**Breda Academy**

**Numeracy** **Booklet**

**A** **guide** **for** **staff, parents & pupils**

## What is the purpose of the booklet?

This booklet has been produced to give guidance to pupils and parents on how certain common Numeracy topics are taught in mathematics and throughout the school. Staff from all departments have been issued with a copy of the booklet, and it is hoped that with a consistent approach across all subjects’ pupils will progress successfully.

**How** **can** **it** **be** **used?**

The booklet includes Numeracy skills useful in subjects other than mathematics. There is also a useful Mathematical Words Dictionary for reference at the back.

## Why do some topics include more than one method?

In some cases (e.g., percentages), the method used will be dependent on the level of difficulty of the question, and whether or not a calculator is permitted.

For mental calculations, pupils should be encouraged to develop a variety of strategies so that they can select the most appropriate method in any given situation.

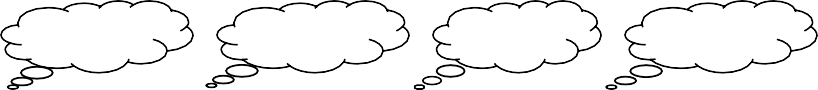
**Showing Working Out**

Pupils are always encouraged to write down all steps of calculations, especially at KS4 as marks are awarded for this. Even in a calculator question all steps must be shown.

**Units**

Some questions my contain units of measure. Pupils must include units in their answer to these questions too.

|  |  |
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# Mental strategies

There are a number of useful mental strategies for addition. Some examples are given below.

**Example** Calculate 54 + 27

**Method** **1** Add tens, then add units, then add together.

50 + 20 = 70 4 + 7 = 11 70 + 11 = 81

**Method** **2** Split up the **number** **to** **be** **added** into tens and units and add separately.

54 + 20 = 74 74 + 7 = 81

**Method** **3** Round up to nearest 10, then subtract.

54 + 30 = 84 but 30 is 3 too much so subtract 3;

84 - 3 = 81

# Written Method

When adding numbers, ensure that the numbers are lined up according to place value. Start at right hand side, write down units, carry tens.

**Example** Add 3032 and 589

|  |  |  |  |
| --- | --- | --- | --- |
| 3032 | 3032 | 3032 | 3032 |
| +5819 | +51819 | +51819 | +51819 |
| 1 | 21 | 621 | 3621 |
| 2 + 9 = 11 | 3+8+1=12 | 0+5+1=6 | 3 + 0 = 3 |



We use decomposition as a written method for subtraction (see below). Alternative methods may be used for mental calculations.

**Mental** **Strategies**

**Example**

Calculate 93 - 56

**Method** **1** Break up the number being subtracted

e.g. subtract 50, then subtract 6

93 – 50 = 43

43 – 6 = 37

6 50

37

43

93

Start

**Method** **2** Count on

Count on from 56 until you reach 93. This can be done in several ways e.g.

4

30

3

= 37

56

60

70

80

90 93

**Written** **Method**

**Example** **1** 4590 – 386

458910

- 386

4204

**Example** **2**

Subtract 692 from 14597

14597

- 692

13905

3 1

**We** **do** **not** **“borrow** **and** **pay** **back”.**



It is essential that you know all of the multiplication tables from 1 to 10. These are shown in the tables square below.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 |
| 4 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 |
| 5  6  7  8  9  10 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 |
| 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 |
| 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 |
| 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 |
| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |

# Mental Strategies

**Example** Find 39 x 6

## Method 1

30 x 6

= 180

9 x 6

= 54

180 + 54

= 234

## Method 2

40 x 6

=240

40 is 1 too many

so, take away 6x1

240 - 6

= 234



**Multiplying** **by** **multiples** **of** **10** **and** **100**

To multiply by **10** you move every digit ***one*** place to the left.

To multiply by **100** you move every digit ***two***

places to the left.

**Example** **1** (a) Multiply 354 by 10 (b) Multiply 50.6 by 100

Th H T U

3 5 4

Th H T U  t

5 0  6

3 5

4 0

5

0 6

0  0

354 x 10 = 3540

50.6 x 100 = 5060

(c) 35 x 30

(d) 436 x 600

35 x 3 = 105

436 x 6

= 2616

105 x 10 = 1050 2616 x 100 = 261600

so, 35 x 30 = 1050

so, 436 x 600 = 261600

We may also use these rules for multiplying decimal numbers.

