COMPOUND INTEREST AND DEPRECIATION

Number

Key Concepts

We use **multipliers** to increase and decrease an amount by a particular percentage.

Percentage increase:

$Value \times (1 + percentage\ as\ a\ decimal)$

Percentage decrease:

$Value \times (1 - percentage\ as\ a\ decimal)$

Appreciation means that the value of something is going up or increasing.

Depreciation means that the value of something is going down or reducing.

Per annum is often used in monetary questions meaning **per year.**

Examples

Compound interest:

Joe invest £400 into a bank account that pays 3% **compound interest** per annum. Calculate how much money will be in the bank account after 4 years.

$Value \times (1 + percentage\ as\ a\ decimal)^{years}$
$= 400 \times (1 + 0.03)^4$
$= 400 \times (1.03)^4$
= £450.20

Compound depreciation:

The original value of a car is £5000. The value of the car **depreciates** at a rate of 7.5% per annum. Calculate the value of the car after 3 years.

$Value \times (1 - percentage\ as\ a\ decimal)^{years}$
$= 5000 \times (1 - 0.075)^3$
$= 5000 \times (0.925)^3$
= £3957.27

MathsWatch

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Key Words

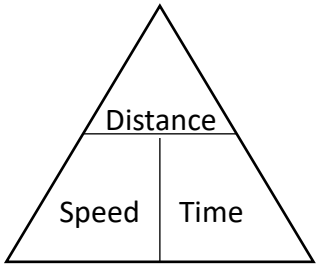
Percent
Appreciate
Depreciate
Interest
Annum
Compound
Multiplier

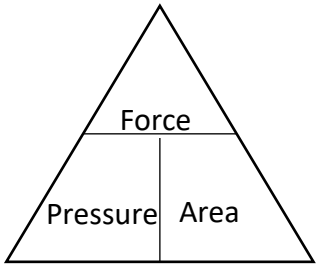
1) Jane invests £670 into a bank account that pays out 4% compound interest per annum. How much will be in the bank account after 2 years?
2) A house has decreased in value by 3% for the past 4 years. If originally it was worth £180,000, how much is it worth now?

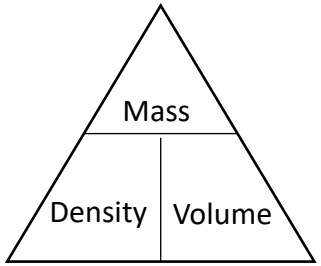
ANSWERS A 1) £724.67 2) £159352.71

COMPOUND MEASURES
Geometry and Measures

Key Concepts





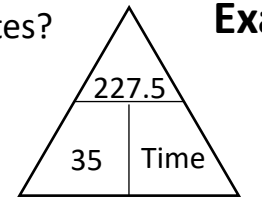


Examples

A car is travelling at a speed of 35mph and is scheduled to travel 227.5 miles. How long will this take in hours and minutes?

$$Time = \frac{distance}{speed}$$

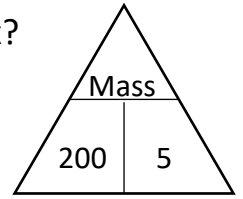
$$Time = \frac{227.5}{35} = 6.5hours = 6\ hours\ 30\ minutes$$



A 5m^3 box has a density of 200g/m^3. What is the mass of the box?

$$Mass = Density \times Volume$$

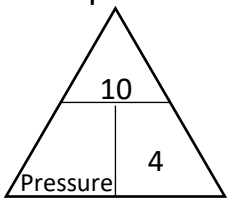
$$Mass = 200 \times 5 = 1000g$$



10N of force are applied to a block with area 4m^2. Calculate the pressure.

$$Pressure = \frac{force}{area}$$

$$Pressure = \frac{10}{4} = 2.5N/m^2$$



MathsWatch

142

Key Words

Speed
Distance
Time
Pressure
Force
Area
Density
Mass
Volume

1) A block exerts a force of 120 Newtons on the ground. The block has an area of 2 m^2.
Work out the pressure on the ground.

