Percentage Calculations









What do you already know about percentages? Fill in the pieces with some facts you already have.





Q Look at this nutritional information for a packet of food.

Nutritional Information				
Serving size: 5 g				
	Avg Qty per Serve	Avg Qty per 100g		
Energy	78 kJ	1550 kJ		
Protein	0.4 g	8.0 g		
Fat, total	0.2 g	4.4 g		
-saturated	0.0 g	0.4 g		
Carbohydrate	3.8 g	75.0 g		
-sugars	1.3 g	25.9 g		
Sodium	8 mg	165 mg		
Vitamin C	75 mg	1500 mg		
Vitamin A	1539 IU	28390 IU		

The standard method used by nutritionists to estimate our minimum daily grams of protein needed is to multiply the body weight in kilograms by 0.8.

- **a** Calculate your minimum daily requirement of protein.
- How many servings of this food will a 75 kg adult need to eat to get their minimum daily requirement of protein?







Fractions and percentages

Percent (%) = for every (per) 100 (cent)

:. 50% means 50 for every 100, which as a fraction = $\frac{50}{100} = \frac{1}{2}$ \leftarrow Always write in simplest form

To change fractions to a percentage, write as an **equivalent fraction** with a denominator of 100.

• Proper fractions (for amounts smaller than the whole and percentages < 100%)



• Mixed numerals and improper fractions (for amounts larger than the whole and percentages > 100%)



Another simple way to change fractions to a percentage is by multiplying the fraction by 100.

$$\frac{1}{4} = \left(\frac{1}{4} \times 100\right)\% = 25\% \qquad \qquad \frac{3}{2} = \left(\frac{3}{2} \times 100\right)\% = 150\%$$

Convert these fractions and percentages using the method given

(i) 75% (Equivalent fraction method)	$75\% = \frac{75}{100}$	Percent signs means 'over 100'
	$=\frac{3}{4}$	Simplify fraction
(iii) 8 (Equivalent for sting moth cal)	8 8÷2	
(ii) $\frac{1}{200}$ (Equivalent fraction method)	$\overline{200} = \overline{200 \div 2}$	Divide numerator and denominator by 2
	$=\frac{4}{100}$	Equivalent fraction with $100\ \mathrm{as}\ \mathrm{denominator}$
	= 4%	
(iii) $\frac{6}{5}$ (Multiplication method)	$\frac{6}{5} = \left(\frac{6}{5} \times 100\right)\%$	Multiply fraction by 100
	= 120%	





Your Turn

Write these as equivalent fractions with a denominator of 100 and then as a percentage.







Fractions and percentages

Write these as equivalent fractions with a denominator of 100 and then as a percentage.



Write these as equivalent mixed numerals with a denominator of 100 and then as a percentage.



7

Use the multiplication method to write these fractions as percentages.



8 (

Change these to improper fractions and use the multiplication method to change to a percentage.



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Fractions and percentages



Write these as a percentage in decimal and mixed numeral form.



Write these as a percentage in decimal and improper fraction form.





Decimals and percentages

Changing between decimals and percentages is all about multiplying and dividing by 100.



Move decimal point 2 spaces left

Let's look at two more examples moving in opposite directions.

Write these as their equivalent percentage or decimal			
(i) 1%	$1\% = 1 \div 100$	Divide by 100 to get equivalent decimal	
	= $.01$.	Move decimal point 2 spaces left	
	= 0.01	Equivalent decimal	
(ii) 0.7	$0.7 = (0.7 \times 100)\%$	Multiply by 100 to get equivalent percentage	
	= 0.70.%	Move decimal point 2 spaces right	
	= 70%	Equivalent percentage	
(iii) 0.025	$0.025 = (0.025 \times 100)\%$	Multiply by 100 to get equivalent percentage	
	= 0.02.5%	Move decimal point 2 spaces right	
	$= 2.5\%$ or $2\frac{1}{2}\%$ or $\frac{3}{2}\%$	Equivalent percentage in all forms	
(iv) 101.5%	$101.5\% = 101.5 \div 100$	Divide by 100 to get equivalent decimal	
	= 1.01.5%	Move decimal point 2 spaces left	
	= 1.015	Equivalent decimal	
	$= 1\frac{15}{1000} \left(= 1\frac{3}{200}\right)$	Equivalent mixed numeral	





Your Turn





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Always simplify

Recurring decimals and percentages

Recurring decimals are treated just like terminating decimals when changing to percentages.



