

Maths

Level – L2

Type of Pack: Taster/Introduction



Name:



**Prison
Education**

 HM Prison &
Probation Service

INTRODUCTION

Hello...

We hope you find this **Taster/Introduction Pack** easy to follow and interesting whilst in Lockdown.

This pack contains a variety of activities that you may see when starting on the course.

These activities should be easy to follow but where there are questions, we would encourage you to have a go without looking at the answers to see how you get on.

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- Place Value
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- Sharing Quantities in a Given Ratio
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- Performing calculations with time
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Revision - Functional Skills Maths Level 2

Number (25 marks)

Fractions
Decimals
Percentages
Ratio
Drawing a Table
Substitute into formula
Reverse calculation

Shape Space and Measure (25 marks)

Interpret scale drawing
Convert metric / Imperial measurements
Area
Perimeter
Volume
Checking a scale line

Handling Data (25 marks)

Mean, Median, Mode
Range
Percentage/Probability
Drawing and reading:
Bar charts, Line graphs,
Scatter graph and pie chart
Reverse Calculations

Creating a table

Reminder - you can use wording in the question for your heading.

A table looks like this do not draw a bar graph.

Name	Amount made
Ross	£200
Tom	£300
Sarah	£100
Neve	£50

A table will be drawn on blank paper NOT on graph paper

FRACTIONS, DECIMALS, AND PERCENTAGES

1
5

$$1 \div 5$$

0.20

$$0.2 \times 100$$

20%

Finding a fraction of an amount

Divide by the bottom

Times by the top

$$\frac{2}{5} \text{ of } 500 \quad 500 \div 5 = 100$$

$$100 \times 2 = 200$$

Alternative method

Divide the numerator by the denominator and times by the whole number

$$2 \div 5 \times 500 = 200$$

Finding a percentage of an amount

Divide by 100 to find 1%

Times by the percentage needed
35% of 500
 $500 \div 100 \times 35 = 175$

Finding a ratio of an amount

Convert to a fraction then calculate as a fraction of amount.

Share 300 into the ratio 2:1

$$\frac{2}{3} \text{ of } 300 \quad \text{and} \quad \frac{1}{3} \text{ of } 300$$

Check you calculations

Original calculation = $25 \times 3 = 125$

Reverse calculation = $125 \div 3 = 25$

Check your scale (task 2)

The scale was 2 boxes = 1m.

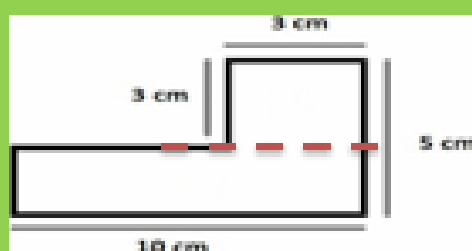
So line A is 4 boxes = 2m

Check the range on task 3

Original calculation = $12 - 1 = 11$

Reverse calculation = $11 + 1 = 12$

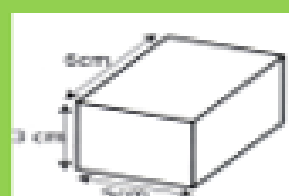
Area and Perimeter



Remember to split the shape into two then work out each area and add them together.
 $3 \times 3 = 9\text{cm}^2$ $10 \times 2 = 20\text{cm}^2$
Total area is 29cm^2

Perimeter is the length around the edge
 $3 + 5 + 10 + 2 + 7 + 3 = 30\text{cm}$

Volume



To find the volume:

Work out the area of one face and then multiply the answer by the remaining measurement.
 $L \times W = 3 \times 5 = 15\text{ cm}$
 $15 \times 6 = 90\text{cm}^3$

Metric Conversions

Convert all your units so they are the same.

cm	→	m	+ 100
m	→	cm	X 100
m	→	km	+ 1000
km	→	m	X 1000
mm	→	m	+ 1000
m	→	mm	X 1000
mm	→	cm	+ 10
cm	→	mm	X 10

5 people tried and rated blueberry and cherry muffins

Cherry	Blueberry	Rating (scale of 10- 1) <i>10 = loved it 1 = didn't like it</i>
✓	✓	10
✓	x	8
✓	✓	9
x	✓	8
✓	✓	0

Mean and Range

Mean = find the total and divide by how many numbers there are:

What is the mean rating?

$$10 + 8 + 9 + 8 + 0 = 32$$

$$32 \div 5 = 6.4$$

Choose the mean because it includes all the data

Range = Highest - Lowest

What is the range of ratings?

$$10 - 0 = 10$$

What does the range show?