2) A piece of gold has a mass of 760 grams and a volume of 40 cm^3.
Work out the density of the piece of gold.

3) Dani leaves her house at 08 00. She drives 63 miles to work. She drives at an average speed of 27 miles per hour. At what time does Dani arrive at work?

ANSWERS 1) 60N/m^2 2) 19g/cm^3 3) 10:20am

DECIMALS
Number

Key concepts

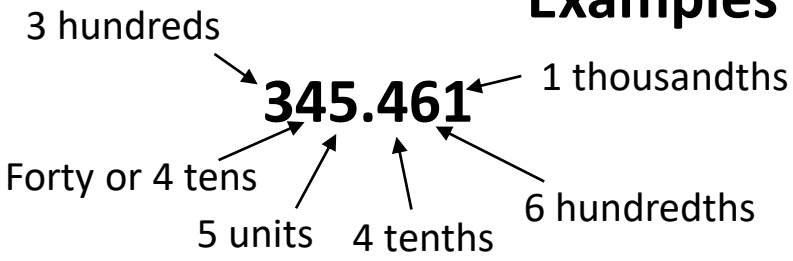
Place value:

Th H T U . t h th

When adding and subtracting decimals we must ensure the decimal places are underneath each other when setting up.

When multiplying decimals, calculate without the decimal point and use estimation to help replace it.

Examples



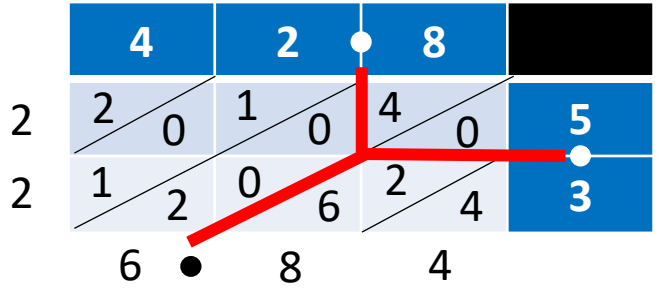
42.8 + 5.32

42.80
+ 5.32
48.12

42.8 − 5.32

3 1 7 1
42.80
- 5.32
37.48

42.8 × 5.3



2 2 6 . 8 4

Estimated answer 40 × 5 = 200

MathsWatch

1, 66, 67

Key Words

Decimal
Tenths
Hundredths
Thousandths

A) What is the value of the 4 in each number?
1) 498 2) 8746 3) 6.243 4) 1.004
B) Work out:
1) 3.1 + 5.27 2) 16.4 – 9.18 3) 0.03 × 500 4) 3.4 × 5.6
5) 4.79 × 6.8

ANSWERS: A 1) 4 hundred 2) forty 3) 4 hundredths 4) 4 thousandths
B 1) 8.37 2) 7.22 3) 15 4) 19.04 5) 32.572

FACTORS, MULTIPLES AND PRIMES

Number

Key Concepts

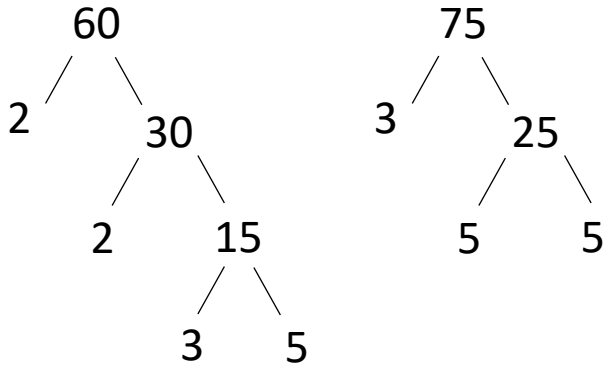
Prime factor decomposition
Breaking down a number into its prime factors