It is usually nicer to write recurring decimals as a mixed numeral percentage where possible.

 $\therefore 66.\dot{6}\% = 66\frac{6}{9}\% = 66\frac{2}{3}\%$

These tables show that there are patterns for writing simple recurring decimals as fractions:

Here are some more examples with slight differences involving recurring decimals (i) Convert $0.00\dot{4}$ to its equivalent percentage value. $0.00\dot{4} = 0.00444...$ $= (0.00444... \times 100)\%$ Multiply the decimal by 100 Remember: = 0.444...%Change so the recurring pattern $= 0.\dot{4}\%$ Recurring decimal percentage starts from the $=\frac{4}{9}\%$ decimal point. Percentage form from the table (ii) Convert $2\frac{2}{3}\%$ to its equivalent decimal and fraction values. $2\frac{2}{3}\% = 2.6\%$ $= 2.\dot{6} \div 100$ Divide by 100 = 0.02.666...Decimal point moves two spaces to the left $= 0.02\dot{6}$ Equivalent recurring decimal $0.02\dot{6} = \frac{2}{100} + \frac{6}{900}$ $=\frac{2}{75}$ Equivalent fraction



Your Turn



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Recurring decimals and percentages

Here are some examples of the many other recurring decimals along with their equivalent fractions.



Remember: A dot is placed above the first and last digit of the recurring pattern.

To change the fraction into the recurring decimal, just divide the numerator (top) by the denominator (bottom) on your calculator.

Write these fractions as recurring decimals and then as equivalent percentages rounded to 1 d.p.



Complementary percentages



Percent (%) = for every 100 (per) (cent) 100% = 100 for every 100

In other words, 100% represents the whole amount.

Complementary percentages split up the whole amount into two parts.

So complementary percentages add to 100%

For example, 40% of the people partying below have a hat. What percentage are not wearing hats?



People without party hats = All the people partying - the people partying with hats

$$= 100\% - 40\%$$

= 60%

Percentage without party hats and percentage with party hats are complementary percentages 60% + 40% = 100%

Complementary fractions and decimals add to 1 (which is 100% in decimal/ fraction form).

Find the complem	ent for each of these	
(i) 20.5%	100% - 20.5% = 79.5% The complement of 20.5% is 79.5%	Subtract from 100%
(ii) <u>2</u> 7	$1 - \frac{2}{7} = \frac{5}{7}$ The complement of $\frac{2}{7}$ is $\frac{5}{7}$	Subtract from fraction equivalent of 100% , 1
(iii) 0.3(= 0.333	.) $1 - 0.\dot{3} = 0.\dot{6}$ ∴ The complement of $0.\dot{3}$ is $0.\dot{6}$	Subtract from decimal equivalent of 100%, 1 Corresponding decimal places add to 9





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Percentage of an amount



These types of calculations let you to work out how much of an object the percentage represents.

For example, paint 65% of the shape below:



This shape is divided into $20\ {\rm equal}\ {\rm triangles}.$

 \therefore The question is just asking you to calculate 65% of 20.





65% of this shape (13 triangles) has been painted.



Your Turn



Percentage of an amount

Complete the steps for these percentage calculations:



Your Turn



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Percentage of an amount

- 6 Show all working for these questions and answer with a statement:
 - At dinner function, 40% of the 95 diners chose the vegetarian main course dish. How many diners chose the non-vegetarian main course option?



During one 8-hour work day, Mitch spent 30% of the time in meetings with his team. How many hours did he spend in meetings on that day?

• Only 15.5% of the 12800 tickets on sale for a concert were still available one hour after tickets went on sale. How many tickets are there left after 1 hour?

A kayaker used the right-side paddle 0.42 of the time and the left side paddle 0.58 of the time while travelling down a river. How many times did the right paddle enter the water if there were a total of 3650 paddle strokes made?



This one will earn you an awesome passport stamp! Use working to show that 40% of 75 the same as 75% of 40. Briefly explain why this is true for all percentage calculations.





Percentage of an amount

Complementary percentages can be used to simplify percentage problems:

Find the complement for each of these

At a call centre, 32% of the 50 people working there are currently not taking phone calls. How many people are currently taking phone calls?