**Example** **2** (a) 2.36 x 20

(b) 38.4 x 50

2.36 x 2 = 4.72

4.72 x 10 = 47.2

38.4 x 5 = 192.0

192.0x 10 = 1920

so, 2.36 x 20 = 47.2

so, 38.4 x 50 = 1920

To multiply by 30, multiply by 3,

then by 10.

To multiply by 600, multiply by 6,

then by 100.



You should be able to divide by a single digit or by a multiple of 10 or 100 without a calculator.

**Written** **Method**

**Example** **1** There are 192 pupils in first year, shared equally between 8 classes. How many pupils are in each class?

2 4

8 1 932

There are 24 pupils in each class

**Example** **2** Divide 4.74 by 3

1 . 5 8

3 4 . 1724

**Example** **3** A jug contains 2.2 litres of juice. If it is poured evenly into 8 glasses, how much juice is in each glass?

0 . 2 7 5

8 2 .226040

Each glass contains

0.275 litres

**When** **dividing** **a** **decimal** **number** **by** **a** **whole** **number,** **the** **decimal** **points** **must** **stay** **in** **line.**

**If** **you** **have** **a** **remainder** **at** **the** **end** **of** **a** **calculation,** **write** **a** **zero** **at** **the** **end** **of** **the** **decimal** **and** **continue** **with** **the** **calculation.** **This** **continues** **until** **no** **remainder** **is** **achieved.**

Consider this: What is the answer to 2 + 5 x 8 ? Is it 7 x 8 = 56 or 2 + 40 = 42 ?

The correct answer is 42.

Calculations which have more than one operation need to be done in a particular order. The order can be remembered by using the mnemonic **BODMAS**

The **BODMAS** rule tells us which operations should be done first.

**BODMAS** represents:

**(B)rackets** **(O)f**

**(D)ivide** **(M)ultiply** **(A)dd** **(S)ubract**

Scientific calculators use this rule, some basic calculators may not, so take care in their use.



**Example** **1** 15 – 12  6 BODMAS tells us to divide first

|  |  |  |  |
| --- | --- | --- | --- |
| = 15 –  = 13 | | 2 | |
| **Example** **2** | (9 + 5) x 6  = 14 x 6  = 84 | | BODMAS tells us to work out the brackets first |
| **Example** **3** | 18 + 6  (5-2)  = 18 + 6  3  = 18 + 2  = 20 | | Brackets first Then divide Now add |



To find the value of a variable in a formula, we must substitute all of the given values into the formula, then use BODMAS rules to work out the answer.

**Example** **1**

Use the formula *P* *=* 2*L* *+* 2*B* to evaluate *P* when *L* = 12 and *B* = 7.

*P* = 2*L* + 2*B*

*P* = 2 x 12 + 2 x 7

*P* = 24 + 14

*P* = 38

Step 1: write formula

Step 2: substitute numbers for letters Step 3: start to evaluate (BODMAS) Step 4: write answer

**Example** **2**

Use the formula *I* = *V*

*R*

to evaluate I when *V* = 240 and *R* = 40

*I* = *V*

*I* = 240

*R*

40

*I* = 6

**Example** **3**

Use the formula *F* = 32 + 1.8*C* to evaluate *F* when C = 20

*F* = 32 + 1.8*C*

*F* = 32 + 1.8 x 20

*F* = 32 + 36

*F* = 68



Numbers can be rounded to give an approximation.

2652

2600 2610 2620 2630 2640 2650 2660 2670 2680 2690 2700

26**5**2 rounded to the nearest 10 is 2650.

2**6**52 rounded to the nearest 100 is 2700.

When rounding numbers which are exactly in the middle, the convention is to **round** **up**.

78**6**5 rounded to the nearest 10 is 78**7**0.

The same principles apply to rounding decimal numbers.

In general, to round a number, we must first identify the place value to which we want to round. We must then look at the next digit to the right - if it is 5 or more round up.

**Example** **1** Round 46 753 to the nearest thousand.

6 is the digit in the thousand’s column - the next digit (in the hundreds column) is a 7, so round up.

4**6** 753

= 47 000 to the nearest thousand

**Example** **2** Round 1.57359 to 2 decimal places

The second number after the decimal point is a 7 - the next digit (the third number after the decimal point) is a 3, so round down.

1.5**7**359

= 1.57 to 2 decimal places

We can use rounded numbers to give us an approximate answer to a calculation. This allows us to check that our answer is sensible.