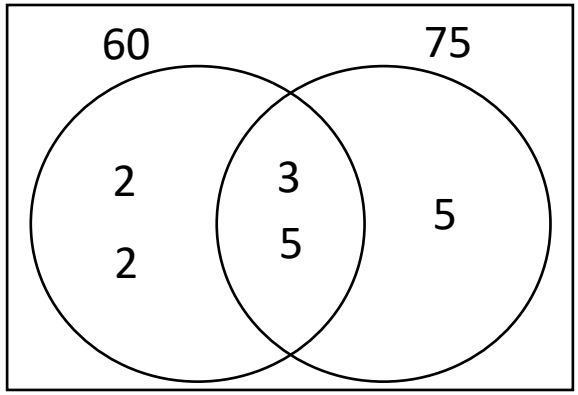
Highest common factor
Finding the largest number which divides into all numbers given

Lowest common multiple
Finding the smallest number which both numbers divide into

Examples

Find the **highest common factor** and **lowest common multiple** of 60 and 75:





$2 \times 2 \times 3 \times 5$

$2^2 \times 3 \times 5$

$3 \times 5 \times 5$

3×5^2

HCF – Mulitiply all numbers in the intersection

$= 3 \times 5 = 15$

LCM – Multiply all numbers in the Venn diagram

$= 2 \times 2 \times 3 \times 5 \times 5 = 300$

MathsWatch

28, 78, 79, 80

Key Words

Factor
Multiple
Prime
Highest Common Factor
Lowest Common Multiple

Questions

1) Write 80 as a product of its prime factors
2) Write 48 as a product of its prime factors
3) Find the LCM and HCF of 80 and 48

ANSWERS: 1) $2^4 \times 5$ 2) $2^4 \times 3$ 3) LCM = 240 and HCF = 16

FOUR OPERATIONS WITH FRACTIONS

Number

Key Concepts

An **improper fraction** is when the numerator is larger than the denominator e.g. $\frac{20}{12}$

Converting from a mixed number into an improper fraction:

$$2\frac{3}{5} = \frac{(2\times 5)+3}{5} = \frac{13}{5}$$

A **reciprocal** is the value that when multiplied by another gives the answer of 1.

Eg. $\frac{1}{8}$ is the reciprocal of 8.

$\frac{2}{5}$ is the reciprocal of $\frac{5}{2}$

Examples

$1\frac{2}{3}+2\frac{1}{4}$

$= \frac{5}{3}+\frac{9}{4}$ — Convert into an improper fraction

$= \frac{20}{12}+\frac{27}{12}$ — Find a common denominator

$= \frac{47}{12}$

$= 3\frac{11}{12}$ — Convert back into a mixed number

$2\frac{2}{3}-1\frac{1}{4}$

$= \frac{8}{3}-\frac{5}{4}$ — Convert into an improper fraction

$= \frac{32}{12}-\frac{15}{12}$ — Find a common denominator

$= \frac{17}{12}$

$= 1\frac{5}{12}$ — Convert back into a mixed number

$1\frac{1}{3}\times 2\frac{3}{4}$

$= \frac{4}{3}\times\frac{11}{4}$ — ×, ×

$= \frac{44}{12}$

$= 3\frac{8}{12}$

$2\frac{1}{3}\div 1\frac{3}{5}$

$= \frac{7}{3}\div\frac{8}{5}$ — Find the reciprocal of the second fraction….

$= \frac{7}{3}\times\frac{5}{8}$ — …and multiply

$= \frac{35}{24}$

$= 1\frac{11}{24}$

MathsWatch

25, 26, 71, 73, 74

Key Words

Fraction
Equivalent
Reciprocal
Numerator
Denominator
Improper/Top heavy
Mixed number

Calculate:

1) $1\frac{2}{3}+2\frac{3}{4}$

2) $3\frac{3}{4}-1\frac{1}{3}$

3) $3\frac{1}{5}\times 1\frac{2}{3}$

4) $1\frac{3}{5}\div 2\frac{7}{10}$

What is the reciprocal of:

5) $\frac{2}{3}$

6) 9

7) 0.75

ANSWERS A 1) $4\frac{5}{12}$ 2) $2\frac{5}{12}$ 3) $5\frac{1}{3}$ 4) $\frac{16}{27}$ 5) $\frac{3}{2}$ 6) $\frac{1}{9}$ 7) $\frac{4}{3}$

FOUR OPERATIONS WITH INTEGERS & DECIMALS

Number

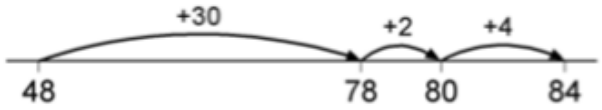
Key Words

Place Value: The value a digit takes when placed in a particular position of a number.

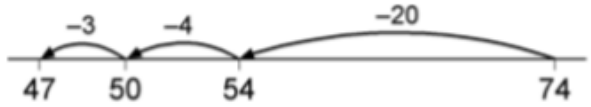
Add Sum Total All together Plus In all	Multiply Product Times Twice Total Multiplied by
Subtract Remain Difference Less than Fewer How many more Minus	Divide Quotient Goes into Split Equally Each

Examples

48 + 36 = 84



74 – 27 = 47 worked by counting back:



$$3\overline{)29^{2}1} \quad 97$$

$$\begin{array}{r} 258 \\ +\ 87 \\ \hline 345 \\ 11 \end{array}$$

$$\begin{array}{r} 3\ 1 \\ 4\ 5 - \\ 2\ 8 \\ \hline 1\ 7 \end{array}$$

$$\begin{array}{r} 38 \\ \times\ 7 \\ \hline 56 \\ 210 \\ \hline 266 \end{array}$$

56 × 27

×	20	7	
50	1000	350	1350
6	120	42	162
			1512
			1

MathsWatch

17, 18, 19,20,
66, 67

Tip

Multiplication and addition are associative, so you can work them out in any order.
So 3 × 4 is the same as 4 × 3.
4 + 3 is the same as 3 + 4

Questions

1) a) 49 + 37 b) 125 + 69 c) 5.6 + 24.8
2) a) 64 – 28 b) 134 – 57 c) 16.2 – 9.5
3) a) 7 × 146 b) 34 × 67 c) 2.9 × 7.2 4) a) 294 ÷ 7 b) 192 ÷ 6

ANSWERS : 1) a) 86 b) 194 c) 30.4 2) a) 36 b) 77 c) 6.7
3) a) 1022 b) 2278 c) 20.88 4) a) 42 b) 32

FRACTIONS, DECIMALS AND PERCENTAGES
Number

Key Concepts

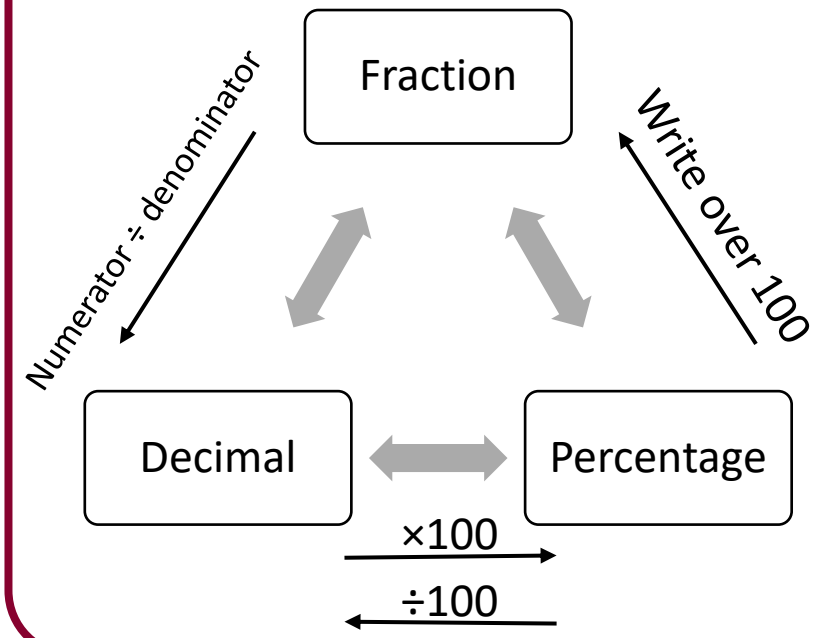
A **fraction** is a numerical quantity that is not a whole number.

