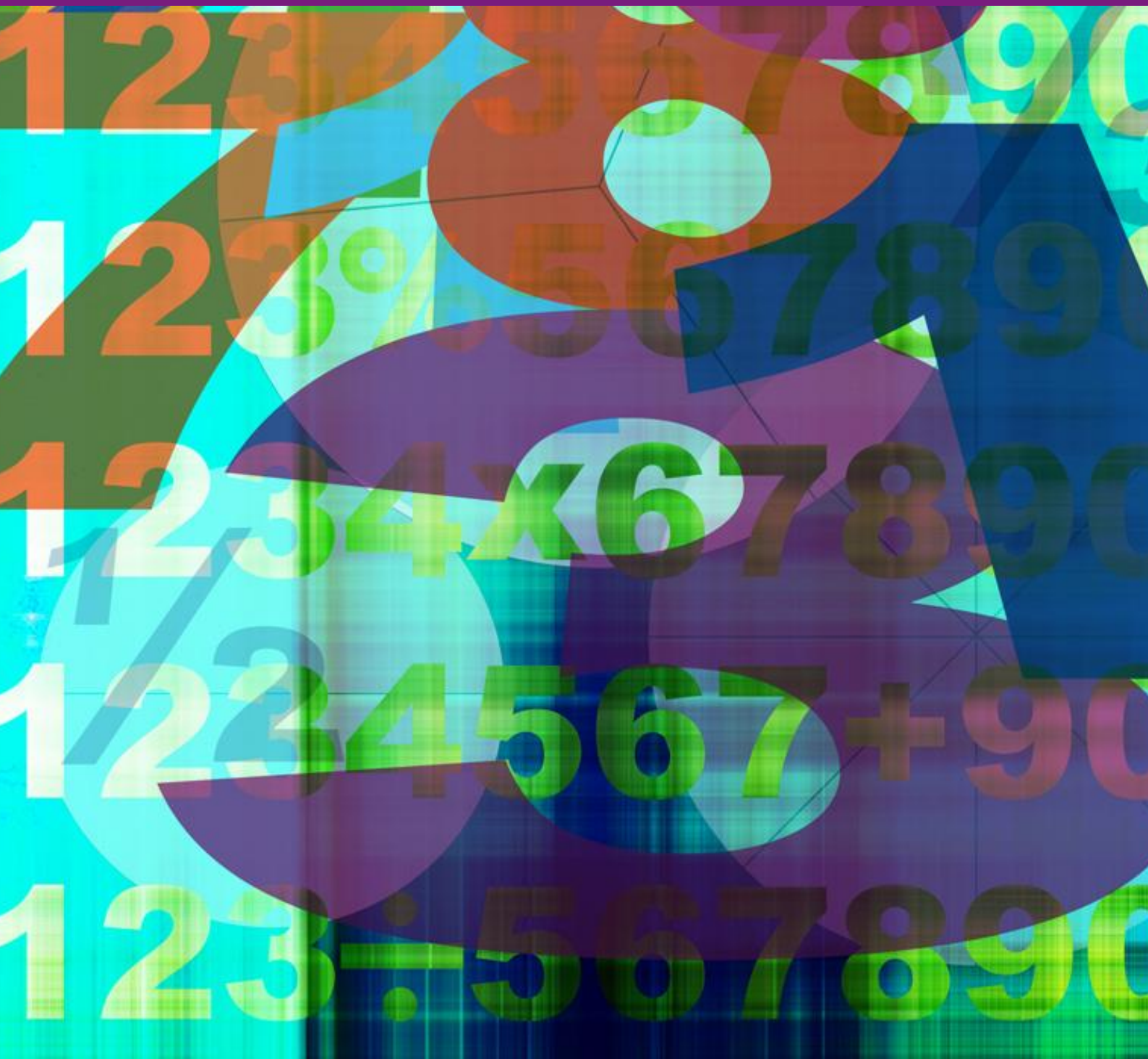
Learner Pack

Level 4: Mathematics
Unit 4: Data Handling



Activity Phone Code D1

This activity links to award learning outcomes 4.1 and 4.4.

