

Percentages

Basic Percentages / Percentage Increases & Decreases / Reverse Percentages

Easy (18 questions)	/52
Medium (17 questions)	/59
Hard (20 questions)	/80
Total Marks	/191

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Easy Questions

- 1 Bill's weight decreases from 64.8 kg to 59.3 kg.

Calculate the percentage decrease in Bill's weight.
Give your answer correct to 3 significant figures.

(3 marks)

- 2 Ria is going to buy a caravan.

The total cost of the caravan is £7000 **plus** VAT at 20%.

Ria pays a deposit of £3000 She pays the rest of the total cost in 6 equal monthly payments.

Work out the amount of each monthly payment.

(4 marks)

- 3 Tom is a ski jumper.

The maximum length of skis he can use is 145% of his height. Tom's height is 1.80 m.

Work out the maximum length of skis Tom can use.

(3 marks)

- 4 George wants to watch all 23 games that a football team will play at home next season.

He can buy

a season ticket costing £425
or 23 separate tickets costing £24 each ticket.

What percentage of the total cost of 23 separate tickets does George save by buying a season ticket?

(3 marks)

- 5 Emily buys a pack of 12 bottles of water.
The pack costs £5.64

Emily sells all 12 bottles for 50p each.

Work out Emily's percentage profit.
Give your answer correct to 1 decimal place.

(3 marks)

- 6 Gladys buys a table for \$465 to sell in her shop.

She sells the table for \$520

Work out the percentage profit that Gladys makes from the sale of the table.

Give your answer correct to 3 significant figures.

.....%

(3 marks)

- 7** In 2018, the population of Sydney was 5.48 million.
This was 22% of the total population of Australia.

Work out the total population of Australia in 2018 Give your answer correct to 3 significant figures.

..... million

(3 marks)

- 8** Victor buys 12 bottles of apple juice for a total cost of \$21
Victor sells all 12 bottles at \$2.45 each bottle.

Work out Victor's percentage profit.

.....%

(3 marks)

- 9** Lijuan's salary is 180000 Hong Kong Dollars (HK\$).
She gets a salary increase of 3%

Work out Lijuan's salary after this increase.

HK\$

(3 marks)

10 Work out 320 as a percentage of 80

- A. 25%
- B. 75%
- C. 300%
- D. 400%

(1 mark)

11 Work out 40 as a percentage of 10.

- A. 4%
- B. 4%
- C. 300%
- D. 400%

(1 mark)

12 The table shows information about the population of a city.

Population in 2001	Population in 2011
420 000	480 000

Liam claims,

“From 2011 to 2021 the population of the city will increase by the same percentage as from 2001 to 2011”

He works out,

population increase from 2001 to 2011 = $480\,000 - 420\,000$

$$= 60\,000$$

$$\text{population in 2021} = 480\,000 + 60\,000$$

$$= 540\,000$$

Does the population of 540 000 match his claim?

You **must** show your working.

(3 marks)

13 In 1999 the minimum wage for adults was £3.60 per hour.

In 2013 it was £6.31 per hour.

Work out the percentage increase in the minimum wage.

(3 marks)

14 In 2017, a chocolate bar had a mass of 250g.

In 2018, the mass of the chocolate bar was reduced to 220g.

Work out the percentage decrease in the mass of the chocolate bar from 2017 to 2018.

..... %

(3 marks)

15 Ed has a card shop.

He buys a particular card for £1.20 and sells it for £1.68.

Calculate his percentage profit on this card.

(3 marks)

16 Ed has a card shop.

Ed's profit on "Good Luck" cards in 2018 was £360.

This was a decrease of 20% on his profit in 2017.

Work out Ed's profit on "Good Luck" cards in 2017.

£

(3 marks)

17 Shari buys a box of 60 candles for £125.

She sells the candles for £2.25 each.

Calculate her percentage profit.

(4 marks)

18 Here is the nutritional information for a 110g serving of cereal.

Carbohydrates 99.4g

Proteins 9.5g

Fats 1.1g

Emily says that more than 90% of this serving is carbohydrates.

Is she correct?

Explain your reasoning.

(3 marks)

Medium Questions

- 1 Railtickets and Cheaptrains are two websites selling train tickets.

Each of the websites adds a credit card charge and a booking fee to the ticket price.

Railtickets	Cheaptrains
Credit card charge: 2.25% of ticket price	Credit card charge: 1.5% of ticket price
Booking fee: 80 pence	Booking fee: £1.90

Nadia wants to buy a train ticket.
The ticket price is £60 on each website.
Nadia will pay by credit card.