A **decimal** is a number written using a system of counting based on the number 10.

Thousands	Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
8	7	6	5	.	4	3	2

A **percentage** is an amount out of 100.

Examples



Order the following in ascending order:

$\frac{3}{5}$ 62% 0.67 $\frac{7}{10}$ 0.665

×20 → $\frac{60}{100}$; ×100 ; ×10 → $\frac{70}{100}$; ×100

60% 62% 67% 70% 66.5%

$\frac{3}{5}$ 62% 0.665 0.67 $\frac{7}{10}$

MathsWatch

84, 85, 88, 89,

Key Words

Fraction
Decimal
Percentage
Division
Multiply

1) Convert the following into percentages:
   a) 0.4 b) 0.08 c) $\frac{6}{20}$ d) $\frac{3}{25}$
2) Compare and order the following in ascending order:

$\frac{3}{4}$ 76% 0.72 $\frac{4}{5}$ 0.706

ANSWERS 1a) 40% b) 8% c) 30% d) 12% 2) 0.706 0.72 $\frac{3}{4}$ 76% $\frac{4}{5}$

FRACTIONS
Number

Key Concepts

$\frac{x}{y}$ → Numerator / Denominator

Equivalent fractions have the same value as one another.

Eg. $\frac{1}{4} = \frac{2}{8} = \frac{3}{12}$

Examples

Calculate $\frac{4}{5}$ of 65:

$65 \div 5 = 13$ ← Divide by the denominator

$13 \times 4 = 52$ ← Multiply this by the numerator

$\frac{4}{5}$ of a number is 52, what is the original number?

$52 \div 4 = 13$ ← Divide by the numerator

$13 \times 5 = 65$ ← Multiply this by the denominator

Order these fractions in ascending order:

$\frac{2}{5}$ ×6 → $\frac{12}{30}$ (1)

$\frac{1}{2}$ ×15 → $\frac{15}{30}$ (3)

$\frac{5}{6}$ ×5 → $\frac{25}{30}$ (4)

$\frac{7}{15}$ ×2 → $\frac{14}{30}$ (2)

To be able to compare fractions we must have a **common denominator**

MathsWatch

24, 25, 26, 70, 72

Key Words

Fraction
Equivalent
Reciprocal
Numerator
Denominator

1) Calculate $\frac{2}{7}$ of 56.

2) $\frac{3}{8}$ of a number is 36, what is the original number?

3) Order the following in ascending order: $\frac{2}{3}$ $\frac{5}{6}$ $\frac{3}{8}$ $\frac{7}{12}$

ANSWERS A 1) 16 2) 96 3) $\frac{3}{8}$ $\frac{7}{12}$ $\frac{2}{3}$ $\frac{5}{6}$

INDICES AND ROOTS
Algebra

Key Concepts

$a^m \times a^n = a^{m+n}$

$a^m \div a^n = a^{m-n}$

$(a^m)^n = a^{mn}$

$a^{\frac{1}{n}} = \sqrt[n]{a}$

$a^{-m} = \frac{1}{a^m}$

Examples

Simplify each of the following:

1) $a^6 \times a^4 = a^{6+4}$
$= a^{10}$

2) $a^6 \div a^4 = a^{6-4}$
$= a^2$

3) $(a^6)^4 = a^{6\times4}$
$= a^{24}$

4) $(3a^4)^3 = 3^3a^{4\times3}$
$= 27a^{12}$

5) $\frac{5^2 \times 5^6}{5^4} = \frac{5^8}{5^4}$
$= 5^{8-4}$
$= 5^4$

6) $a^{\frac{1}{2}} = \sqrt{a}$

7) $9^{\frac{1}{2}} = \sqrt{9}$
$= 3 \text{ or } -3$

8) $2^{-3} = \frac{1}{2^3} = \frac{1}{8}$

MathsWatch

29 82 154 188 131

Key Words

Powers
Roots
Indices
Reciprocal

Simplify:

1) $a^3 \times a^2$ 2) $b^4 \times b$ 3) $d^{-5} \times d^{-1}$ 4) $m^6 \div m^2$ 5) $n^4 \div n^4$

6) $\frac{8^4 \times 8^5}{8^6}$ 7) $\frac{4^9 \times 4}{4^3}$ 8) $(3^2)^5$ 9) $81^{\frac{1}{2}}$ 10) 5^{-2}

ANSWERS: 1) a^5 2) b^5 3) d^{-6} 4) m^4 5) 1 6) 8^3 7) 4^7 8) 3^{10} 9) 9 or −9 10) $\frac{1}{25}$

INTEGERS, ROUNDING AND PLACE VALUE
Number

Key Concepts

Digits are the individual components of a number.

Integers are whole numbers.

Rounding rules:
A value of 5 to 9 rounds the number up.
A value of 0 to 4 keeps the number the same.

Examples

Order the following numbers starting with the smallest:

1) 5, -3, 4, 7, -2
-3, -2, 4, 5, 7

2) 0.067 0.6 0.56 0.65 0.605
Rewrite 0.067, 0.600, 0.560, 0.650, 0.605
0.067 0.56 0.6 0.605 0.65

Round 3.527 to:

a) 1 decimal place
3 . 5 | 2 7 → 3.5

b) 2 decimal places
3 . 5 2 | 7 → 3.53

c) 1 significant figure
3 | . 5 2 7 → 4

MathsWatch

2, 3, 31, 32, 90

Key Words

Integer
Digit
Decimal place
Significant figures
Even
Odd

A) Order the following numbers starting with the smallest:
1) 6, -2, 0, -5, 3 2) 0.72, 0.7, 0.072, 0.07, 0.702

B) Round the following numbers to the given degree of accuracy
1) 14. 1732 (1 d.p.) 2) 0.0568 (2 d.p.) 3)3418 (1 S.F)

ANSWERS: A1) -5, -2, 0, 3, 6 2) 0.07, 0.072, 0.7, 0.702, 0.72
B1) 14.2 2) 0.06 3) 3000

ORDER OF OPERATIONS

Number

Key Concept

B Brackets

I Indices

D Division

M Multiplication

A Addition

S Subtraction

If a calculation contains the looped calculations work from left to right.

MathsWatch

75

Key Words

Operation: In maths these are the functions × ÷ + -.

Commutative: Calculations are commutative if changing the order does not change the result.

Associative: In these calculations you can re-group numbers and you will get the same answer.

Indices: These are the squares, cubes and powers.

Tip

- Put brackets around the calculations which need to be done first.
- Indices also includes roots.

Examples

$$5 \times 4 - 8 \div 2$$

$$20 \quad - \quad 4 \quad = \mathbf{16}$$

$$(2^2 + 6)^2 \times 4 - 8$$

$$(4 + 6)^2 \times 4 - 8$$

$$(10)^2 \times 4 - 8$$

$$100 \times 4 - 8$$

$$400 - 8 = \mathbf{392}$$

Questions

1) $7 - 10 \div 2$
2) $4^3 - 13 \times 4$
3) $21 \div 7 - 2$
4) $12 \div (7 - 3)$
5) $20 \div 2^2$
6) $(16 - 13) \div 3$
7) Place brackets to make the calculation work $20 \div 5 - 3 = 10$

ANSWERS: 1) 2 2) 12 3) 1 4) 3 5) 5 6) 1 7) $20 \div (5 - 3) = 10$

PERCENTAGE CHANGE AND REVERSE PERCENTAGES

Number

Key Concepts

Calculating percentages of an amount without a calculator:

10% = divide the value by 10
1% = divide the value by 100

Calculating percentages of an amount with a calculator:

Amount × percentage as a decimal

Calculating percentage increase/decrease:

Amount × (1 ± percentage as a decimal)

Percentage change:

A dress is reduced in price by 35% from £80. What is it's **new price**?