Introduction

We regularly read and hear about surveys or polls in the newspapers and on the news. But are we able to interpret this information? The activity on the iPhone will help us with this.

Materials you will need

- Magazines, newspapers

Learning Outcomes

Understand, recognise and distinguish between key concepts involved in collecting data:

- Population
- Sample
- Variable
- Statistic

Key Learning Points

- Data
- Population, Sample, Variable, Statistic

What do you need to know before you start?

Maths

Statistics are often given in survey reports. For example, we might read that 40% of those surveyed are unhappy with the recent tax increases. Or we might hear that 62% of people surveyed think that Manchester United will win the English Premier League this season.

Statistics can also be misleading at times. Think about the two examples above: in what way could those statistics be misleading?

In order for us to present and analyse this type of information we need to know more details about the **sampling**, especially: What is the **population?** What is the **sample**? What is the **variable** being measured?

Language of data handling:

The following terms are important:

Population: This means the entire group of objects or subjects about which we want the information.

Sample: Any subset of the population: for example, those people who took part in the survey.

Variable: The question that is being asked or the information being looked for. For example: What is your favourite soap opera? This variable can change from person to person since not everyone likes the same soap opera.

Statistic: This represents some value that we are interested in calculating for the sample we are surveying. For example: "**60%** of people in a representative sample chose Eastenders as their favourite soap opera." 60% is the statistic.

iPhone

The iPhone is a line of Internet and multimedia-enabled smartphones made by Apple Inc. A recent iPhone is the iPhone 4. The iPhone is very popular but expensive.

Task 1:
Identifying the population, the sample, the variable and the statistic

Example

In a local school, a group of first year students conducting a small project wish to see how many of the students in the school with an iPhone are happy, or otherwise, with their phone.

The first year students set up a stall in the school canteen and asked all iPhone owners to come to the stall to fill in a short questionnaire on the iPhone. 35 iPhone owners completed the questionnaire at the stall. 25 out of the 35 iPhone users said they are happy with their phone.

Identify the following in the above example:

(i) the population
(ii) the sample
(iii) the variable measured
(iv) the statistic provided (as a percentage).

Solution

(i) The population was the students of the school.

(ii) The sample was the 35 iPhone owners who filled in the questionnaire.

(iii) The variable measured was how many students in the school who own an iPhone are happy with it?

(iv) We know that 25 out of the 35 students who own an iPhone and took part in the survey are happy with it. From Unit 1, we know how to convert this to a percentage: $^{25}/_{35} \times {}^{100}/_{1} =$ 71.43%. So **the statistic is 71.43%.** 71.43% of those who completed the questionnaire said they are happy with their iPhone.

Now you try this

- A gym manager wished to know how its members rated the customer service offered by its staff. She got a list of all 500 members and posted each member a questionnaire. The questionnaire asked them to rate customer service on a scale of 0 to 10. 250 members responded. The average rating was **5** for customer service.

Identify the following:

i. the population:

_____

ii. the sample:

_____

iii. the variable measured:

_____

iv. the statistic provided:

_____

Practise your skills

- Practice Sheet D1 will help you develop your skills recognising and distinguishing between population, sample, variable measured and statistic.
- Find a recent survey or poll in a newspaper or on the internet.

Tell your tutor what information the survey gives on the following:

a. population
b. sample
c. variable measured

Activity **Cancer Trials** **Code D2**

This activity links to award learning outcomes 4.1 and 4.4.

Introduction

We often hear about one factor having an affect on another factor. For example: the amount of times the rugby player Ronan O'Gara practises kicking the ball between the posts is likely to affect how he performs in a game. This activity on cancer trials will help us understand how one factor or **variable** affects another.

