Foundation / Higher

Maths GCSE Problem Solving Questions Workbook

Percentages

GRADES 4 – 6

MATHS-SCHOOL

Percentage of a quantity

EXAMPLE

What is 50 as a percentage of 20?

$$50 \div 20 \times 100 = 250\%$$

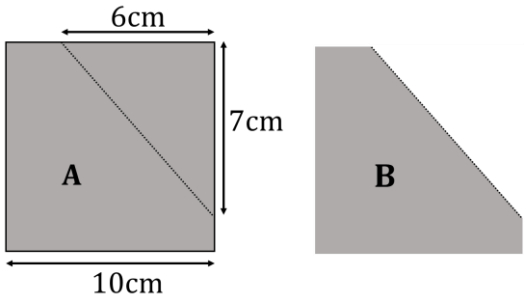
1 Work out 32 as a percentage of 8

2 Work out 18 as a percentage of 22. Give your answer to 1 decimal place

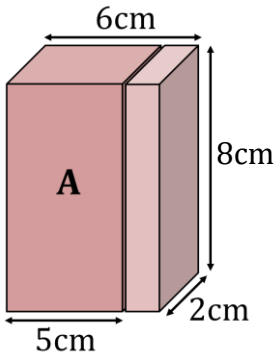
3 Work out 56 as a percentage of 65. Give your answer to 1 decimal place

4 Freddie gets 39 out of 65 in of Maths test. What is Freddie's test score as a percentage?

5 A 10cm x 10cm square piece of paper (A) is folded over as shown in the diagram (B).
The triangular section that is created is cut off
Work out what percentage of the original piece of paper which is now left (B)



6 A wooden block with dimensions of 6cm x 5cm x 2cm as shown, has a thin 1cm slice removed from it. Work out the percentage of the original block that is left after the slice has been removed



Percentage increase / decrease

EXAMPLE

Chloe buys a dress and pays £120. The full price dress which is normally priced at £180 pounds.
What was her percentage discount?

$$\textbf{Amount decreased} = 180 - 120 = 60$$

$$\%\ \textbf{discount} = \frac{\textbf{decrease}}{\textbf{original price}} \times 100$$

$$= \frac{60}{180} \times 100 \quad = 33.3\%$$

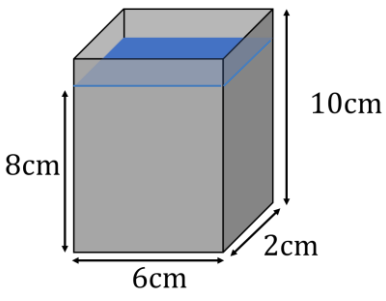
1 Zack buys a new watch online and gets £52.50 discount off the full price.
The watch is normally priced at £350 pounds.
What was his percentage discount?

2 A bungalow goes up in price from £230,000 to £250,000
What was the percentage increase?
Give your answer to 1 decimal place

3 Two swabs of bacteria were taken from a kitchen before and after it was cleaned
Before it was cleaned it had a reading of 5000 bacteria per square inch.
After it was cleaned it had a reading of 1200 bacteria per square inch.
What was the percentage decrease in bacteria after the kitchen had been cleaned?

4 A square has a side length of 8cm. Work out the percentage increase of the square's **area** if both dimensions of the square increased by 1cm

5 A cuboid metal tin is originally filled with water. Its dimensions are 10cm x 2cm x 6cm. Some water is poured out, so its depth drops by 2cm as shown. What is the percentage decrease of the volume of water in the tin?



Increasing by a percentage

EXAMPLE

A family uses 400 units of electricity.
Each unit of electricity costs 12p without VAT.
VAT of 5% is added to the bill.
Work out the total electric bill.

$$\textbf{Total before VAT} = 400 \times 0.12 = £48$$

$$\textbf{VAT} = £48 \div 100 \times 5 = £2.40$$

$$\textbf{Total bill} = £48 + £2.40 = £50.40$$

1 An office buys 400 reems of paper.
Each reem of paper costs £2.40 without VAT.
VAT of 20% is added to the invoice.
Work out the total invoice amount for the paper.

2 Adam's Aviary needs 100 boxes of bird seed each week.
The wholesaler sells these to the aviary at 75p per box
The wholesaler delivers the bird seed to the aviary, but charges delivery at a cost of 15% of the value of any order made.
Adam's Aviary orders 4 weeks' worth of bird seed from the wholesaler to be delivered.
How much is the aviary charged by the wholesaler?