## Example 1

Tickets for a concert were sold over 4 days. The number of tickets sold each day was recorded in the table below. How many tickets were sold in total?

|  |  |  |  |
| --- | --- | --- | --- |
| Monday | Tuesday | Wednesday | Thursday |
| 486 | 205 | 197 | 321 |

Estimate = 500 + 200 + 200 + 300 = 1200

Calculate:

486

205

197

+321

1209

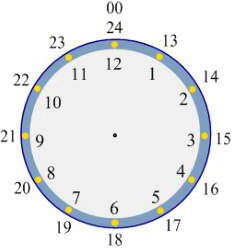
Answer = 1209 tickets



## Example 2

A bar of chocolate weighs 42g. There are 48 bars of chocolate in a box. What is the total weight of chocolate in the box?

Estimate = 50 x 40 = 2000g Calculate: 42 x 48 = 2016g



Time may be expressed in 12 or 24 hour notation.

**12-hour** **clock**

Time can be displayed on an analogue clock face, or digital clock.

These clocks both show quarter past five.

When writing times in 12 hour notation, we need to add a.m. or p.m. after the time.

a.m. is used for times between midnight and 12 noon (morning)

p.m. is used for times between 12 noon and midnight (afternoon / evening).

**24-hour** **clock**

In 24 hour clock, the hours are written as numbers bet ween 00 and 24. Midnight is expressed as 00 00, or 24 00. After 12 noon, the

hours are numbered 13, 14, 15 … etc.

**Examples**

9.55 am

3.35 pm

12.20 am

02 16 hours

20 45 hours

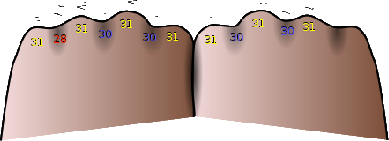
09 55

15 35

00 20

2.16 am

8.45 pm



It is essential to know the number of months, weeks and days in a year, and the number of days in each month.

**Time** **Facts**

In 1 year, there are:

365 days (366 in a leap year) 52 weeks

12 months

A **decade** is 10 years. A **century** is 100 years.

The number of days in each month can be remembered using the rhyme: “30 days hath September,

April, June and November, All the rest have 31, Except February alone, which has 28 days clear, And 29 in each leap year.”

There is also an easy way to remember the days in a month using your knuckles.

Put your hands together leaving out your thumb knuckle as shown above. Begin counting through the months from your furthest left knuckle, counting in turn the knuckles and the grooves in between.

**Rule:** Every month which lands on a knuckle has 31 days. Every month which lands on a groove has 30 days (except February 28 days or 29 in leap year)

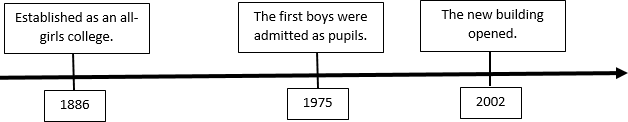


**Timelines**

A timeline represents a period of time, on which important events are marked.

**Example** **1**

Below is a timeline of a school:



**Example** **2**

For how many years was it an all-girls College?

4 + 10 + 70 + 5 = **89** **years**

*Look* *back* *at* *‘subtraction’* *for* *other* *possible* *methods.*

**Important** **Information**

B.C -> Before Christ

A.D -> Anno Domini (*in* *the* *year* *of* *our* *Lord*)

**Distance,** **Speed** **and** **Time**.

For any given journey, the distance travelled depends on the speed and the time taken. If speed is constant, then the following formulae apply:

Distance = Speed x Time or D = S T We can

remember

these

Speed = Distance D formulae in

Time or S = T the following

triangle:

Time = Distance D D

Speed or T = S

S T

**Example** **One** Calculate the speed of a train which travelled

D

450 km in 5 hours S = T

S = 450

5

S = 90 km/h

**Example** **Two** Calculate the distance travelled at a speed of 15km/h for 3 and a half hours.

D = S T

D = 15 x 3.5 D = 52.5km

**Example** **Three** Calculate the time it takes for Kathryn to walk to school, a distance of 5km, at a speed of 4 km/h.

D T = S

5

T = 4 = 1.25h

= 1 hour 15 minutes

**Important** **Note** In these formulae time must be written as a

decimal fraction of an hour.

To convert a number of minutes into a decimal fraction divide by 60. To convert a decimal fraction of an hour into minutes multiply by 60.