The percentage of people taking phone calls is the complement of 32%.

The complement of 32% is 68%.

 $\therefore 68\%$ of the 50 people are taking calls.

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\therefore 0.68 \times 50 = 34
```

 \therefore 34 people are currently taking phone calls in the call centre.

8 75% of a 64GB (gigabytes) music device is filled with tunes from the owner's music collection. How many gigabytes does the owner have left available for more music downloads?

A shopping list contained 96 different items. If the shopper has only 12.5% of the listed items remaining to collect, how many items from the shopping list are in the trolley?



- A 900 piece jigsaw puzzle has 0.43 of the pieces placed correctly into the puzzle. Use the complementary decimal to calculate how many pieces are left to complete the jigsaw.
- (i) A snow-sled is 0.15 of the way down a 450 metre hill. Calculate the complementary decimal that represents how far the sled has left to go.



(ii) How far does the sled have left to go to get to the bottom of the hill?





Where does it work?

Percentage of an amount

- When a thunder storm passed over the town of Zappville, the golf-course received $\frac{1}{3}$ of the 78 lightning strikes caused by the storm.
 - (i) Calculate the complementary percentage that represents the number of strikes that did not occur on the golf course.
 - (ii) How many lightning strikes were not on the golf course?
- A survey was posted out to 252 houses in a suburb to see what services residents would like to have improved for their local community. The post office received back $83\frac{1}{3}\%$ of the envelopes mailed out with completed surveys. How many surveys were not returned?



¹⁴ $\frac{2}{7}$ % of the dots printed on a normal six-sided die are located in the centre of the side. How many other non-centred dots are there on a normal six-sided die?



- If the water level in an 18 metre deep well is $0.795\dot{3}$ of the well's depth from the top.
 - (i) How far from the top of the well is the water level, accurate to 1 decimal place?
 - (ii) The well is only ever less than 25% full during drought conditions. Determine if this water level indicates drought conditions or not.





One amount as a percentage of another

The results of comparing values such as scores out of a total amount are often given as a percentage.



Here is where this type of percentage calculation can be applied:



10 seconds have passed on a stop-watch. If the person pushes 'stop' after a further 26 seconds, what percentage of one minute (60 seconds) has passed?

10 seconds + 26 seconds = 36 seconds

$$\therefore \frac{36}{60} = 60\%$$

Let's look at a few more examples before trying some for yourself.

These examples are more complex and require the use of a calculator				
(i) What percentage does $12\frac{1}{5}$ out of 25 represent?				
12.2 out of 2.	$5 = \frac{12.2}{25} \times 10$	0%	Equivalent decimal	
	$=\frac{1220}{25}\%$		Multiplied by 100	
	=48.8% c	r 48	$\frac{4}{5}\%$ Decimal and mixed numeral form	
You can also be asked to calculate the complementary percentage.				
(ii) Hugo scored 23.5 out of a possible 30 points in a recent competition. What percentage represents the number of points he did not score?				
Points not score	d = 30 - 23.5			
	= 6.5			
.:. 6.5 out of 3	$0 = \frac{6.5}{30} \times 100$)%		
	$=\frac{650}{30}\%$		Multiplied by 100	
	= 21.Ġ or	$21\frac{2}{3}$	-% Decimal and mixed numeral form	



Where does it work?	Your Turn	Percentage Calculations
One amount as	a percentage of ano	ther HEINT
Calculate these percentage a	mounts:	4 HO
a 35 out of 50	b 3.2 o	ut of 5
Calculate these percentage a	mounts, leaving your answers	as mixed numeral percentages:
a 17 out of $22\frac{1}{2}$	b $\frac{1}{3}$ or	t of $\frac{4}{5}$
Calculate these percentage a	mounts, rounding your answe	rs to 2 decimal places:
a 10.5 out of 83.4	b 12.25	5 out of 50

Four different 22.5 gram pieces of lead were studied and found to contain 15.3, 13.05, 18.225 and 16.825 grams of graphite. Calculate the percentage of graphite found in each lead and then use the table below to determine what pencil type each lead was from.

Pencil Type	Graphite	Clay, Wax, etc.	a) 15.3 grams of graphite	Pencil type
6H	50%	50%		
5H	53%	47%		
4H	55%	45%	13.05 grams of graphite	Pencil type
3Н	58%	42%		
2Н	61%	39%		
Н	63%	37%	18 225 grams of graphite	Pencil type
HB	68%	32%		
2В	73%	27%		