Materials you will need

- Internet
- Books
- Newspapers
- Magazines

Learning Outcomes

1. Understand the concepts of dependent and independent variables.

Key Learning Points

1. Independent
2. Dependent

What do you need to know before you start?

Maths

When collecting data we are often concerned with the effects one variable (the **independent variable**) has on another variable (**dependent**). A researcher might want to see if the independent variable has any effect on the dependent variable.

For example: If I'm playing basketball, does **the number of times I practise** taking a free throw have an effect on **the number of free throws I score**?

In that example, the **independent variable** is the number of times I practise free throws and the outcome or the **dependent variable** is the number of free throws I score in the game.

Of course there may be other variables that affect the outcome of how many free throws I make. Can you think of any?

Language of data handling:

There are two key terms that are important here:

Independent variable: The independent variable in an experiment or survey or piece of research **is something that is varied or changed by the researcher.**

Dependent variable: A dependent variable is the factor studied, the outcome, and is expected to **change** as a result of the researcher varying the independent variable. There can be more than one dependent variable.

Cancer Trials

In the world of medicine researchers continue to strive for a cure for illnesses including cancer. Cancer trials are a very important type of study or research.

Task 1 Understanding independent and dependent

Example

Suppose a research team wishes to conduct clinical trials for a new drug treatment for lung cancer. Researchers believe the new drug will help with the success rate of chemotherapy. They want to test this new drug in the clinical trials. A number of lung cancer patients will be given this extra form of medication in addition to their normal medication. The remaining patients in the trial will stay on their normal course of medication only. This trial will help determine if the new drug assists the chemotherapy in reducing the size of the tumour.

In this trial, what is the independent variable?

What is the dependent variable?

Solution

The independent variable is the drugs provided to subjects. It is varied by the researcher since some patients receive the new drug while the other patients remain on their normal course of medication. This is done so as to study the effects the new drug has, if any, on reducing the tumour.

The dependent variable is the tumour size which is dependent on the drugs given to the subjects.

Do you think there are other important variables or factors that may be present in this study?

Now you try this

- A group of researchers wish to research the physical activity levels of 50 secondary school students in Ireland and the impact this may have on their health. The researchers ask one class to do a certain level of physical activity every week, keeping it at the same level each week. They ask another class to increase their level of physical activity every week.

What is the independent variable and the dependent variable in this research study?

Independent variable:

_____

_____

Dependent variable:

_____

_____

Practise your skills

- Practice sheet D2 will help you develop your skills in understanding the concepts of dependent and independent variables.

- Research the internet, books, newspapers, television or any other source to find an example of a study comparing the effects of one variable (independent) on another (dependent variable or variables). This can be a study of any topic: it does not have to be about health and fitness.

- Show your tutor what you found out about the study or survey or research.

Activity Families: Time watching TV Code D3

This activity links to award learning outcomes 4.1 and 4.4.

Introduction

We can write numbers as whole numbers and as decimals or fractions. We can collect information of both kinds. For example, I can ask a group of people how many times they go to the shop to buy sweets every week. Different answers might include 3 times or 4 times (whole numbers). I could also ask how much money they spend a week on sweets and I might get answers such as €5.50 or €9.20 (decimals). The tasks in this activity will help us understand this.

Learning Outcomes

1. Understand and distinguish between discrete and continuous data.

Key Learning Points

1. Discrete
2. Continuous

What do you need to know before you start?

Maths

There are different types of data represented by numbers. These may be whole numbers such as 1, 2, 3, or numbers which include decimal points, such as 1.5, 7.5, 3.6. This depends on the question we ask when we are collecting the data.

Here are two examples:

1. In a typical week, how many text messages would you send?
   The answer to this can only be a whole number, for example 50 text messages a week. That is an example of discrete data.