**Distance,** **Speed** **and** **Time**.

For any given journey, the distance travelled depends on the speed and the time taken. If speed is constant, then the following formulae apply:

Distance = Speed x Time or D = S T

Speed = Distance

Time

or S = D

T

Time = Distance

Speed

or T = D

S

**Example** **One**

Calculate the speed of a train which travelled 450 km in 5 hours S = D

S = 450

T

5

S = 90 km/h

**Example** **Two**

Calculate the distance travelled at a speed of 15km/h for 3 and a half hours.

D = S T

D = 15 x 3.5 D = 52.5km

**Example** **Three**

Calculate the time it takes for Kathryn to walk to school, a distance of 5km, at a speed of 4 km/h.

T = D

T = 5 = 1.25h

S

4

= 1 hour 15 minutes

**Important** **Note** In these formulae time must be written as a

decimal fraction of an hour.

To convert a number of minutes into a decimal fraction divide by 60. To convert a decimal fraction of an hour into minutes multiply by 60.

Addition, subtraction, multiplication and division of fractions are studied in mathematics.

However, the examples below may be helpful in all subjects.

# Understanding Fractions

## Example

A necklace is made from black and white beads.

What fraction of the beads are black?

There are 3 black beads out of a total of 7, so are black.

# Equivalent Fractions

## Example

What fraction of the flag is shaded?

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

6 out of 12 squares are shaded. So is shaded. This is also equal or equivalent to



**Simplifying** **Fractions**

The top of a fraction is called the **numerator**, the bottom is called the **denominator**.

To simplify a fraction, divide the **numerator** and

**denominator** of the fraction by the same number.

**Example** **1**

(a)

÷5

=

÷5

(b)

20

25

4

5

16

24

÷8

=

÷8

2

3

This can be done repeatedly until the numerator and denominator are the smallest possible numbers - the fraction is then said to be in it’s **simplest** **form**.

**Example** **2** Simplify 72

84

84 42 21 7

72 = 36 = 18 =

6 (simplest form)

**Calculating** **Fractions** **of** **a** **Quantity**

To find a fraction of a quantity, divide by the denominator, then multiply the answer by the numerator. To find 1 divide by 2, to find 1 divide by 3, to find

2

3

7

3 divide by 7, then multiply by 3 etc.

**Example** **1**

**Example** **2**

Find of £150

Find of 48

of £150 = 150 ÷ 5

= £30

of 48 = 48 ÷ 4 x 3

= 12 x 3

= 36

|  |  |  |
| --- | --- | --- |
| Percent means out of 100.  A percentage can be converted to an equivalent fraction or decimal.  36% means 36  100  36% is therefore equivalent to 9 and 0.36  25  **Common** **Percentages**  Some percentages are used very frequently. It is essential to know and recall these as fractions and decimals. | | |
| Percentage | Fraction | Decimal |
| 1% | 1  100 | 0.01 |
| 10% | 1  10 | 0.1 |
| 20% | 1  5 | 0.2 |
| 25% | 1  4 | 0.25 |
| 331/3% | 1  3 | 0.333… |
| 50% | 1  2 | 0.5 |
| 662/3% | 2  3 | 0.666… |
| 75% | 3  4 | 0.75 |
|  | | |



There are many ways to calculate percentages of a quantity. Some of the common ways are shown below.

**Non-Calculator** **Methods**

**Method** **1** **Using** **Equivalent** **Fractions**

**Example**

Find 25% of £640

25% of £640 = 1 of £640

4

= £640 ÷ 4 = £160

**Method** **2** **Using** **1%**

In this method, first find 1% of the quantity (by dividing by 100), then multiply to give the required value.

**Example**

Find 9% of 200g

1% of 200g = 1 of 200g = 200g ÷ 100 = 2g

100

so 9% of 200g = 9 x 2g = 18g

**Method** **3** **Using** **10%**

This method is similar to the one above. First find 10% (by dividing by 10), then multiply to give the required value.

**Example**

Find 70% of £35

10% of £35 = 1 of £35 = £35 ÷ 10 = £3.50

10

so 70% of £35 = 7 x £3.50 = £24.50



**Non-Calculator** **Methods** **(continued)**

The previous 2 methods can be combined to calculate any percentage.