3B	75%	25%	16 825 grams of graphite	Pencil type
4B	78%	22%		
5B	81%	19%		
6B	84%	16%		•••••••••••••••••••••••••••••••••••••••

Each student in a class of twenty five is asked to select one of forty different vegetables to write a nutrition report about it. The same vegetable cannot be picked twice. What percentage of vegetables do not get a nutrition report written about them?





Where does it work?

One amount as a percentage of another

It's time for 582 birds to migrate. 368 of the birds start their migration while the remainder of the birds wait until the first flock has left. What percentage of birds leave as part of the second flock? Round your answer to the nearest whole percentage.

- The surface area of the Earth is roughly 510072000 km^2 (or 196935000 square miles).
 - If 361130 976 km² of the Earth's surface is covered with salt water oceans, what percentage of the Earth's surface is covered in salt water?
 - Use the percentage calculated in part a to calculate the surface area of the Earth covered in salt water oceans in square miles (accurate to the nearest whole square mile).

- A video goes viral and attracts an average of 980.24 hits every second in the first five minutes. After one hour it has had 1 225 300 hits. What percentage of the hits occurred in the first five minutes? Psst: 1 minute = 60 seconds
- If $70\frac{4}{5}$ gallons of rain water has been released from a water tank, what percentage of water remains if the $125\frac{3}{4}$ gallon tank was full before the water was released? Round answer to 2 d.p.









Percentage change

There are two types of percentage changes: increases and decreases.

An increase means you finish with more than what you started with.

So we add the percentage amount to the whole amount (100%) that we had to begin with.

If a javelin thrower beats their personal best distance by 5%, then the new personal best distance is:





130

NJIBOHS

A decrease means you finish with a less than what you started with.

So subtract the percentage from the whole amount (100%) that we had to begin with.

If a skater reduces their personal best time around a track by 11%, then the new personal best time is:



100% - 11% = 89% of the previous personal best time Initial personal best Percentage of time time around track reduced by

Perform these percentage change calculations

(i) Increase 20 by 15%.

(ii) Decrease 5.2 by 25%.

An increase of 15% = 100% + 15%= 115% of original amount $\therefore 115\%$ of $20 = 1.15 \times 20$ = 23

A Decrease of 25% = 100% - 25%=75% of original amount $\therefore 75\%$ of $5.2 = 0.75 \times 5.2$ $= 3.9 \text{ or } 3\frac{9}{10}$

(iii) How many hexagons must be filled to increase the number of shaded hexagons by $33\frac{1}{3}\%$?

: just focusing on the nine shaded hexagons, not all the hexagons.

An increase of $33\frac{1}{3}\% = 100\% + 33\frac{1}{3}\%$ $= 133\frac{1}{3}\%$ of original amount $\therefore 133\frac{1}{3}\%$ of 9 hexagons = 1.3×9 hexagons = 12 hexagons

 \therefore 3 more hexagons must be shaded to increase the number of shaded hexagons by $33\frac{1}{3}\%$.







Other method:

Find 10% of 25 and add to 25



Calculate these percentage changes:

a Decrease 50 by 30%.

Increase 6.2 by 5%.

• Mark 258 larger by $33\frac{1}{3}\%$.

40% decrease = 100%
$$40\%$$

= $\%$ of initial amount
∴ Decrease of 40% = $\times 65 =$
Decimal form

Other method:

Find 40% of 65 and subtract from 65



b Increase 76 by 25%.

d Reduce 8 by 1.5%.

f Add a further 92% to $12\frac{4}{5}$ %.

3 a Decrease 50 cars by 100%.

b Can you decrease a physical quantity (such as cars) by more than 100%? Briefly explain your answer.





a Increase 70 by 100%



- **b** Write down another mathematical calculation which also increases a number by 100%.
- **c** Increase 70 by 200%.
- **Write down another mathematical calculation which also increases a number by** 200%
- Write down a general rule you could use to make increasing a number by a multiple of 100% quick and simple.
- **5 a** Increase $\pounds 20$ by 50%.
 - **b** Reduce the answer to part **a** by 50%.
 - C Did you expect to get the same amount of £20 for part b because you were increasing and decreasing by the same percentage? Explain briefly why you think the answer to part b could not be £20.



- **6** a Lengthen 80 m by 20%, then increase this length by a further 25%.
 - Is increasing a number by 20% and then increasing the answer by 25% the same as increasing the original amount by 45%? Briefly explain why/why not.