2. How much did you spend on your last haircut?
   The answer to this can include decimal points, for example €37.50.

Language of data handling

There are two key terms that are important here:

Discrete data or variables: Data that can only have a finite number of numeric values (whole numbers only). For example: family size, number of TV's in a household.

Continuous data or variables: Data that can assume an infinite number of values (including decimal places or fractions). For example, height, weight, speed of a car.

Task 1 Understanding different types of data

Example

A number of secondary school students were asked how many siblings they have. These were the results

6	4	3
2	1	6
5	1	2
2	7	3
2	3	4
5	4	3
1	2	6
6	3	3

How many students were in the survey?

Is the data discrete or continuous?

Solution

24 students were in the survey. Simply count the number of answers

Discrete – the data consists of only whole numbers i.e. 3 students said they have only one sibling.

Example

The same families were asked how much time they spent watching television a week. These were the results:

3.5 hours	4.5 hours	9 hours
5.75 hours	9.25 hours	7.5 hours
10.5 hours	10 hours	5.5 hours
10 hours	3.5 hours	8.25 hours
8.5 hours	4.5 hours	6.5 hours
4.5 hours	2 hours	9.25 hours
2.25 hours	1.5 hours	3.75 hours
1 hour	8.25 hours	3.25 hours

How many students were in the survey?

Is the data discrete or continuous?

Solution

There were 24 students in the survey.

The data is continuous as it is a measurement and includes decimal points.

Now you try this

- Here are a few sample questions from a survey. For each question, identify whether the data will be **discrete** or **continuous** and say why.

1. In a typical week, how often would you exercise?

_____

Discrete or continuous? _____

Why? _____

_____

How much of your weekly money do you spend on chocolate?

Discrete or continuous? _____

Why? _____

_____

How long is it (in days or weeks) since you last exercised?

Discrete or continuous? _____

Why? _____

_____

Rate your interest in exercise on a scale of 0 to 10 where 0 represents ‘not interested’ and 10 represents ‘extremely interested’.

Discrete or continuous? _____

Why? _____

Practise your skills

- Practice sheet D3 will help you develop your skills in understanding the concepts of **discrete and continuous data**.

- Choose a topic you are interested in. Make a list of questions that you would like the members of your group and other friends to fill in. Your questions must give answers that they can record with whole numbers. Then categorise the data as **either discrete or continuous**. An example of discrete data is: the number of people in a family discrete data. An example of continuous data is: the time spent watching television.

- Hand the questionnaire out to as many of your friends, family or classmates as you can.

- **Once your data is collected, it is time to analyse it!**

  Answer the following questions:

  How many people are in the survey?

  Which data is discrete?

  Which data is continuous?

Activity **X Factor** **Code D4**

This activity links to award learning outcomes 4.2 and 4.4.

Introduction

In 2010, X Factor was a very popular programme watched in Ireland. People often talked about their favourite judge in the show. If we had this information we could represent our data on a **graph**. The X Factor activity will help you to do this.

Materials you will need

- Graph paper
- Pencil and ruler

Learning Outcomes

1. Understand the concept of categorical data.
2. Represent data graphically using frequency tables and bar charts.
3. Interpret the data.

Key Learning Points

- Bar Charts
- Graphs

What do you need to know before you start?

Maths

We can show data visually using graphs. This helps to describe the data and puts it into a more eye-catching form. There are a number of different graphical methods we can use. The method depends on whether the data is **numeric** (discrete or continuous) or **categorical**.

We looked at numeric data in activity D3. **Categorical data** is not numeric. The data can be divided into categories and the number of cases that fall into each category can be counted. For example, one category could be "people with brown hair". We can count the number of people with brown hair in our group.

The number in each category is called **frequency**. Frequency means the number of times something occurs: for example: "There are 7 people with brown hair in our group".

We can represent this kind of information on a **bar chart**. The height of each bar on the chart represents the number of cases in each category. There are smaller gaps between the bars.