**Example**

Find 23% of £15000

10% of £15000 = £1500 so 20% = £1500 x 2 = £3000

1% of £15000 = £150 so 3% = £150 x 3 = £450

23% of £15000

= £3000 + £450

= £3450

**Finding** **VAT** **(without** **a** **calculator)**

Value Added Tax (VAT) = 20% (from 4th January 2010) To find VAT, divide by 5.

**Example**

Calculate the total price of a computer which costs £650 excluding VAT

20% of £650 = of 650

= 650 ÷ 5

= 130

Total price = 650 + 130

= £780



**Calculator** **Method**

To find the percentage of a quantity using a calculator, divide the amount by 100 then multiply by the percentage.

**Example** **1** Find 23% of £15000

15000 ÷ 100 x 23 = £3450

We do not use the % button on calculators. The methods taught in the mathematics department are all based on this shown method.

**Example** **2** House prices increased by 19% over a one year period. What is the new value of a house which was valued at

£236000 at the start of the year?

236000 ÷ 100 x 19 = £44840

Value at end of year = original value + increase

= £236000 + £44840

= £280840

The new value of the house is £280840



**Finding** **the** **percentage**

To find a percentage of a total, first make a fraction. Convert to a percentage by dividing the top by the bottom and multiplying by 100.

**Example** **1** There are 30 pupils in Class A3. 18 are girls.

What percentage of Class A3 are girls?

18

30

= 18  30 x 100 = 60%

60% of A3 are girls

**Example** **2** James scored 36 out of 44 in his biology test. What is his percentage mark?

Score = 36

44

36 ÷ 44 x 100 = 0.81818… x 100

= 81.818..% = 81.82% (to two decimal places)

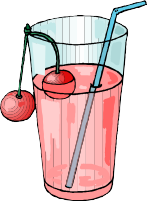
**Example** **3** In class P1, 14 pupils had brown hair, 6 pupils had blonde hair, 3 had black hair and 2 had red hair. What percentage of the pupils were blonde?

Total number of pupils = 14 + 6 + 3 + 2 = 25 6 out of 25 were blonde, so,

6 x 100 = 24%

25

24% were blonde.



When quantities are to be mixed together, the ratio, or proportion of each quantity is often given. The ratio can be used to calculate the amount of each quantity, or to share a total into parts.

**Writing** **Ratios**

**Example** **1**

To make a fruit drink, 4 parts water is mixed with 1 part of cordial.

The ratio of water to cordial is 4:1 (said “4 to 1”)

The ratio of cordial to water is 1:4.

**Example** **2**

In a bag of balloons, there are 5 red, 7 blue and 8 green balloons.

The ratio of red : blue : green is 5 : 7 : 8

**Simplifying** **Ratios**

Ratios can be simplified in much the same way as fractions.

**Example** **1**

Purple paint can be made by mixing 10 tins of blue paint with 6 tins of red. The ratio of blue to red can be written as 10 : 6

It can also be written as 5 : 3, as it is possible to split up the tins into 2 groups, each containing 5 tins of blue and 3 tins of red.

**B B B B B R R R**

**B B**

**B B B R R R**

Blue : Red = 10 : 6

= 5 : 3

**Order** **is** **important** **when** **writing** **ratios.**

To simplify a ratio, divide each figure by the highest common factor.

**Simplifying** **Ratios** **(continued)**

**Example** **2**

Simplify each ratio:

(a) 4:6

(b) 24:36

(c) 6:3:12

(a) 4:6

= 2:3

(b) 24:36

= 2:3

(c) 6:3:12

= 2:1:4

**Example** **3**

Concrete is made by mixing 20 kg of sand with 4 kg of cement. Write the ratio of sand : cement in its simplest form

Sand : Cement = 20 : 4

= 5 : 1

**Using** **ratios**

The ratio of fruit to nuts in a chocolate bar is 3 : 2. If a bar contains 15g of fruit, what weight of nuts will it contain?

Fruit 3

x5

15

Nuts 2

x5

**10**

So the chocolate bar will contain 10g of nuts.

Divide each figure by 2

Divide each figure by 12

Divide each figure by 3

**Sharing** **in** **a** **given** **ratio**

**Example**

Lauren and Sean earn money by washing cars. By the end of the day they have made £90. As Lauren did more of the work, they decide to share the profits in the ratio 3:2. How much money did each receive?

Step 1

Add up the numbers to find the total number of parts

3 + 2 = 5

Step 2

Divide the total amount by this number to find the value of one part

90 ÷ 5 = £18

Step 3

Multiply to find the value of each part

3 x £18 = £54

2 x £18 = £36

Step 4

Check that the total is correct

£54 + £36 = £90

Lauren received £54 and Sean received £36

Two quantities are said to be in direct proportion if when one doubles the other doubles.