Will it be cheaper for Nadia to buy the train ticket from Railtickets or from Cheaptrains?

(4 marks)

- 2 A company sells boxes to factories.
Fred buys boxes.
The boxes are sold in packs of 1000.
Each pack costs £193.86

Fred orders 3 packs of boxes.
He gets a discount on his total order.

The table shows the discount he will get.

Total Order	Discount
£100 - £300	5%
£301 - £400	10%
£401 and above	15%

Work out the total cost of the order after the discount.
You must show your working.

(5 marks)

3 Greg sells car insurance and home insurance.

The table shows the cost of these insurances.

Insurance	car insurance	home insurance
Cost	£200	£350

Each month Greg earns

£530 basic pay

5% of the cost of all the car insurance he sells

and 10% of the cost of all the home insurance he sells

In May Greg sold

6 car insurances

and 4 home insurances

Work out the total amount of money Greg earned in May.

(5 marks)

- 4** Mr Watkins needs to buy some oil for his central heating.

Mr Watkins can put up to 1500 litres of oil in his oil tank.

There are already 850 litres of oil in the tank.

Mr Watkins is going to fill the tank with oil.

The price of oil is 67.2p per litre.

Mr Watkins gets 5% off the price of the oil.

How much does Mr Watkins pay for the oil he needs to buy?

(5 marks)

5 The table gives some information about student attendance at a school on Friday.

	Number of students		
Year	Present	Absent	Total
Year 7	192	16	208
Year 8	219	22	241
Year 9	234	28	262
Year 10	233	28	261
Year 11	214	24	238

The school has a target of 94% of students being present each day.

Did the school meet its target on Friday?

(3 marks)

6 Sean wants to go on holiday.

He is going to get a loan of £720 to help pay for the holiday.

Sean will have to pay back the £720 plus interest of 15%.

He will pay this back in 12 equal monthly installments.

How much money will Sean pay back each month?

(4 marks)

7 The table gives information about Ali's spending last month.

Item	Percentage of total spending
rent	30%
food	15%
transport	12%
other	43%

Ali's total spending last month was £800.

Next month Ali's rent, in pounds, is going to rise by 20%.

His total spending will still be the same.

Express the amount of money Ali will spend on rent next month as a percentage of £800.

(3 marks)

8 Bill buys and sells laptops.

Last month Bill bought 50 laptops.
He paid £400 for each laptop.

He sold

40 of these laptops at a profit of 30% on each laptop 10 of these laptops at a profit of 15% on each laptop

Bill's target last month was to sell all 50 laptops for a total of at least £25 000
Did Bill reach this target?

(5 marks)

9 Renee buys 5 kg of sweets to sell.
She pays £10 for the sweets.

Renee puts all the sweets into bags.
She puts 250 g of sweets into each bag.
She sells each bag of sweets for 65p.

Renee sells all the bags of sweets.

Work out her percentage profit.

(4 marks)

10 The normal price of a television is reduced by 30% in a sale.

The sale price of the television is £350.

Work out the normal price of the television.

(3 marks)

11 Claire is making a loaf of bread.

A loaf of bread loses 12% of its weight when it is baked.

Claire wants the baked loaf of bread to weigh 1.1 kg.

Work out the weight of the loaf of bread before it is baked.

(3 marks)

12 (a) Each year Wenford Hospital records how long patients wait to be treated in the Accident and Emergency department.

In 2015 patients waited 11% less time than in 2014

In 2015 the average time patients waited was 68 minutes.

Work out the average time patients waited in 2014

Give your answer to the nearest minute.

(3 marks)

- (b) The hospital has a target to reduce the average time patients wait to be treated in the Accident and Emergency department to 60 minutes in 2016.

Work out the percentage decrease from 68 minutes to 60 minutes.

(2 marks)

- 13 Jules buys a washing machine.

20% VAT is added to the price of the washing machine.

Jules then has to pay a total of £600

What is the price of the washing machine with **no** VAT added?

(2 marks)

- 14 A force of 70 newtons acts on an area of 20 cm^2

$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

The force is increased by 10 newtons. The area is increased by 10 cm^2

Helen says,

"The pressure decreases by less than 20%"

Is Helen correct?

You must show how you get your answer.

(3 marks)

15 In a shop, all normal prices are reduced by 20% to give the sale price.

The sale price of a TV set is then reduced by 30%.

Mary says,

" $30 + 20 = 50$, so this means that the normal price of the TV set has been reduced by 50%"

Is Mary right?

You must give a reason for your answer.