X Factor

The X Factor is a British television singing competition. The show begins with open auditions to the public and is aired live on television once the final acts have been selected. Usually, one act is sent home after each live show. There are four judges on the show. In 2010 they were Simon Cowell, Louis Walsh, Cheryl Cole and Danni Minogue.

How can you find this out?

- Ask a friend.
- Ask your tutor.
- Look it up on the internet.
- Watch the programme.

Task 1 Reading Frequency Tables

Example

A group of friends did a survey of 20 trainees in the centre to find out which of the judges on the X Factor show are most popular. These were the results:

Simon	Cheryl	Cheryl
Danni	Simon	Louis
Louis	Simon	Cheryl
Cheryl	Danni	Simon
Simon	Simon	Louis
Danni	Cheryl	Simon
Louis	Danni	

How can they represent this data on a frequency table?

Solution

It is easier for us to see this data clearly if we put it in a frequency table, like this:

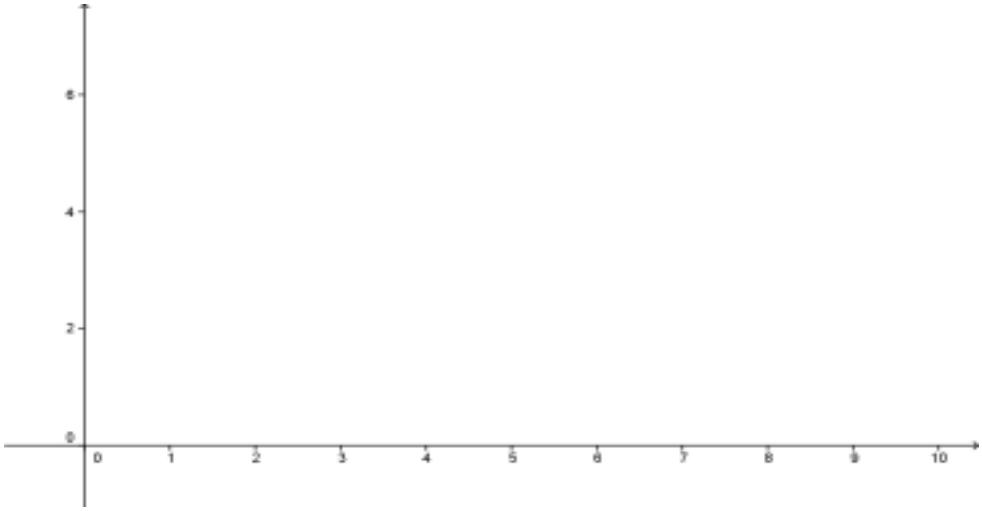
X Factor Judge	Simon Cowell	Louis Walsh	Cheryl Cole	Danni Minogue
Number of votes	7	4	5	4

This is the same information but it is less messy than the first table. It simply puts the judges' names across the top column and the number of votes each judge received on the bottom column. Just count up the number of people whose favourite judge is Simon Cowell, then enter that number (7) under his name and beside "number of votes". Continue this way for the other judges.