We can use proportion to solve problems.

It is often useful to make a table when solving problems involving proportion.

## Example 1

A car factory produces 1500 cars in 30 days. How many cars would they produce in 90 days?

Days Cars

30 1500

x3 x3

90 **4500**

The factory would produce 4500 cars in 90 days.

## Example 2

5 adult tickets for the cinema cost £27.50. How much would 8 tickets cost?

Working:

|  |  |
| --- | --- |
| Tickets | Cost |
| 5 | £27.50 |
| 1 | £5.50 |
| 8 | £44.00 |

£5.50 £5.50

Find the cost of 1 ticket



The cost of 8 tickets is £44

5 £27.50

4x 8

£44.00

|  |  |  |
| --- | --- | --- |
| Mark | Tally | Frequency |
| 16 - 20 | || | 2 |
| 21 - 25 | |||| || | 7 |
| 26 - 30 | |||| |||| | 9 |
| 31 - 35 | |||| | 5 |
| 36 - 40 | ||| | 3 |
| 41 - 45 | || | 2 |
| 46 - 50 | || | 2 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| It is sometimes useful to display information in graphs, charts or tables.  **Example** **1** The table below shows the average maximum temperatures (in degrees Celsius) in Barcelona and Edinburgh. | | | | | | | | | | | | | |
|  | J | F | M | A | M | J | J | A | S | O | N | D |  |
| Barcelona | 13 | 14 | 15 | 17 | 20 | **24** | 27 | 27 | 25 | 21 | 16 | 14 |
| Edinburgh | 6 | 6 | 8 | 11 | 14 | 17 | 18 | 18 | 16 | 13 | 8 | 6 |
| The average maximum temperature in June in Barcelona is 24C  **Frequency** **Tables** are used to present information. Often data is grouped in intervals.  **Example** **2** Homework marks for Class 4B  27 30 23 24 22 35 24 33 38 43 18 29 28 28 27  33 36 30 43 50 30 25 26 37 35 20 22 24 31 48  Each mark is recorded in the table by a tally mark.  Tally marks are grouped in 5’s to make them easier to read and count. | | | | | | | | | | | | | |



**Method** **of** **Travelling** **to** **School**

9

8

7

6

5

4

3

2

1

0

Walk

Bus

Car

Cycle

**Method**

Bar graphs are often used to display data. The horizontal axis should show the categories or class intervals, and the vertical axis the frequency. All graphs should have a title, and each axis must be labelled.

**Example** **1** The graph below shows the homework marks for Class 4B.

**Example** **2** How do pupils travel to school?

When the horizontal axis shows categories, rather than grouped intervals, it is common practice to leave gaps between the bars.

**Class** **4B** **Homework** **Marks**

10

9

8

7

6

5

4

3

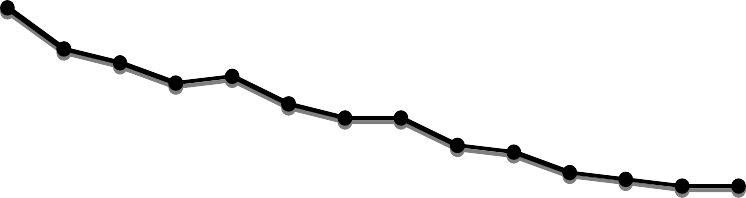
2

1

0

16 - 20 21 - 25 26 - 30 31 - 35 36 - 40 41 - 45 46 - 50

**Mark**



Line graphs consist of a series of points which are plotted, then joined by a line. All graphs should have a title, and each axis must be labelled. The trend of a graph is a general description of it.

**Example** **1** The graph below shows Heather’s weight over 14 weeks as she follows an exercise programme**.**

The trend of the graph is that her weight is decreasing.