$Value \times (1 - percentage\ as\ a\ decimal)$
$= 80 \times (1 - 0.35)$
= £52

A house price appreciates by 8% in a year. It originally costs £120,000, what is the **new value** of the house?

$Value \times (1 + percentage\ as\ a\ decimal)$
$= 120{,}000 \times (1 + 0.08)$
= £129,600

Reverse percentages: This is when we are trying to find out the original amount.

A pair of trainers cost £35 in a sale. If there was 20% off, what was the **original price** of the trainers?

$Value \div (1 - 0.20)$
$= 35 \div 0.8$
= £43.75

A vintage car has increased in value by 5%, it is now worth £55,000. What was it worth **originally**?

$Value \div (1 + 0.05)$
$= 55{,}000 \div 1.05$
= £52,380.95

Examples

MathsWatch

109, 110

Key Words

Percent
Increase/decrease
Reverse
Multiplier
Inverse

1a) Decrease £500 by 6%
b) Increase 70 by 8.5%
2) A camera costs £180 in a 10% **sale**. What was the **pre-sale** price
3) The cost of a holiday, including **VAT** at 20% is £540. What is the **pre-VAT** price?

ANSWERS A 1a) £470 b) £75.95 2) £200 3) £450

PERCENTAGES
Number

Key Concepts

Calculating percentages of an amount without a calculator:

10% = divide the value by 10
1% = divide the value by 100

Calculating percentages of an amount with a calculator:

Amount × percentage as a decimal

Calculating percentage increase/decrease:

Amount × (1 ± percentage as a decimal)

Calculating a percentage – non calculator:

Calculate 32% of 500g:

10% ⟶ 500 ÷ 10 = 50
30% ⟶ 50 × 3 = 150
1% ⟶ 500 ÷ 100 = 5
2% ⟶ 5 × 2 = 10

32% = 150 + 10 = 160g

Calculating a percentage – calculator:

Calculate 32% of 500g:

$Value \times (percentage \div 100)$
$= 500 \times 0.32$
= 160g

Examples

Percentage change:

A dress is reduced in price by 35% from £80. What is it's **new price**?

$Value \times (1 - percentage\ as\ a\ decimal)$
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= £129,600

MathsWatch

40, 86, 87, 108

Key Words

Percent
Increase/decrease
Appreciate
Depreciate
Multiplier
Divide

1) Write the following as a decimal multiplier: a) 45% b) 3% c) 2.7%
2) Calculate 43% of 600 without using a calculator
3) Calculate 72% of 450 using a calculator
4a) Decrease £500 by 6%
b) Increase 65g by 24%
c) Increase 70m by 8.5%

ANSWERS 1a) 0.45 b) 0.03 c) 0.027 2) 258 3) 324 4a) £470 b) 80.6g c) 75.95m

PLACE VALUE, DECIMALS & USING SCALES

Number

Key Concept

Multiply/Divide by powers of 10

10 000	1000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$

Multiplying

X 10 digits move LEFT **1** space
X 100 digits move LEFT **2** spaces
X 1000 digits move LEFT **3** spaces

Dividing

÷ 10 digits move RIGHT **1** space
÷ 100 digits move RIGHT **2** spaces
÷ 1000 digits move RIGHT **3** spaces

Key Words

Decimal: A number that contains a point.

Metric measure: The unit used to measure length, mass etc.

Scale: The conversion to convert between drawings and real life sizes.

Examples

Ordering Decimals

0.3, 0.21, 0.305, 0.38, 0.209

Add zero's so that they all have the same number of decimal places.