High range shows a lot of variability in the scores

Probability/Percentage

What is the probability that someone tried both muffins?

$$\text{Likely} = 3/5 = 60\%$$

What % of people gave a score of 9 or more?

$$\frac{2}{5} \times 100 = 40\%$$

What % of people tried a cherry muffin?

$$\frac{3}{5} \times 100 = 60\%$$

$$\frac{3}{5} \times 100 = 60\%$$

Median

The middle number once in order

0, 8, 8, 9, 10 = median = 8

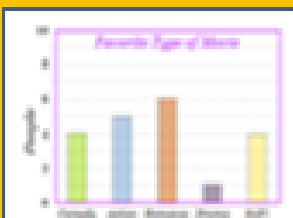
If there are 2 middle numbers add them together and divide by 2

Median excludes extreme values

Mode

Number which occurs the most often 0, 8, 8, 9, 10

Mode is 8 (you could also have more than 1 mode)



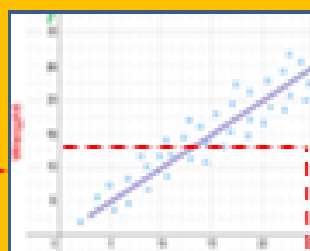
Charts and graphs

If you are given a choice always draw a bar chart.

Remember to include all your labels include the Y axis

Scatter graphs usually require a line of best fit through the middle of the points. Use the line of best fit to make predictions.

Use proportions for numbers not shown on the graph. If 100 = 50 then 200 = 100 etc.



Pie charts

Find the total

$$3 + 5 + 4 = 12$$

Divide each number by the total and x 360

$$\text{Apple} = 3 \div 12 \times 360 = 90$$

$$\text{Banana} = 5 \div 12 \times 360 = 150$$

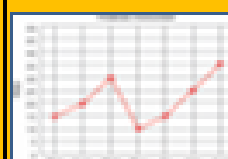
$$\text{Pear} = 4 \div 12 \times 360 = 120$$

apple	3
banana	5
pear	4



Line Graphs

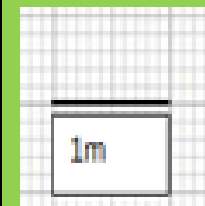
Join the points to show changes over time.



Interpreting scale

Try and remember to figure out what each small box is worth on the diagram.

Divide the whole number by how many tiny boxes there are:



In this example there are 10 small squares to 1 m.

$$1 \div 10 = 0.1 \text{ each small box is } 0.1\text{m}$$

On occasion you may see the scale 1:10

If no units are given this means each number has the same unit. In this case it could be 1cm:10cm meaning 1 cm on the plan is the same as 10cm in real life.

Solving problems with shape

A wall measures 4m by 2.5m

How many pictures measuring 50cm by 75cm fit on the wall? = 25

Convert your units

Tiles measure 0.5m by 0.75m

Then divide

$$4 \div 0.75 = 5 \text{ (length by length)}$$

$$2.5 \div 0.5 = 5 \text{ (width by width)}$$

Then multiply $5 \times 5 = 25$

FS Maths Exams – Hints and Tips

- hour-controlled assessment
- 3 sections (number, shape space and measure and handling data)
- Answer section 3 first then section 1 (each answer attracts more points and therefore you can increase the points you achieve) . Leave the middle section until last (less points)
- Always check your calculations – choose a simple one stage calculation and just check one sum:

$$1 + 3 = 4$$

$$4 - 3 = 1$$

** Remember for section 2 you need to state the scale and then apply it. Such as the scale was 2 boxes = 1m so 7m was 14 boxes.

- **Label everything** – if you can't use the scale draw something and label it
- If you haven't got a clue how to answer a question always make an attempt at an answer so you can carry on with the rest of the questions - you can still get follow on marks.
- Tables are **only** drawn on blank paper
- Bar charts are **only** drawn on graph paper

Place value

You might find it useful to look at a place value chart to help you understand place value:

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
4	2	3	4	1	9	8

Here you have the number 4 million 2 hundred and thirty four thousand 1 hundred and ninety eight.

In numbers this would be: 4,234, 198

It is important to know the values of numbers up to millions.

Example: What is 4.2 Million written in numbers?

4, 200,000 (** top tip - be careful that your comma's do not look like decimal points).

Can you write the following amounts in numbers:

1. Thirty eight thousand, four hundred -
2. Two hundred and four thousand -
3. Eighty-nine thousand four hundred and four -.....
4. Nineteen thousand nine hundred and ninety nine -.....
5. Nine hundred and nine thousand six hundred and one -.....
6. Seventy thousand, two hundred and eighty -.....

Answers – Place Value

1. Thirty eight thousand, four hundred = 38,400
2. Two hundred and four thousand = 204,000
3. Eighty-nine thousand four hundred and four = 89,404
4. Nineteen thousand nine hundred and ninety nine = 19,999
5. Nine hundred and nine thousand six hundred and one = 909601
6. Seventy thousand, two hundred and eighty =70,280

Rounding to 2 decimal places

Remember that 2 decimal places means 2 numbers after the decimal point.

Example: 354.678657 - Here the 7 is in the second decimal place.

When rounding , you look at the 3rd digit after the decimal point

Rounding - if the 3rd digit place is 5 or higher , you round up otherwise , you leave it as the two decimal places.