**Example** **2** Graph of temperatures in Edinburgh and Barcelona.

**Average** **Maximum** **Daily** **Temperature**

30

25

20

15

10

5

0

**Month**

Barcelona Edinburgh

**Heather's** **weight**

85

80

75

70

65

60

1 2 3 4 5 6 7 8 9 10 11 12 13 14

**Week**

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

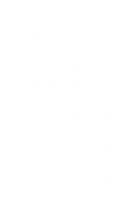
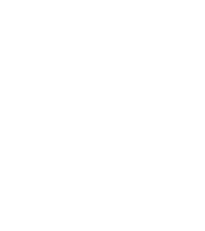
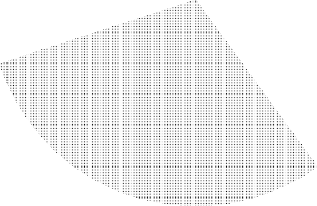
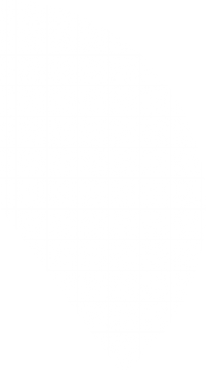
Sep

Oct

Nov

Dec

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| A scatter diagram is used to display the relationship between two variables.  A pattern may appear on the graph. This is called a **correlation**.  **Example** The table below shows the arm span and height of a group of first year boys. This is then plotted as a series of  points on the graph below. | | | | | | | | | | | | | | | | |
| Arm  Span (cm) | 150 | 157 | 155 | 142 | 153 | 143 | 140 | 145 | 144 | 150 | 148 | 160 | 150 | 156 | 136 |  |
| Height  (cm) | 153 | 155 | 157 | 145 | 152 | 141 | 138 | 145 | 148 | 151 | 145 | 165 | 152 | 154 | 137 |  |
| **S1** **Boys**  170  165  160  155  150  145  140  135  130  130 140 150 160 170  **Arm** **Span**  The graph shows a general trend, that as the arm span increases, so does the height. This graph shows a positive correlation.  The line drawn is called the line of best fit. This line can be used to provide estimates. For example, a boy of arm span 150cm would be expected to have a height of around 151cm. | | | | | | | | | | | | | | | | |



A pie chart can be used to display information. Each sector (slice) of the chart represents a different category. The size of each category can be worked out as a fraction of the total using the number of divisions or by measuring angles.

**Example**

30 pupils were asked the colour of their eyes. The results are shown in the pie chart below.

**Eye** **Colour**

**Hazel**

**Brown**

**Blue**

**Green**

How many pupils had brown eyes?

The pie chart is divided up into ten parts, so pupils with brown eyes represent 2 of the total.

10

2 of 30 = 6 so 6 pupils had brown eyes.

10

If no divisions are marked, we can work out the fraction by measuring the angle of each sector.

The angle in the brown sector is 72.

so the number of pupils with brown eyes

= 72 x 30 = 6 pupils.

360

If finding all of the values, you can check your answers -

the total should be 30 pupils.

# Drawing Pie Charts

On a pie chart, the size of the angle for each sector is calculated as a fraction of 360.

**Statistics**

**Example:** In a survey about television programmes, a group of people were asked what their favourite soap was. Their answers are given in the table below. Draw a pie chart to illustrate the information.

|  |  |
| --- | --- |
| **Soap** | **Number** **of** **people** |
| Eastenders | 28 |
| Coronation Street | 24 |
| Emmerdale | 10 |
| Hollyoaks | 12 |
| None | 6 |

Total number of people = 80 so 360 ÷ 80 = 4.5

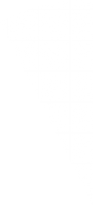
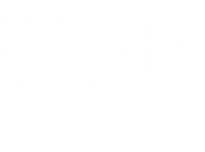
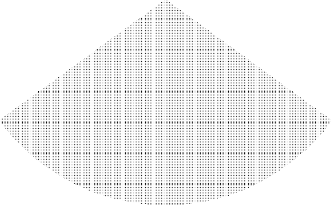
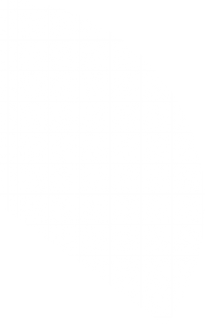
Eastenders = 28 x 4.5 = 126

Coronation Street = 24 x 4.5 = 108

Check that the total = 360

Emmerdale = 10 x 4.5 = 45

Hollyoaks = 12 x 4.5 = 54



Favourite Soap Operas

None

Hollyoaks

Eastenders

Emmerdale

Coronation Street

None = 6 x 4.5 = 27



To provide information about a set of data, the average value may be given. There are 3 ways of finding the average value – the mean, the median and the mode.

# Mean

The mean is found by adding all the data together and dividing by the number of values.