3 Derek's Diner buys plastic straws in batches of 200. Each batch costs £3.40.
After some feedback from customers, the diner decides to buy paper straws instead.
Unfortunately, the cost of paper straws is 15% higher than the plastic straws
If the diner buys 800 paper straws, how much will it cost them?

4 A square has an area of 144cm^2.
Work out the area of the square if the sides are increased by 15%

Decreasing by a percentage

EXAMPLE

A family uses 700 units of electricity.
Each unit of electricity costs 12p without VAT.
As the family pay by direct debit, an 8% discount is applied to their bill.
Work out the total electric bill after the discount is applied

$$\textbf{Total before VAT} = 700 \times 0.12 = £84$$

$$\textbf{Discount} = £84 \div 100 \times 8 = £6.72$$

$$\textbf{New price} = £84 - £6.72 = £77.28$$

1 A school purchases 500 new text books. Each textbook has a price of £2.40.
A 14% discount is applied on orders over £1000.
Work out the total invoice the school should expect for the textbooks.

2 Bridget's Bakery need lots of bags of flour to bake their cakes
Each bag of flour cost 75p
The supermarket offer a 7.5% bulk discount for orders of 500 bags or more.
If the bakery order 800 bags, how much should they expect to pay?

3 An office usually buys black pens in batches of 200. Each batch costs £3.40.
As an incentive for larger purchases from their supplier, the office manager is told that he can now by pens 15% cheaper, if he buys at least 1000 pens at a time.
How much will it cost for 1000 pens?

4 A cube has a volume of 125cm^3.
Work out the volume of the cube if the sides are decreased by 20%

Solutions

Page 1 – Percentage of a quantity

1. 400% : $32 \div 8 \times 100$

2. 81.8% : $18 \div 22 \times 100$

3. 86.2% : $56 \div 65 \times 100$

4. 60% : $39 \div 65 \times 100$

5. 79% : Original $= 10 \times 10 = 100\text{cm}^2$

Triangle $= \frac{1}{2} \times 6 \times 7 = 21\text{cm}^2 \rightarrow 100 - 21 = 79$

6. 83.33% : Original $= 8 \times 6 \times 2 = 96\text{cm}^2$

Left $= 8 \times 5 \times 2 = 80 \rightarrow 80 \div 96 \times 100$

Page 2 – Percentage increase / decrease

1. 15% : $52.50 \div 350 \times 100$

2. 8.7% : $\frac{20{,}000}{230{,}000} \times 100$

3. 76% : $\frac{3800}{5000} \times 100$

4. 26.6% : $8 \times 8 = 64, 9 \times 9 = 81$

$81 - 64 = 17 \rightarrow \frac{17}{64} \times 100 = 26.6$

5. 20% : $10 \times 2 \times 6 = 120\text{cm}^3$

Water: $8 \times 2 \times 6 = 96\text{cm}^2$

Amount decreased $= 120 - 96 = 24$

$24 \div 120 \times 100 = 20$

Page 3 – Increasing by a percentage

1. £1,152.00 : Before VAT $= 400 \times 2.40 = £960$

VAT $= £960 \div 100 \times 20 = £192$; $£960 + £192$

2. £345 : Cost $= 0.75 \times 100 \times 4 = £300$

Delivery $= £300 \div 100 \times 15 = £45 \rightarrow £300 + £45$

3. £15.64 : Increase $= £3.40 \div 100 \times 15 = £0.51$

Cost of $200 = 3.40 + 0.51 = £3.91$

$\rightarrow 800 = 4 \times 3.91 = 15.64$

4. 190.44cm^2 : Side length $= \sqrt{144} = 12\text{cm}$

$12 \div 100 \times 15 = 1.8 \rightarrow$ side $= 12 + 1.8 = 13.8$

$\rightarrow$ Area $= 13.8 \times 13.8 = 190.44$

Page 4 – Decreasing by a percentage

1. £1032 : Before discount $= 500 \times 2.40 = £1200$

Discount $= £1200 \div 100 \times 14 = £168$

New price $= 1200 - 168 = 1032$

2. £555 : Cost of flour $= 0.75 \times 800 = £600$

Discount $= 600 \div 100 \times 7.5 = £45$

Amount charged $= £600 - £45$

3. £14.45 : Cost of 1000 pens $= 5 \times £3.40 = £17$

15% cheaper $= 17 \div 100 \times 15 = £2.55$

Cost of pens in bulk $= 17 - 2.55$

4. 64cm^3 : Side length $= \sqrt[3]{125} = 5\text{cm}$

$5 \div 100 \times 20 = 1 \rightarrow$ side $= 5 - 1 = 4$

$\rightarrow$ Volume $= 4 \times 4 \times 4 = 64$