2 a Increase 60 by $33\frac{1}{3}\%$, then decrease the answer by 20%.

b Reduce 200 by 25%, then reduce the result by 70.5%.

C Decrease $\pounds 55$ by 12%, then increase the result by 16%. Round answer to 2 decimal places.

Inflate £90 by $5\frac{1}{4}\%$, then reduce the result by $\frac{3}{5}\%$. Round the **final** answer to 2 decimal places.

Increase the number of triangles in this image by 45%.



b Cross out enough bananas below so the total number of bananas has shrunk by $66\frac{2}{3}\%$.



60% of the squares below were shaded in before 75% of the shaded squares were cleared again. Calculate how many squares would now be shaded and shade the diagram appropriately.









- In the ingredients below are used to prepare a particular dish.
 - The mass/quantity of each ingredient required is shown next the name of the ingredient.
 - The values in square brackets indicate how many people each given amount is used for.

A chef is making the dish for 4 people. Using percentage change calculations, match each ingredient to the correct percentage change and ingredient amount required for 4 people by drawing a straight line between the dots.

Write each letter in the matching number squares below to reveal the dish this chef is making. Psst: calculate the percentage change for the number of serves and apply this to the ingredients





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Unitary method

Unitary method for percentages is a mathematician's way of saying "find how much 1% is first".

Once you know what amount 1% represents, you can calculate any other percentage amount.

A $210\,{\rm g}$ slice of birthday cake is 15% of the whole cake. What is the mass of the birthday cake?

15% of the birthday cake = 210 $\therefore 1\% \text{ of the birthday cake} = 210$ $= 14 \text{ g}$	g g÷15 Divide by 1	5% amount by 15 to get $1%$		
$\therefore 100\%$ of the birthday cake = 14 g = 140	$s \times 100$ Multiply 19 0 g	% amount by 100 to get $100%$		
\therefore The mass of the birthday cake $= 140$	0 g or 1.4 kg Answer wit	th a satement		
Here are some more examples using unitary metho	d for different circumstance	s		
(i) After a recent survey, 27 new saplings of a rare 135% from a previous survey, how many sapli previous survey?	e tree were discovered. If t ngs of this rare tree were d	his is an increase of liscovered during the		
135% of the previous survey $\therefore 1\%$ of the previous survey	= 27 saplings = 27 saplings \div 135 = 0.2 saplings	Divide by 135 to get 1%		
100% of the previous survey $\therefore 100\%$ of the previous survey	$= 0.2$ saplings $\times 100$ = 20 saplings	Multiply 1% amount by 100		
∴ The saplings discovered in the previous surv	rey = 20	Answer with a statement		
(ii) $66\frac{2}{3}\%$ of an image made entirely of equal-sized hexagons is visible below. How many hexagons would you see if 80% of this image was made visible?				
The number of hexagons visible	= 10			
$\sim 66\frac{2}{3}\%$ of the full picture	= 10 hexagons			
\therefore 1% of the full picture	= 10 hexagons $\div 66\frac{2}{3}\%$ = 0.15 hexagons	Divide by $66\frac{2}{3}\%$ to get 1%		
$\therefore 80\%$ of the full picture	$= 0.15$ hexagons $\times 80$ = 12 hexagons	Multiply by $80 ext{ to get } 80\%$		
\therefore The number of hexagons visible in 80% of t	he full image $= 12$	Answer with a statement		





Unitary method

Complete these calculations using the unitary method to find 100% of the given amount.



Calculate the amount represented by 100% for each of these values. Show all your working.
55% of the amount is 220.
325% of the amount is 487.5.

• 34.2% of the amount is 282.15.

d $115\frac{3}{8}\%$ of an amount is $1269\frac{1}{8}$.

e 286% of the amount is 16094.

(1) $14\frac{2}{3}\%$ of an amount is 7.16.







Unitary method

- 3 Calculate the percentage amount for each of these given quantities. Show all your working.
 - 65% of a length is 390 units.
 How long is 32% of the same length?
- 12% of an ingredient is 46 g.How much is 30% of the same ingredient?

- C 110% of a mass is 5 kg. What is 44% of the same mass?
- **d** 290% of the initial amoeba population is 4096. How many amoeba are there in of $72\frac{1}{2}$ % the initial population?
- Use the unitary method to solve these problems:
 - Concrete is made by mixing cement with sand and gravel. If sand makes up 35% of the whole mixture, what mass of concrete is produced if a 56 kg bag of sand was used?