# Median

The median is the middle value when all the data is written in numerical order (if there are two middle values, the median is half-way between these values).

# Mode

The mode is the value that occurs most often.

# Range

The range of a set of data is a measure of spread. Range = Highest value – Lowest value

**Example** Class 4B scored the following marks for their homework assignment. Find the mean, median, mode and range of the results.

7, 9, 7, 5, 6, 7, 10, 9, 8, 4, 8, 5, 7, 10

Mean = 7  9  7  5  6  7  10  9  8  4  8  5  7  10

14

= 102  7.285... Mean = 7.3 to 1 decimal place

14

Ordered values: 4, 5, 5, 6, 7, 7, 8, 8, 9, 9, 10, 10

7, 7,

Median = 7 7 is the most frequent mark, so Mode = 7 Range = 10 – 4 = 6

**Mathematical** **Dictionary** **(Key** **words):**

|  |  |
| --- | --- |
| Add; Addition (+) | To combine 2 or more numbers to get one number (called the sum or the total)  Example: 12+76 = 88 |
| a.m. | (ante meridiem) Any time in the morning (between  midnight and 12 noon). |
| Approximate | An estimated answer, often obtained by rounding to  nearest 10, 100 or decimal place. |
| Calculate | Find the answer to a problem. It doesn’t mean that  you must use a calculator! |
| Data | A collection of information (may include facts, numbers  or measurements). |
| Denominator | The bottom number in a fraction (the number of parts  into which the whole is split). |
| Difference (-) | The amount between two numbers (subtraction). Example: The difference between 50 and 36 is 14  50 – 36 = 14 |
| Division () | Sharing a number into equal parts.  24  6 = 4 |
| Double | Multiply by 2. |
| Equals (=) | Makes or has the same amount as. |
| Equivalent fractions | Fractions which have the same value. Example 6 and 1 are equivalent fractions  12 2 |
| Estimate | To make an approximate or rough answer, often by  rounding. |
| Evaluate | To work out the answer. |
| Even | A number that is divisible by 2.  Even numbers end with 0, 2, 4, 6 or 8. |
| Factor | A number which divides exactly into another number, leaving no remainder.  Example: The factors of 15 are 1, 3, 5, 15. |
| Frequency | How often something happens. In a set of data, the  number of times a number or category occurs. |
| Greater than (>) | Is bigger or more than. Example: 10 is greater than 6.  10 > 6 |
| Least | The lowest number in a group (minimum). |
| Less than (<) | Is smaller or lower than.  Example: 15 is less than 21. 15 < 21. |

|  |  |
| --- | --- |
| Maximum | The largest or highest number in a group. |
| Mean | The arithmetic average of a set of numbers (see p33) |
| Median | Another type of average - the middle number of an  ordered set of data (see p33) |
| Minimum | The smallest or lowest number in a group. |
| Minus (-) | To subtract. |
| Mode | Another type of average – the most frequent number  or category (see p33) |
| Most | The largest or highest number in a group (maximum). |
| Multiple | A number which can be divided by a particular number, leaving no remainder.  Example Some of the multiples of 4 are 8, 16, 48, 72 |
| Multiply (x) | To combine an amount a particular number of times.  Example 6 x 4 = 24 |
| Negative  Number | A number less than zero. Shown by a minus sign.  Example -5 is a negative number. |
| Numerator | The top number in a fraction. |
| Odd Number | A number which is not divisible by 2.  Odd numbers end in 1 ,3 ,5 ,7 or 9. |
| Operations | The four basic operations are addition, subtraction,  multiplication and division. |
| Order of  operations | The order in which operations should be done.  BODMAS (see p9) |
| Place value | The value of a digit dependent on its place in the number.  Example: in the number 1573.4, the 5 has a place value  of 100. |
| p.m. | (post meridiem) Any time in the afternoon or evening  (between 12 noon and midnight). |
| Prime Number | A number that has exactly 2 factors (can only be divided by itself and 1). Note that 1 is not a prime  number as it only has 1 factor. |
| Product | The answer when two numbers are multiplied together.  Example: The product of 5 and 4 is 20. |
| Remainder | The amount left over when dividing a number. |
| Share | To divide into equal groups. |
| Square | Multiply by itself.  Example 32 (say “3 squared”) = 3 x 3 = 9 |
| Sum | The total of a group of numbers (found by adding). |
| Total | The sum of a group of numbers (found by adding). |