Example 354.678657 – rounded = 354.68

Example 312.68324 – rounded = 312.68

Try rounding each of these numbers to 2 decimal places:

Original Number	Rounded Number to 2 decimal places
67.89765	
3.4567	
2897.54322	
23.8998	
25678.93300	
345.8765	
3.567	
3.457	
9.896	
4.675	
2.7654	
2345.456	
99.8676	

Answers – Rounding to 2 decimal places

Original Number	Rounded Number to 2 decimal places
67.89765	67.90
3.4567	3.46
2897.54322	2897.54
23.8998	23.90
25678.93300	25678.93
345.8765	345.88
3.567	3.57
3.457	3.46
9.896	9.90
4.675	4.68
2.7654	2.77
2345.456	2345.46
99.8676	99.87

BIDMAS

Work out the answer to the following calculation:

$$5 + 7 \times 3 - 6 \div 2 + 4 =$$

Did you get one of the following numbers ? **27, 19, 14, 37, 35**

The correct answer is 27.

If you got this, well done, you did the calculation in the correct order. If you got any of the other answers you need some practice.

You can see, from the above example, that there are various different answers depending on which way round you do the calculation. It is important that there is only one answer and so there is a specific way round that you must perform calculations.

Remember:

Brackets	(any brackets should be done 1 st)
Indices	(next any powers) (See lesson 2 for help)
Division	} (next any \div or \times)
Multiplication	
Add	} (finally just work from Left to Right doing +
Subtract	

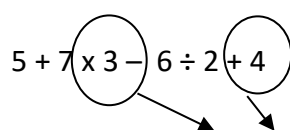
This is often just referred to as “**BIDMAS**” and is the “order of operation”.

All calculations should be done in the order described above. i.e. deal with any brackets first, then any powers. Multiply and divide should be done next (from left to right) then, once you are left with just add and subtract, work from left to right.

Let’s look at the original calculation again:

$$5 + 7 \times 3 - 6 \div 2 + 4$$

There are no brackets or powers, so move onto divide and multiply:



Now we have: $5 + 21 - 3 + 4$

We have done everything else so now we can just go from left to right performing the add and subtract: $5 + 21 - 3 + 4 = \underline{\underline{27}}$

A quick reminder about powers:

A power tells you to multiply a number **by itself** a certain number of times.

e.g.	$3^2 =$	$3 \times 3 =$	9	(n.b. this is <u>not</u> 3×2)
	$3^3 =$	$3 \times 3 \times 3 =$	27	
	$2^4 =$	$2 \times 2 \times 2 \times 2 =$	16	
	$2^5 =$	$2 \times 2 \times 2 \times 2 \times 2 =$	32	

Examples of using BIDMAS:

- Calculate $7 - (3 + 2) \times 8$

Brackets: $7 - \underbrace{5 \times 8}$

\times or \div $7 - 40$

$+$ or $-$ $\underline{\underline{-33}}$ (left to right)

- Calculate $5 \times (7 - 4) + 3^2 - 2$

Brackets: $5 \times 3 + 3^2 - 2$

↓

Indices: $5 \times 3 + 9 - 2$

X or ÷ $15 + 9 - 2$

+ or - $\equiv \underline{\underline{22}}$ (left to right)

- Calculate $16 + (5 - 2)^2 \times 2$

Brackets: $16 + 3^2 \times 2$

Indices: $16 + 9 \times 2$

X or ÷ $16 + 18$

+ or - $\equiv \underline{\underline{34}}$ (left to right)

BIDMAS Practice

Question	Answer
$7 + 4 \times 3 - 8$	
$5 + 27 \div 9 - 6$	
$22 - 12 \div 4 - 5$	
$5 \times (8 - 6) + 3 \times 12$	
$6 \times 5 + 15 \times 3$	
$3 \times 15 + 28 \div 7$	
$3 \times 3 - 2^2$	
$(15 \div 5) + 3^3 \times 5 + 2$	
$27 - 3 \times 9$	
$(7 - 3) \times (4 + 1) - 12$	
$5 \times (8 - 3) - 7 \times 0$	
$42 \times 8 - 8 \times 42$	

Answers – BIDMAS

Question	Answer
$7 + 4 \times 3 - 8$	11
$5 + 27 \div 9 - 6$	2
$22 - 12 \div 4 - 5$	14
$5 \times (8 - 6) + 3 \times 12$	46
$6 \times 5 + 15 \times 3$	75
$3 \times 15 + 28 \div 7$	49
$3 \times 3 - 2^2$	5
$(15 \div 5) + 3^3 \times 5 + 2$	140
$27 - 3 \times 9$	0
$(7 - 3) \times (4 + 1) - 12$	8
$5 \times (8 - 3) - 7 \times 0$	25
$42 \times 8 - 8 \times 42$	0

Substitute into Formula

Examples:

In the following examples we will use 3 formulae:

Area of rectangle = $l \times w$ (l = length, w = width)

Area of circle = πr^2 ($\pi = 3.14$, r = radius)

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

- Find the area of a rectangle with length 7cm and width 5cm.

Choose correct formula:

Replace l with 7 and w with 5:

Calculation

Area = $l \times w$

Area = 7×5

Area = **35cm²**.

- Find the area of a circle with radius 4cm.

Choose correct formula: $\text{Area} = \pi r^2$ (this means $\pi \times r \times r$).
 Replace π with 3.14 & r with 4: $\text{Area} = 3.14 \times 4 \times 4$
 Calculation: $\text{Area} = \underline{50.24\text{cm}^2}$.