(2 marks)

16 At time $t = 0$ hours a tank is full of water.

Water leaks from the tank.

At the end of every hour there is 2% less water in the tank than at the start of the hour.

The volume of water, in litres, in the tank at time t hours is V_t

Given that

- $V_0 = 2000$
- $V_{t+1} = kV_t$

write down the value of k .

(1 mark)

17 The price of a painting decreases by 15%.

This 15% decrease reduces the price of the painting by £171.

Work out the price of the painting before the decrease.

(2 marks)

Hard Questions

1 In 2003, Jerry bought a house.

In 2007, Jerry sold the house to Mia.
He made a profit of 20%

In 2012, Mia sold the house for £162 000.
She made a loss of 10%

Work out how much Jerry paid for the house in 2003.

(3 marks)

2 (a) Ibrar bought a house for £145 000

The value of the house depreciated by 4% in the first year.
The value of the house depreciated by 2.5% in the second year.

Ibrar says,

" $4 + 2.5 = 6.5$ so in two years the value of my house depreciated by 6.5%"

Is Ibrar right?
You must give a reason for your answer.

(2 marks)

(b) The value of Ibrar's house increases by $x\%$ in the third year.
At the end of the third year the value of Ibrar's house is £140 000.

Work out the value of x .
Give your answer correct to 3 significant figures.

(3 marks)

3 In a sale normal prices are reduced by 20%.

A washing machine has a sale price of £464

By how much money is the normal price of the washing machine reduced?

(3 marks)

4 A shop has a sale.

Microwave ovens

$\frac{1}{3}$ off normal price

Combination ovens

40% off normal price

A microwave oven has a sale price of £90

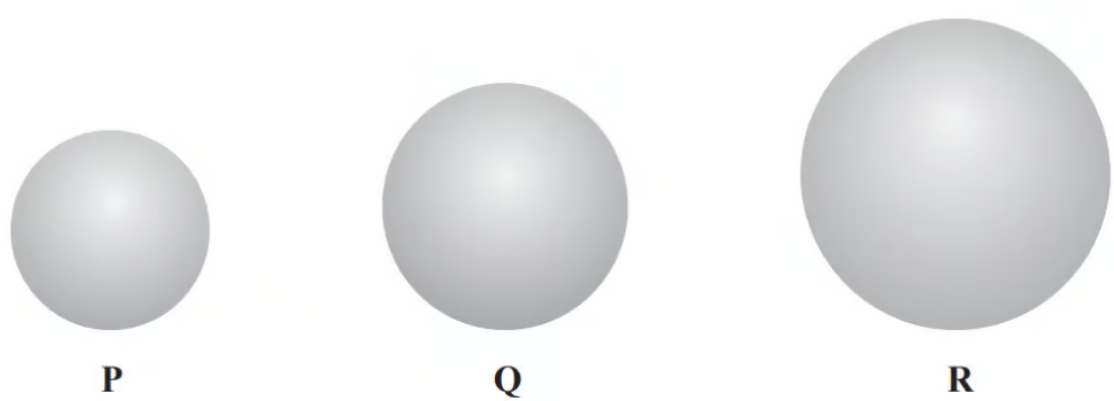
A combination oven has a sale price of £84

Which of these ovens has the greater normal price?

You must show all your working.

(4 marks)

5 Here are three spheres.



The volume of sphere **Q** is 50% more than the volume of sphere **P**.
The volume of sphere **R** is 50% more than the volume of sphere **Q**.

Find the volume of sphere **P** as a fraction of the volume of sphere **R**.

(3 marks)

6 Marie invests £8000 in an account for one year.
At the end of the year, interest is added to her account.

Marie pays tax on this interest at a rate of 20%
She pays £28.80 tax.

Work out the percentage interest rate for the account.

(3 marks)

- 7 Simon bought a house at the beginning of 2018.

The value of Simon's house had decreased by 15% by the end of 2018.

The house increased in value during both 2019 and 2020.

The percentage increases in the value of the house during 2019 and 2020 were the same.

The value of Simon's house at the end of 2020 was 2.85% greater than the amount he paid for his house at the beginning of 2018.

Calculate the percentage increase in the value of the house during 2019.

(4 marks)

- 8 Carlos, Flavia and Tazia shared £861 between themselves.

The amount of money Flavia got is 65% of the amount of money Carlos got.

The amount of money Tazia got is 22% **more** than the amount of money Carlos got.

Work out how much money Carlos got.

(3 marks)

- 9 During last season the cost of a ticket to watch Seapron United increased by 15% and then decreased by 8%.