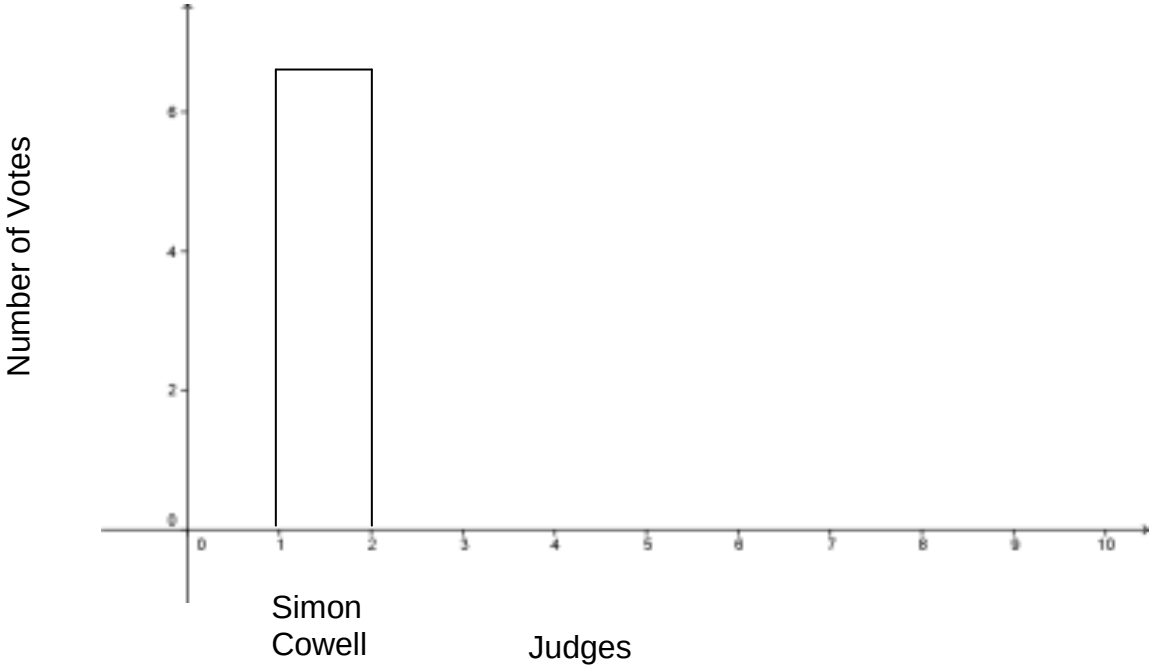
Task 2 Drawing Bar Charts

We can also put the same information into a bar chart:

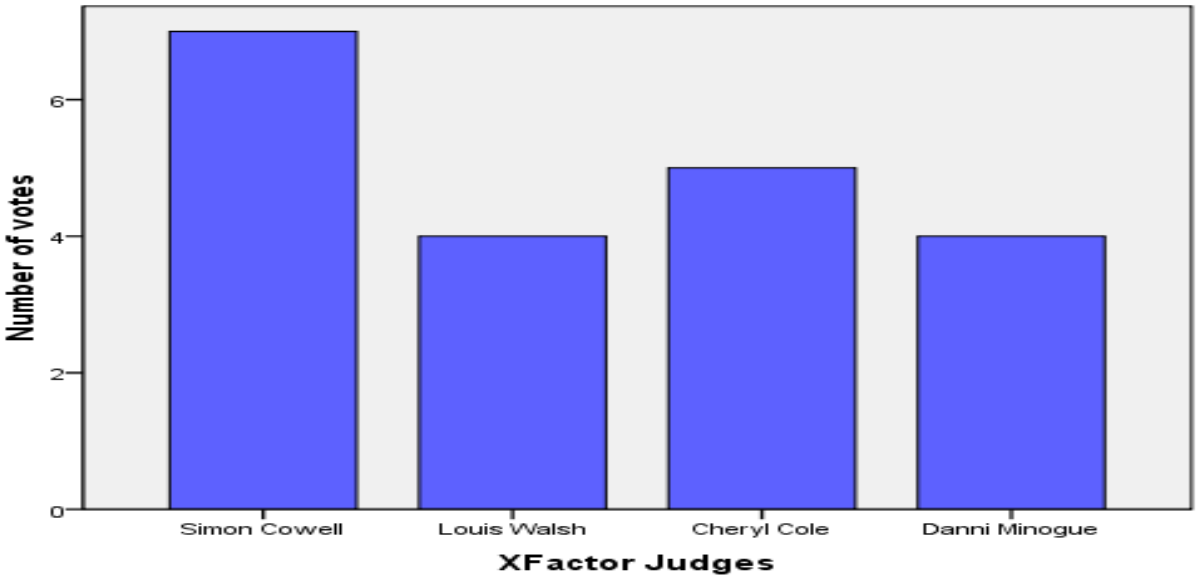
- Decide on the spacing you will use. You can mark the y-axis up in two's (2,4,6 etc) and the x-axis in ones (1,2,3,4 etc).