- Find the volume of a sphere with radius 3cm.

Choose correct formula: $\text{Volume} = \frac{4}{3}\pi r^3$ (this means $\frac{4}{3} \times \pi \times r \times r \times r$).
 Replace π with 3.14 & r with 3: $\text{Volume} = \frac{4}{3} \times 3.14 \times 3 \times 3 \times 3$
 Calculation: $\text{Volume} = \underline{113.04\text{cm}^3}$.

Substitute into Formula Practice

Area of triangle: $A = \frac{1}{2} \times \text{base} \times \text{height}$

Circumference of circle: $C = \pi d$ (where d = diameter)

Area of circle: $A = \pi r^2$ (where r = radius).

Volume of cylinder: $V = \pi r^2 h$ (where r = radius, h = height).

Volume of a cone: $V = \frac{1}{3}\pi r^2 h$

Use the formulae given above to work out the following:

(Remember $\pi \approx 3.14$, and the diameter is double the radius)

- Find the circumference of a circle with a diameter of 15cm.
- Find the area of a triangle with a base of 8m and a height of 15m.
- Find the area of a circle with a **diameter** of 10cm.
- Find the volume of a cylinder with a height of 20m and a radius of 4m.
- Find the volume of a cone with radius 5m and height of 12m.
- Find the volume of a cone with a height of 6m and radius of 4m

Answers – Substituting into formula

- a) Find the circumference of a circle with a diameter of 15cm.
 $3.14 \times 15 = 47.1$
- b) Find the area of a triangle with a base of 8m and a height of 15m.
 $8 \times 15 / 2 = 60\text{m}^2$
- c) Find the area of a circle with a **diameter** of 10cm.
 $3.14 \times 5 \times 5 = 78.5\text{cm}^2$
- d) Find the volume of a cylinder with a height of 20m and a radius of 4m.
 $3.14 \times 4 \times 4 \times 20 = 1004.8\text{m}^3$
- e) Find the volume of a cone with radius 5m and height of 12m.
 $3.14 \times 5 \times 5 \times 12 / 3 = 314\text{m}^3$
- f) Find the volume of a cone with a height of 6m and radius of 4m
 $3.14 \times 4 \times 4 \times 6 / 3 = 100.48\text{m}^3$

Calculating fractions of amounts

To find a fraction of an amount you need to divide the whole number by the bottom of the fraction and then multiply this answer by the top number in the fraction.

Top Tip 'Divide by the bottom multiply by the top'

Example:

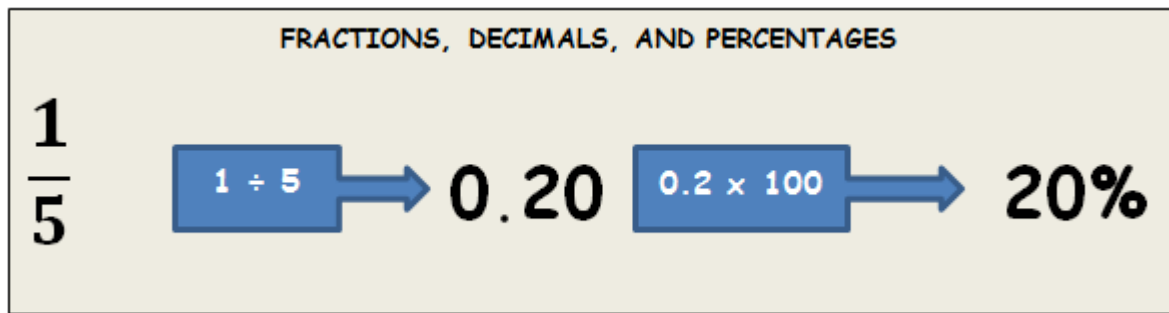
What is $\frac{2}{3}$ of 30? $30 \div 3 \times 2 = 20$

Try these questions make sure you show your workings out		
Question	Working	Answer
$\frac{2}{9}$ of 50		
$\frac{1}{9}$ of 248		
$\frac{2}{7}$ of 80		
$\frac{3}{5}$ of 125		
$\frac{7}{8}$ of 448		
$\frac{3}{4}$ of 884		
$\frac{2}{9}$ of 121		
$\frac{5}{16}$ of 423		
$\frac{7}{11}$ of 431		
$\frac{2}{3}$ of 789		

Answers – Calculating fractions of amounts

Try these questions make sure you show your workings out		
Question	Working	Answer
$\frac{2}{9}$ of 50	$50 \div 9 \times 2 =$	11.11
$\frac{1}{9}$ of 248	$248 \div 9 \times 1 =$	27.56
$\frac{2}{7}$ of 80	$80 \div 7 \times 2 =$	22.86
$\frac{3}{5}$ of 125	$125 \div 5 \times 3 =$	75
$\frac{7}{8}$ of 448	$448 \div 8 \times 7 =$	392
$\frac{3}{4}$ of 884	$884 \div 4 \times 3 =$	663
$\frac{2}{9}$ of 121	$121 \div 9 \times 2 =$	26.89
$\frac{5}{16}$ of 423	$423 \div 16 \times 5 =$	132.19
$\frac{7}{11}$ of 431	$431 \div 11 \times 7 =$	274.27
$\frac{2}{3}$ of 789	$789 \div 3 \times 2 =$	526