In one particular termite nest there are 8575 worker termites. They account for $87\frac{1}{2}\%$ of the entire colony. How many soldier termites are there in the same nest if they account for 11.5% of the colony?

• Two fifths of the 41 250 people at a sport venue represent 60% of all the registered fans of the Pesky Pi-rates team. How many people are registered fans of the Pesky Pi-rates?





6

Unitary method

Here are some more examples using unitary method for different circumstances.New percentage
Initial percentagekInitial percentage
Initial percentage(i) 25% of a number is 120. What is the number (ie 100%)?
 $\frac{100}{25} \times 120 = 480$ (ii) 15% of a number is 45. What is 72% of the same number?
 $\frac{72}{15} \times 45 = 216$ The calculation of 1% still
happens within this formula.
Can you see how?

Use this rule to calculate these rounding your answers to 2 decimal places.

(a) 35% of a number is 16. What is the number? (b) 450% of a number is 96. What is the amount?

- C 71% of a number is 121. What is 45% of the same number?
- 128% of a value is 245.8.What is 50% of the same vlaue?

- 30% of a fraction is $\frac{5}{8}$. What is 140% of the same fraction?
- $5\frac{1}{3}\%$ of a timeframe is 2130 seconds. How long is $10\frac{3}{7}\%$ of the same timeframe?
- Only 2.5% of these images made entirely of equal-sized objects are visible. How many objects would you see in each image if 70% of the image was made visible?









Profit and loss

Profits and losses are usually money values relating to the sale or trade of items by retailers.

Some important terms first:

- cost price: The price retailers pay for the items they are going to sell.
- marked price: The price retailers put on the items they are selling to customers
- The price retailers actually sell the items for. sale price:

A profit is what you gain from a sale



Sale price > Cost price

Sale price - Cost price = Positive answer

A loss is what you lose from a sale



Sale price < Cost price

Sale price - Cost price = Negative answer

Here is an example including some new terms important to these types of percentage calculations

To make a profit, shops increase the cost price of items by a percentage. This is called a **markup**.

Marked price = Cost price + The **markup**

(i) A retailer buys some basketballs for $\pounds 22$ each and decides to add a 75% mark-up to sell them.

 $\pounds 22$ increased by 75% = $\pounds 22 \times 1.75$

Always answer money questions accurate to 2 decimal places.



 \therefore Marked price of a basketball in the shop is £38.50.

To make an item sell quicker, they decrease the cost price by a percentage. This is called a **discount**.

Discount/On-Sale Price = Marked price – the **discount**

=£38.50

(ii) The retailer then discounts the marked price of the basketballs by 12% to sell them faster.

 $\pounds 38.50$ decreased by $12\% = \pounds 38.50 \times 0.88$

 $= \pm 33.88$

 \therefore Discounted (or "on sale") price of a basketball in the shop is £33.88

(iii) Calculate the profit or loss for the retailer if a basketball was sold at the discounted price.

Sale price – Cost price = $\pounds 33.88 \times \pounds 22$

$$=$$
 £11.88

Positive answer, so the retailer made a profit of $\pounds 11.88$







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TOPIC



A store purchases 10 dining tables for $\pounds 210$ per table. The markup put on each table by the store was 50%.

Five tables were successfully sold for the marked price. Calculate the profit made from the sale of these five tables.

Write the profit made as a percentage of the cost price for the five tables sold.

C The store discounted the marked price of the five remaining tables by 40% to make room for new stock. Calculate the new discounted price for each table.

O Calculate the profit/loss made on the sale of all ten tables.





The unitary method is helpful for these profit and loss questions:



A store held a 'special letter tag' sale. Any item in the store labelled with an S, A, L or E tag was discounted by the percentages shown below (-70% means a discount of 70%). Use the given information to calculate the marked price for the items tagged below:



An item costing $\pounds 40$ is given a mark up of 20%. If the item was then given a 15% discount when sold, did retailer make a profit or a loss? Show the calculations used to get your answer.