Work out the overall percentage change in the cost of a ticket to watch Seapron United during last season.

(2 marks)

10 Mariana sells bags of bird food.

The bags that Mariana sold last week each contained 12kg of seeds.

The bags that she is going to sell next week will each contain a mixture of nuts and seeds where for each bag

$$\text{weight of nuts} : \text{weight of seeds} = 4 : 5$$

The total weight of the nuts and the seeds in each bag will be 19.35 kg

The weight of seeds in each bag that Mariana sells next week will be less than the weight of seeds in each bag that Mariana sold last week.

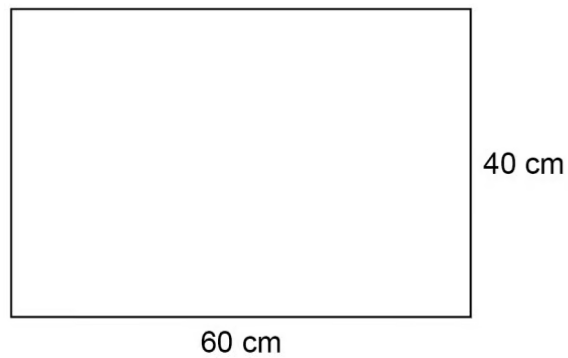
Work out this decrease as a percentage of the weight of seeds in each bag that Mariana sold last week.

Give your answer correct to one decimal place.

..... %

(4 marks)

- 11 A rectangle has length 60 cm and width 40 cm



Not drawn
accurately

The length decreases by 15%
The width decreases by 10%

Sue says,

"The perimeter decreases by 25% because $15\% + 10\%$ is 25%"

Is she must correct?

You **must** show calculations to support your answer.

(4 marks)

- 12 (a) Show that $a\%$ of $b = b\%$ of a

(1 mark)

(b) Rosie says,

"160% of 40 = 140% of 60 because $a\%$ of $b = b\%$ of a "

Is she correct?

Tick a box.

☐ Yes ☐ No

Give a reason for your answer.

(1 mark)

13 When you earn money you pay income tax.

The amount you pay depends on how much you earn that year. You pay

0% on the first £12500 you earn

20% on the next £37 500 you earn

40% on the next £112 500 you earn.

One year, Kim paid £9260 income tax.

Work out how much she earned that year.

£.....

(4 marks)

14 Hanif makes green paint by mixing blue paint and yellow paint in the ratio

blue : yellow = 7 : 3

He buys blue paint in 50-litre containers, each costing £225

He buys yellow paint in 20-litre containers, each costing £80

He wants to

sell the green paint in 5-litre tins make 40% profit on each tin.

How much should he sell each tin for?

£.....

(5 marks)

15 Lily buys and sells microwaves.

She buys each one for £32 and sells it for £60.

She also pays £7 for the delivery of each microwave she sells.

If she sells a microwave that is faulty then Lily must pay for its repair and redelivery.

This costs her another £25 for each faulty microwave.

Last month, 6 out of the 80 microwaves Lily sold were faulty.

This month she has orders for 133 microwaves.

Calculate her expected percentage profit on this month's order. Showing your working in the boxes below may help you present your work.

Expected number of faulty microwaves:	Expected costs:
Income from sales:	Expected percentage profit:

.....%

(6 marks)

16 Each day, Eve records how long it takes her to complete a puzzle.

On Friday, she took 50% less time than on Thursday.

On Saturday, she took 20% less time than on Friday.

On Saturday, she takes 36 minutes to complete the puzzle.

How many minutes did she take to complete the puzzle on Thursday?

Show your working.

..... minutes

(5 marks)

17 Paintings are sold in an art gallery.

The cost of a painting has $k\%$ commission added to it.

Tax of 15% is then added to the total cost to give the price to pay.

Layla correctly calculates the price to pay by multiplying the cost of the painting by 1.403.

Work out the value of k .

$k =$

(3 marks)

- 18** Amrit's income is 32% more than Bethan's income.
Amrit and Bethan's combined income is £54868.

Calculate Amrit's income.

£

(5 marks)

- 19** In 2017, the value of a house increased by 4%. In 2018, the value of the house then decreased by 3%.
Teresa says

"Over the two years the value of the house increased by exactly 1% because $4 - 3 = 1$."

Show that Teresa is wrong.

(6 marks)

20 In a village the ratio of males to females is 2:1.

40% of the people in the village are right-handed males.

25% of the people in the village are right-handed females.

Show that the proportion of females who are right-handed is greater than the proportion of males who are right-handed.

(6 marks)