Converting between fractions and percentages



Reminder: 20% means 20 out of 100 so to write 20% as a fraction you just write: $\frac{20}{100}$

1. What is:

- a. $\frac{1}{4}$ as a decimal =
- b. $\frac{3}{4}$ as a decimal =
- c. $\frac{3}{5}$ as a decimal =

2. What is:

- a. 80% as a fraction =
- b. 35% as a fraction =

3. What is:

- a. $\frac{3}{10}$ as a percentage =
- b. $\frac{4}{5}$ as a percentage =
- c. $\frac{11}{20}$ as a percentage =
- d. $12/40$ as a percentage =

4. A bag of sweets has 30 sweets, 18 are toffees the rest are chocolates:

- a. how many are chocolates =
- b. what fraction are toffees =

Answers – Converting between fractions and percentages

1. What is:

- a. $\frac{1}{4}$ as a decimal $1 \div 4 = \mathbf{0.25}$
- b. $\frac{3}{4}$ as a decimal $3 \div 4 = \mathbf{0.75}$
- c. $\frac{3}{5}$ as a decimal $3 \div 5 = \mathbf{0.6}$

2. What is:

- a. 80% as a fraction $8/100 = \mathbf{8/10}$
- b. 35% as a fraction $35/100 = \mathbf{7/20}$

3. What is:

- a. $\frac{3}{10}$ as a percentage $3 \div 10 \times 100 = \mathbf{30\%}$
- b. $\frac{4}{5}$ as a percentage $4 \div 5 \times 100 = \mathbf{80\%}$
- c. $\frac{11}{20}$ as a percentage $11 \div 20 \times 100 = \mathbf{55\%}$
- d. $12/40$ as a percentage $12 \div 40 \times 100 = \mathbf{30\%}$

4. A bag of sweets has 30 sweets, 18 are toffees the rest are chocolates:

- a. how many are chocolates $30 - 18 = \mathbf{12}$
- b. what fraction are toffees $= \mathbf{18/30}$

Percentage of an amount

To calculate a % you need to divide by 100 then x by whatever % you need.

For example: 65% of 350 = $350 \div 100 \times 65 = 227.5$

- | | |
|-----------------|-----------------|
| 1. 13% of 500= | 2. 12% of 800= |
| 3. 23% of 600= | 4. 26% of 700= |
| 5. 28% of 900= | 6. 24% of 1400= |
| 7. 32% of 800= | 8. 38% of 1300= |
| 9. 31% of 300 = | 10. 35% of 600= |

Answers – Percentage of an amount

- | | |
|----------------------------|-----------------------------|
| 1. 13% of 500 = 65 | 2. 12% of 800 = 96 |
| 3. 23% of 600 = 138 | 4. 26% of 700 = 182 |
| 5. 28% of 900 = 252 | 6. 24% of 1400 = 336 |
| 7. 32% of 800 = 256 | 8. 38% of 1300 = 494 |
| 9. 31% of 300 = 93 | 10. 35% of 600 = 210 |

Written questions

- 1) In a school of 260 children, 50% are girls.
How many girls are there?
At the same school, 10% of children leave for a school trip.
How many pupils go on the trip?

- 2) A man bought a TV for £300.
He had to pay a deposit of 10%.
How much did he pay?

- 3) A box contains 500 apples.
20% are rotten.
How many apples are

- 4) A test has a total of 80 marks.
To pass, you need at least 40%.
How many marks do you need to pass?

Answers – Written questions

- 1) In a school of 260 children, 50% are girls. How many girls are there? = **130**
At the same school, 10% of children leave for a school trip.
How many pupils go on the trip? = **26**
- 2) A man bought a TV for £300. He had to pay a deposit of 10%.
How much did he pay? **£30**
- 3) A box contains 500 apples. 20% are rotten.
How many apples are rotten? = **100**
- 4) A test has a total of 80 marks. To pass, you need at least 40%.
How many marks do you need to pass? = **32 marks**

Percentage increase and decrease

Percentage increase

You are paid £120 a week.

You get a pay rise of 2%.

What is your new weekly income?

Find 2% = $120 \times 2\%$ (£2.40)

Then add it on to the original amount

$£120 + £2.40 = £122.40$

Percentage decrease

A dress costs £35.00, the shop has a 30% off sale.

What is new price?