0.300, 0.210, 0.305, 0.380, 0.209

Then they can be placed in order:

0.209, 0.21, 0.3, 0.305, 0.38

Multiplying/Dividing by powers of 10

3.4×100

100	10	1	$\frac{1}{10}$
		3	4
3	4	0	

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1, 3, 30

Tip

- Add digits when ordering decimals.
- The number of zero's tells you the number of places to move the digits.

Questions

1) Order 1.52, 1.508, 1.5, 1.05, 1.51

2) Work out a) 1.35×10 b) 0.6×100 c) $4.5 \div 100$

3) Convert a) 36 mm to cm b) 7 cm to mm c) 450 cm to m
d) 620 g to kg e) 4.2 kg to g f) 0.7 kg to g

ANSWERS: 1) 1.05, 1.5, 1.508, 1.51, 1.52 2) a) 13.5 b) 60 c) 0.045
3) a) 3.6cm b) 70mm c) 4.5m d) 0.62kg e) 4200 f) 700g

PROFIT AND LOSS
Number

Key Concepts

A person or company makes a **profit** when they have a **financial gain**. It is the difference between the price a product is sold for and the price it was originally bought for. It will be a **positive** value.

A person or company makes a **loss** when they **lose money**. It is the difference between the price a product is sold for and the price it was originally bought for. It will be a **negative** value.

Calculating percentage change:

$$\frac{\textit{sell price} - \textit{original price}}{\textit{orginal price}} \times 100$$

Examples

A house is valued at £200,000 in 2018. It was sold in 2020 for a price of £240,000.
What percentage profit was made on this house?

$$\textit{Profit} = \frac{240000 - 200000}{200000} \times 100$$

$$= 20\% \textit{ Profit}$$

A car originally cost £8500. It was sold to another owner 3 years later for a price of £5000.
What percentage loss was made on this car?

$$\textit{Loss} = \frac{5000 - 8500}{5000} \times 100$$

$$= -70\%$$

$$= 70\% \textit{ Loss}$$

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Key Words
Profit
Loss
Percentage
Financial

1) A market seller buys a box of apples for £5. He sells all of the apples for a total of £5.50. What is the percentage profit made on the apples?
2) A mobile phone was originally bought for £800. It was resold 2 years later for a price of £350. What was the percentage loss of the phone?

ANSWERS 1) 10% profit 2) 56.25% loss

STANDARD FORM
Number

Key Concepts

We use standard form to write a very large or a very small number in scientific form.

Must be $\times 10$
b is an integer

$$a \times 10^b$$

Must be $1 \leq a < 10$

Examples

Write the following in **standard form**:

1) 3000 = 3×10^3

2) 4580000 = 4.58×10^6

3) 0.0006 = 6×10^{-4}

4) 0.00845 = 8.45×10^{-3}

Calculate the following, write your answer in **standard form**:

1) $(3 \times 10^3) \times (5 \times 10^2)$

$3 \times 5 = 15$
$10^3 \times 10^2 = 10^5$
15×10^5
$= 1.5 \times 10^6$

2) $(8 \times 10^7) \div (16 \times 10^3)$

$8 \div 16 = 0.5$
$10^7 \div 10^3 = 10^4$
0.5×10^4
$= 5 \times 10^3$

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Key Words
Standard form
Base 10

Links
Science

A) Write the following in standard form:
1) 74 000 2) 1 042 000 3) 0.009 4) 0.000 001 24
B) Work out:
1) $(5 \times 10^2) \times (2 \times 10^5)$ 2) $(4 \times 10^3) \times (3 \times 10^8)$
3) $(8 \times 10^6) \div (2 \times 10^5)$ 4) $(4.8 \times 10^2) \div (3 \times 10^4)$

ANSWERS: A1) 7.4×10^4 2) 1.042×10^6 3) 9×10^{-3} 4) 1.24×10^{-6}
B1) 1×10^8 2) 1.2×10^{12} 3) 4×10 4) 1.6×10^{-2}