
Try a variety of written practice

Worksheets

Workbooks

Practice Exam Papers

Maths Problems





Lesson: Practice – just the numbers

A Write what each ratio means

Eg: 1:2 means x2 bigger

- 1) 1:3
- 2) 1:5
- 3) 4:1
- 4) 11:1
- 5) 2:8
- 6) 7:1
- 7) 10:1
- 8) 1:50
- 9) 2:100
- 10) 15:5

B Write what each ratio means

Eg: 1:2 means x2 bigger

- 11) 3:2
- 12) 3:9
- 13) 10:2
- 14) 60:40
- 15) $\frac{1}{2}$:4
- 16) 50%:25%
- 17) 0.3:0.03

C Simplify these ratios

Eg: 3:6 = 1:3

- 18) 4:2
- 19) 16:8
- 20) 18:6
- 21) 10:100
- 22) 4:20
- 23) 63:9
- 24) 7:56

D Simplify these ratios

Eg: 3:6 = 1:3

- 25) 45:9
- 26) 300:15
- 27) 1K:500
- 28) 80%:15%
- 29) $\frac{1}{5}$: $\frac{4}{5}$
- 30) £3M:£2K
- 31) 2cm:50mm
- 32) 240:80

E Increase or decrease the values shown using the ratio given

Eg: £400 by 1:3 = £400 x3 = £1200

- 33) 2 by 1:10 =
- 34) 9 by 1:5 =
- 35) 10 by 1:4 =
- 36) 25 by 5:1 =
- 37) 18 by 3:1 =
- 38) 16 by 2:3 =
- 39) 30 by 6:5 =
- 40) 19 by 1:6 =
- 41) 40 by 4:2 =
- 42) 300 by 15:1 =
- 43) £2.50 by 5:6 =
- 44) 20 miles by 10:15 =

F Split these values up in the given ratios

Eg: 200g, 1:2:2 (1+2+2=5 parts so 200g/5=40g) 40:80:80

- 45) £300, 1:3:5 =
- 46) 500, 2:1:2 =
- 47) 600m 40:20 =



Lesson: Practice – word problems

Q1 A boxer wins one in three of his fights. In his career he has 60 professional fights. How many does he win?

Q2 To place a pic on Facebook I need to reduce its memory size in a 4 : 1 ratio. The original pic has 2MB (two million bytes of memory). What is the memory size of the reduced pic ?

Q3 A TV has a screen 'Aspect Ratio' of 4 : 9. If the actual length of the screen is 45cm, how tall is it ?



Q4 A map scale is 1 : 60,000. A distance measured on a map is 3cm. How far is the real distance ?

Q5 Sales of shoes to clothes in a shop are at 2 : 7. If one million pairs of shoes are sold, how many items of clothing are sold?

Q6 A mixture for a drink is made with concentrate 1 part and water 5 parts. I want to make three litres of drink. How much water do I need. Clue..1000ml is 1 litre

Q7 Two companies make the following losses during the year. What is the ratio of losses between company A and B in its simplest terms ?

Company A - £ 24

Company B - £ 6



Lesson: Practice – Making it Functional



Answer the questions relating to this picture, on the next page



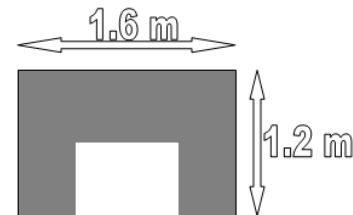
Lesson: Practice – Making it Functional

1. The width of a chair in the garden is 1 metre. Measure the chair in the drawing and work out a scale for the drawing.

2. Using your scale work out how long the actual length of the bed is.

3. How long is the actual length of the garden?

4. Draw a BBQ onto the drawing in the garden that has the following actual dimensions...





TOPIC ANSWERS

Just the sums

A

- 1) Three times bigger
- 2) Five times bigger
- 3) Four times smaller
- 4) Eleven times smaller
- 5) Four times bigger
- 6) Seven times smaller
- 7) Ten times smaller
- 8) Fifty times bigger
- 9) Fifty times bigger
- 10) Three times smaller

B

- 11) One third smaller
- 12) Three times bigger
- 13) Five times smaller
- 14) One third smaller
- 15) Eight times bigger
- 16) Half times smaller
- 17) Ten times smaller

C

- 18) 2 : 1
- 19) 2 : 1
- 20) 3 : 1
- 21) 1 : 10
- 22) 1 : 5
- 23) 7 : 1
- 24) 1 : 8

D

- 25) 5 : 1
- 26) 20 : 1
- 27) 2 : 1
- 28) 16 : 3
- 29) 1 : 4
- 30) 1500 : 1
- 31) 2 : 5
- 32) 3 : 1

E

- 33) 20
- 34) 45
- 35) 40

E cont.

- 36) 5
- 37) 6
- 38) 24
- 39) 25
- 40) 114
- 41) 20
- 42) 20
- 43) £3
- 44) 30 miles

F

- 45) £33 : £99 : £166
- 46) 200 : 100 : 200
- 47) 400m : 200m

Word Problems

- Q1 boxer wins 20 fights
- Q2 500kb memory, (500,000)
- Q3 20 cm tall
- Q4 180,000cm which is 1800m or 1.8 km
- Q5 3.5M

Word Problems cont.

- Q6 2.5 litres of water (which is 5/6 of 3 litres)
- Q7 4 : 1

Functional Skills Q's

- 1 Your answer will be around 2cm wide for the chair if you view it on a laptop screen or print on A4 paper so... 1m = 2cm, or the map scale is 1cm = 50cm, 1:50 (or thereabouts)
- 2 The ben in the picture is 5cm long on an A4 sheet of paper, so.... using 1:50, 5cm x 50 = 250cm long (which is 2.5m long)
- 3 The garden is 20cm long on A4, so using the scale 1:50 again, 20cm x 50 = 1000cm (or 10m)
- 4 The BBQ is 1.6m an 1.2m so using the scale 1:50 you need to draw them x50 smaller. 1.6m / 50 = 3.2cm long and 1.2m / 50 = 2.4cm wide

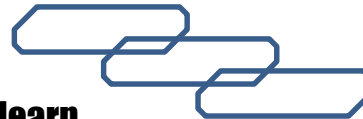


Progress Checker 2

What do you now know about ratios and scale ?

How would you now rate your skills in using ratios and scale ?

- 1) Excellent ability
- 2) Good ability, but still working to improve
- 3) Ok, made a start but I know I have lots to still learn



My aims for today **were...**

A To read and write quantities in ratio form

B Change ratio values to equivalent or simplest forms, keeping proportions correct

C Use ratios to solve problems, including splitting values up



1:10,000





Continuing to Study and Learn

What else can you do to help yourself to learn and practice? Here are ten suggestions, record which you do each week and also record your progress.

Internet websites

Repeat the lesson, make notes, organise a folder, revise

Own maths workbook

Study together with a friend or family member

Finish activities in this book

Complete class handouts or tasks

Practice exams / past papers

Use maths skills learnt at home or at work in real situations

Play games

Experiment yourself, try new things ask yourself questions



Try making a graph of number of practice methods you use against your progress score in each topic. Are you showing more practice gives better results?