Find 30% = $35 \times 30\%$ (10.50)

Then take it away from the original amount

$£35.00 - £10.50 = £24.50$

Try to answer these questions

Increased by 150% =

Increased by 20% =

Decreased by 12% =

Increased by 12.7% =

£420

Decreased by 50% =

Answers – Percentage increase and decrease

Increased by 150% =

£1050

Increased by 20% =

£504

Increased by 12.7% =

£473.34

Decreased by 12% =

£369.60

Decreased by 50% =

£210

Percentage increase and decrease problems

<p>Your wages increase by 11%. They used to be £10 p/h What is your new wage?</p>	
<p>Your new football boots are reduced by 17% in the sale. They used to cost £35. What is the new price?</p>	
<p>Claire improves her further distance for running by 19%. She used to be able to run 4km. How far can she run now?</p>	
<p>Ben loses 36% of his Instagram followers. He used to have 380. How many does he have now?</p>	

<p>One Directions album is reduced in a sale by 11%.</p> <p>It used to cost £10</p> <p>What is the new price?</p>	
<p>Sarah average kills per game on MW3 is 16.</p> <p>She improves and kills increased by 65%.</p> <p>What is her new kills per game score?</p>	
<p>Michael gets 42% better at push ups.</p> <p>He used to be able to do 32.</p> <p>How many can he do now?</p>	
<p>Red bull has 94% more sugar than Coke Life.</p> <p>Coke Life has 1.2g of sugar.</p> <p>How much g of sugar does Red Bull have?</p>	

Answers – Percentage increase and decrease problems

<p>Your wages increase by 11%.</p> <p>They used to be £10 p/h</p> <p>What is your new wage?</p>	<p>11% of £10 = £1.10</p> <p>£10.00 + £1.10 =</p> <p>£11.10 per hour</p>
<p>Your new football boots are reduced by 17% in the sale.</p> <p>They used to cost £35.</p> <p>What is the new price?</p>	<p>17% of 35 = £5.95</p> <p>£35 – 5.95 = £29.05</p> <p>New price is £29.05</p>
<p>Claire improves her further distance for running by 19%.</p> <p>She used to be able to run 4km.</p> <p>How far can she run now?</p>	<p>19% of 4 = 0.76</p> <p>4 + 0.76 = 4.76</p> <p>She can run 4.76km</p>
<p>Ben loses 36% of his Instagram followers.</p> <p>He used to have 380.</p> <p>How many does he have now?</p>	<p>36% of 380 = 136.8</p> <p>380 – 136.8 = 243.2</p> <p>He now has 243 followers</p>
<p>One Directions album is reduced in a sale by 11%.</p> <p>It used to cost £10</p> <p>What is the new price?</p>	<p>11% of £10 = £1.10</p> <p>£10.00 - £1.10 =</p> <p>£8.90</p>
<p>Sarah average kills per game on MW3 is 16.</p> <p>She improves and kills increased by 65%.</p> <p>What is her new kills per game score?</p>	<p>65% of 16 is 10.4</p> <p>16 + 10.4 = 26.4</p> <p>Her new average KPG is 26.4</p> <p>(keep the decimals for averages)</p>
<p>Michael gets 42% better at push ups.</p> <p>He used to be able to do 32.</p> <p>How many can he do now?</p>	<p>42% of 32 = 13.44</p> <p>32 + 13.44 = 45.44</p> <p>Now he can do 45 kick ups</p>
<p>Red bull has 94% more sugar than Coke Life.</p> <p>Coke Life has 1.2g of sugar.</p> <p>How much g of sugar does Red Bull have?</p>	<p>94% of 1.2 is 1.128</p> <p>1.2 + 1.128 = 2.328</p> <p>Red Bull has 2.328 grams of sugar</p>

Percentage change

$$\text{Percentage Change} = \frac{\text{Difference}}{\text{Original Amount}} \times 100$$

Claire does a paper round and gets paid £4.75 an hour.

Next year she will get a pay rise and receive £4.88 an hour.

What is her pay increase as a percentage?

$$\begin{aligned} \text{Percentage Change} &= \frac{4.88 - 4.75}{4.75} \times 100 \\ &= 2.74\% \text{ (2 decimal places)} \end{aligned}$$

Claire will get a 2.74% pay rise.

Calculate the percentage change for the following

Old Amount	New Amount	Percentage change
63	97	
38	45	
88	39	
94	107	
82	79	

In each of the following situations, calculate the percentage change:

- 1) Monthly train tickets are going to increase from £379 to £425=
- 2) A newspaper sold 37566 copies in April and 35369 in May=
- 3) A shop made £1189 one week and £1299 the next week=
- 4) A politician received 156,846 votes in 2005 and 147360 votes in the 2010 election=

Answers – Percentage change

Old Amount	New Amount	Percentage Change
63	97	$34/63 \times 100 = 53.97\%$
38	45	$7/38 \times 100 = 18.42\%$
88	39	$49/88 \times 100 = 55.68\%$
94	107	$13/94 \times 100 = 12.83\%$
82	79	$3/82 \times 100 = 3.66\%$

- 1) $46/379 \times 100 = 12.14\%$
- 2) $2197/37566 \times 100 = 5.85\%$
- 3) $110/1189 \times 100 = 9.25\%$
- 4) $9486/156,846 \times 100 = 6.05\%$

More written Questions on Percentage Changes

1. In a storm 144 fruit trees were left standing out of 180 fruit trees in an orchard.
What is the percentage decrease in the number of trees?
2. A javelin thrower has best throw of 60m. In the next competition he throws 72m.
What is the percentage increase of his personal best?
3. A wine manufacturer puts down 250 bottles for 3 years. After 3 years only 220 bottles are in tact.
What is the percentage decrease in the number of bottles?
4. A man weighs 65Kg. After two weeks on a diet he weighs 58Kg.
What is his percentage decrease in weight?
5. A board 130 cm long is trimmed to 104 cm.
What percentage has been removed?
6. A piece of elastic 48 cm long is stretched to 60 cm.
What percentage of the original length is the increase?
7. There are now 29 girls in a class that originally had 25 girls in it.
What is the percentage increase in the number of girls in the class?
8. After an accident, there are 222 litres of water left in a tank which originally held 240 litres.
What is the percentage loss of water?