When an item is sold for the same amount as the cost price, it is called 'breaking even' (or the retailer says they 'broke even on the sale'). A set of crystal glasses were bought by a retailer for £200 and given a merit.



A set of crystal glasses were bought by a retailer for $\pounds 200$ and given a markup of 35%.

- Calculate the marked price on the crystal glasses in the retail store.
- **b** What percentage discount (to 1 d.p.) was given to a buyer if the retailer broke even on the sale?
- **①** The cost price of a formal dress was 12.5% more than the sale price of £890.

a How much money did the seller lose on the sale of this dress?

What was the labelled price of the dress if the cost price was given a markup of 20%?

- Calculate the discount given to this dress at the time of its sale as a percentage of the cost price (to the nearest whole percent).
- A retailer decides that a 17.25% profit is needed on a new range of products if it is going to continue selling them. The new products were purchased at a cost price of £72.50 each.
 - The products are marked up by 36.3%. What is the marked price for these products to 2 d.p.?
 - What is the minimum price (to the nearest whole dollar) the items must be sold for so the retailer will continue selling them?
 - Calculate the maximum percentage discount that can be given to the marked price to ensure the retailer continues to sell the product (to nearest whole percent)?





More applications of percentage calculations

Look at this nutritional information for a packet of food.

Nutritional Information				
Serving size: 5 g				
	Avg Qty per Serve	Avg Qty per 100g		
Energy	78 kJ	1550 kJ		
Protein	0.4 g	8.0 g		
Fat, total	0.2 g	4.4 g		
-saturated	0.0 g	0.4 g		
Carbohydrate	3.8 g	75.0 g		
-sugars	1.3 g	25.9 g		
Sodium	8 mg	165 mg		
Vitamin C	75 mg	1500 mg		
Vitamin A	1539 IU	283901U		

 Calculate your minimum daily requirement of protein.
 Psst: remember, percent mean per 100!!



The standard method used by nutritionists to estimate our minimum daily grams of protein needed is to multiply the body weight in kilograms by 0.8.

Use the formula to calculate the mass of protein recommended for an adult who weighs 70 kg.

• How many servings of this food will give this person their recommended daily source of protein?

If a 70 kg adult eats just enough servings to get their required daily source of protein, how many grams of carbohydrates will also be eaten?

An expert recommends splitting your total daily food into 50% carbohydrates, 32% proteins and 18% healthy fats for a healthy lifestyle. Use percentage calculations to show whether or not this food is a healthy option by comparing the amount of protein and carbohydrate eaten by this adult.



Planet X11 orbits its sun every 145 days. This is 24.6% of the time taken for Planet G23 to orbit the same sun. How long does it take for Planet G23 to complete 2 orbits to the nearest whole day?
Psst: 2 orbits is like 200%!





More applications of percentage calculations

- 3 Every year, the height of a pine tree in a renewable forestry plantation increases by $20\frac{1}{4}\%$ of the height it reached the year before. The height of one particular tree now is 14 m.
 - a How high will this tree be one year from now?
 - **b** How much further will the grow between one and two years from now to 2 decimal places?

- **C** By what overall percentage will the tree have grown by two years from now to 1 decimal place?
- Once the tree reaches a height of 25 m, it is cut down and used for timber products. Will this tree be cut down three years from now? Show working to back up your answer.
- If allowed to continue growing, four years from now the tree will be more than double the current height. Explain how this is possible if it has only grown by $20\frac{1}{4}$ each year.

This one deserves an awesome passport stamp once completed. While flying 50 m above the ground, a hot air balloon is filled with hot air so its height above the ground increased by 31%. After 20 minutes, the balloon had already lowered 17 m before more hot air is put into the balloon, raising the heigh above the ground at that time by 28.83%. Calculate the percentage change in height from the initial 50 m above ground to nearest whole percent.









Quick method using calculator:

 $\frac{\text{New percentage}}{\text{Initial percentage}} \times \text{Initial percentage amount}$



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