Answers – More written Questions on Percentage Changes

- 1) $180 - 144 = 36$ $36 \div 180 \times 100 = \mathbf{20\%}$
- 2) $72 - 60 = 12$ $12 \div 60 \times 100 = \mathbf{20\%}$
- 3) $250 - 220 = 30$ $30 \div 250 \times 100 = \mathbf{12\%}$
- 4) $65 - 58 = 7$ $7 \div 65 \times 100 = \mathbf{10.77\%}$
- 5) $130 - 104 = 26$ $26 \div 130 \times 100 = \mathbf{20\%}$
- 6) $60 - 48 = 12$ $12 \div 48 \times 100 = \mathbf{25\%}$
- 7) $29 - 25 = 4$ $4 \div 25 \times 100 = \mathbf{16\%}$
- 8) $240 - 222 = 18$ $18 \div 240 \times 100 = \mathbf{7.5\%}$

Sharing Quantities in a Given Ratio

Sometimes you are asked to share a quantity (e.g. an amount of money) in a given ratio.

To do this:

Find the total number of parts needed

Divide by the total number of parts to find the size of 1 part

Multiply each number in the ratio by the value of 1 part.

Examples:

- Split £140 in the ratio 3:4

Total number of parts needed: $3+4 = 7$

Divide the money into 7 equal parts: $140 \div 7 = £20$

Now we know each part is worth £20

The original ratio is 3:4

$$3 \times 20 = £60$$

$$4 \times 20 = £80$$

The 2 amounts of money are: £60 and £80 (check these add to the original £140)

Another example:

Divide £16 in the ratio 3 : 5

Step 1 Add up the ratio numbers

$$3 + 5 = 8$$

Step 2 Divide the amount by this number

$$16 \div 8 = 2$$

Step 3 Multiply by the ratio numbers

$$3 \times 2 = 6$$

$$5 \times 2 = 10$$

Step 4 Check your answers add to the original amount.

$$10 + 6 = 16$$

Try these examples

Divide £24 into the ratio 1 : 3 _____ : _____

Divide 800ml into the ratio 3 : 7. _____ : _____

1. A businessman records his total mileage in one year.
Here are the results: **Business mileage: 7,200 Private mileage: 10,800**
What is the ratio of his business mileage to his private mileage?
2. A total of 1600 people work for a company.
The ratio of male to female employees is 3:5.
How many more females than males are there in the company?
3. A florist feeds her flowers with 6 drops of fertiliser to every 400ml of water.
How many drops of fertiliser are needed for 1.8 litres of water?
4. A union representative collects information on the name, gender, age and wages of employees.
The factory employs 469 men and 231 women.
What is the approximate ratio of men to women employees?
5. A chain of garages sells 2 478 cars one year.
1980 of these are new cars.
Which of these is the closest estimate of the ratio of new cars to used cars?
A. 4 : 5 B. 5 : 4 C. 4 : 1 D. 1 : 4
6. A school collected £140 for charity.
It was decided to divide the money between Dr Barnados and the RSPCA in the ratio 4 : 3.
How much did each charity receive?

Answers – Sharing Quantities in a Given Ratio

Divide £24 into the ratio 1 : 3 = **6 : 18**

$$1 + 3 = 4 \quad 24 \div 4 = 6 \quad 6 \times 1 = 6 \quad 6 \times 3 = 18$$

Divide 800ml into the ratio 3 : 7 = **240ml : 560ml**

$$3 + 7 = 10 \quad 800 \div 10 = 80 \quad 80 \times 3 = 240\text{ml} \quad 80 \times 7 = 560\text{ml}$$

- What is the ratio of his business mileage to his private mileage?
 $7200:10,800 = 72:108 = 36:54 = 18:27 = \mathbf{2:3}$
- How many more females than males are there in the company? **600:1000**
 $3+5 = 8 \quad 1600 \div 8 = 200 \quad 200 \times 3 = 600 \quad 200 \times 5 = 1000$
- How many drops of fertiliser are needed for 1.8 litres of water?
 $1.8\text{l} = 1800\text{ml} \quad 400 \times 4.5 = 1800 \quad 6 \times 4.5 = \mathbf{27 \text{ drops}}$
- What is the approximate ratio of men to women employees?
 $470:230 = \mathbf{47:23}$
- Which of these is the closest estimate of the ratio of new cars to used cars?
C 4 : 1
 $1980:498 = 2000:500 = 20:5 = 4:1$
- How much did each charity receive? **£80: £60**
 $4+3 = 7 \quad 140 \div 7 = £20 \quad 20 \times 4 = £80 \quad £20 \times 3 = £60$

Reverse Calculations - Top Tip 'Checking your calculations'

Example: a subtraction $452 - 197 = 255$

Can be checked, like this (inverse):

$$255 + 197 = 452$$

Check these subtractions by doing an inverse operation on them. Which are wrong?

- $56 - 27 = 39$
- $53 - 29 = 34$
- $67 - 35 = 32$
- $123 - 45 = 72$

Example - division $1288 \div 56 = 23$

Can be checked with a multiplication (inverse)

$$56 \times 23 = 1288$$

Check these divisions by doing the inverse operation on them. Which are wrong?

- $208 \div 8 = 26$
- $3393 \div 39 = 77$
- $1736 \div 31 = 56$
- $824 \div 8 = 113$

Write down the inverse calculation needed to check the answers.

1. Nigel has a piece of wood measuring 2.4 metres long. If he cuts off 90cm, what length of wood is left?
2. Neema buys 12 oranges for £2.76. How much does each orange cost?
3. 27 people pay £148.50 in total to go on a day trip. How much does each person pay?

Answers – Reverse Calculations

Check these subtractions by doing an inverse operation on them. Which are wrong?

- a) incorrect $39 + 27 = 66$
- b) incorrect $34 + 29 = 63$
- c) correct $32 + 35 = 67$
- d) incorrect $72 + 45 = 117$

Check these divisions by doing the inverse operation on them. Which are wrong?

- a) correct $26 \times 8 = 208$
- b) incorrect $77 \times 39 = 3003$
- c) correct $56 \times 31 = 1736$
- d) incorrect $113 \times 8 = 904$

Write down the inverse calculation needed to check the answers.

1. $2.4 - 0.9 = 1.5$ check $1.5 + 0.9 = 2.4$
2. $2.76 / 12 = 0.23$ check $= 0.23 \times 12 = £2.76$
3. $£148.50 / 27 = 5.5$ check $5.5 \times 27 = £148.50$

Performing calculations with time

You need to know that: 1.3 hours is not 1 hour and 30 minutes.

1.5 hours is 1 hour and 30 minutes.

Because $0.5 \times 60 = 30$

So 1.3 hours = 1 hour 18 minutes (0.3×60)

Try these:

Time in hours	Time in hours and minutes	Time in minutes
1.4	1 hour and 24 minutes	84 minutes
2.4		
2.1		
7.8		

7.9		
4.6		
3.4		
5.6		
1.6		
1.8		

Answers – Performing calculations with time

Time in hours	Time in hours and minutes	Time in minutes
1.4	1 hour and 24 minutes	84 minutes
2.4	2 hours and 24 minutes ($0.4 \times 60 = 24$ minutes)	144 minutes $2 \times 60 + 24$
2.1	2 hours and 6 minutes ($0.1 \times 60 = 6$ minutes)	126 minutes $2 \times 60 + 6$
7.8	7 hours and 4.8 minutes ($0.8 \times 60 = 4.8$ minutes)	424.8 minutes $7 \times 60 + 4.8$
7.9	7 hours and 54 minutes ($0.9 \times 60 = 54$ minutes)	474 minutes $7 \times 60 + 54$
4.6	4 hours and 36 minutes ($0.6 \times 60 = 36$ minutes)	276 minutes $4 \times 60 + 36$
3.4	3 hours and 24 minutes ($0.4 \times 60 = 24$ minutes)	204 minutes $3 \times 60 + 24$
5.6	5 hours and 36 minutes ($0.6 \times 60 = 36$ minutes)	336 minutes $5 \times 60 + 36$
1.6	1 hours and 36 minutes ($0.6 \times 60 = 36$ minutes)	96 minutes $1 \times 60 + 36$
1.8	1 hours and 4.8 minutes ($0.8 \times 60 = 4.8$ minutes)	64.8 minutes $1 \times 60 + 4.8$

Converting between Imperial and metric units

You don't need to remember these conversion factors but its good to practice using them.

You will need to use these relationships:

1 foot = 12 inches

1 inch \approx 2.5 cm

1 litre = 1000 ml

1 yard = 3 feet

5 miles \approx 8 km

5 litres \approx 9 pints

1 mile = 1760 yards

1 kg \approx 2.2 pounds

1 gallon = 8 pints

Original unit	Calculation	Convert into	Answer
3 feet		inches	
105 yards		feet	
2 miles		yards	
1 foot		cm	
10 gallons		pints	
2.7 litres		ml	
66 feet		yards	
100kg		pounds	
500 miles		Km	
15cm		Inches	

Answers – Converting between Imperial and metric units

Original unit	Calculation	Convert into	Answer
3 feet	X 12	inches	36
105 yards	X 3	feet	315
2 miles	2 x 1760	yards	3520
1 foot	12 x 2.5	cm	30
10 gallons	10 x 8	pints	80
2.7 litres	X 1000	ml	2700
66 feet	66 ÷ 3	yards	22
100kg	X 2.2	pounds	220
500 miles	X 8 ÷ 5	Km	800
15cm	÷ 2.5	Inches	6