- Using a ruler and pencil start at 1 on the x-axis and draw a vertical line until you are parallel to 7 on y-axis. Draw a horizontal line here (above 1 to 2 on the x-axis) and then join this line withthe x-axis again. The next bar will differ in height but is the same unit size: from 3 to 4. Remember to **label the axis:** put judges on x-axis and number of votes on y-axis.



The final bar chart looks something like this:



We can read the same information from the bar chart as we can from the frequency table we drew. That is, we can see that Simon Cowell had the greatest number of votes (7) while Louis Walsh and Danni Minogue had the least number (4) and Cheryl had 5 votes.

Now you try this

- Using the X Factor data above, draw the bar chart yourself (use graph paper as this will help you make sure that the height for each bar is correct as well as the spacing between the bars etc).

Practise your skills

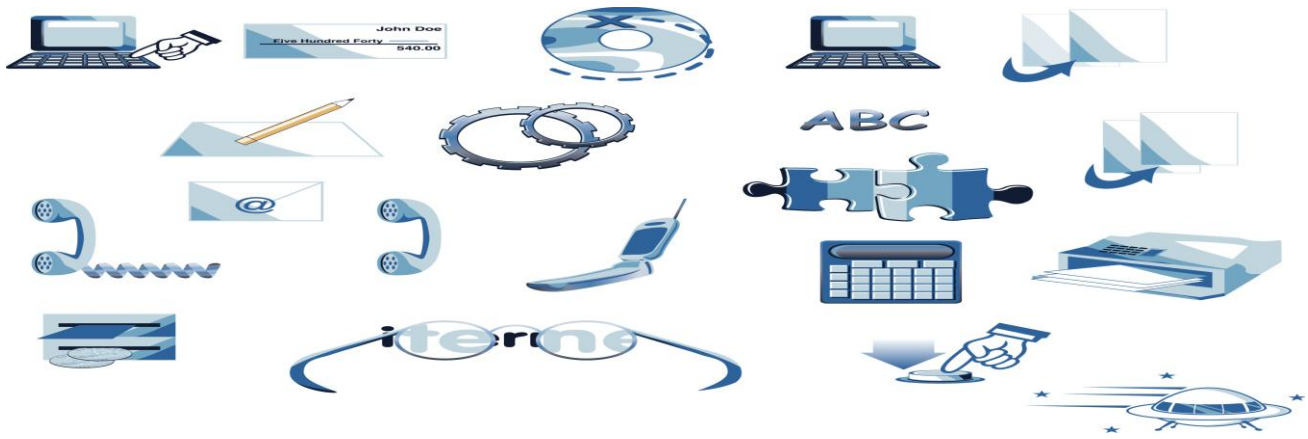
- Practice sheet D4 will help you develop your skills in drawing and interpreting data on a bar chart.
- Collect the same data from your own friends and family and represent it on a bar chart. Then fill in the table below with the data.

X Factor Judge	Simon Cowell	Louis Walsh	Cheryl Cole	Danni Minogue
Number of votes				

Which judge is most popular?

Which judge is least popular?

Activity Careers Code D5



This activity links to award learning outcomes 4.1 and 4.4.

Introduction

People often ask “what do you do for a living?” In this activity we look at some careers and how we can visually represent them on another type of graph called a **pie chart**. It is important to be able to interpret information from a chart and this activity will help you with this.

Learning Outcomes

1. Further understand the concept of categorical data.
2. Interpret data from a pie chart.

Key Learning Points

1. Pie Charts
2. Graphs

What do you need to know before you start?

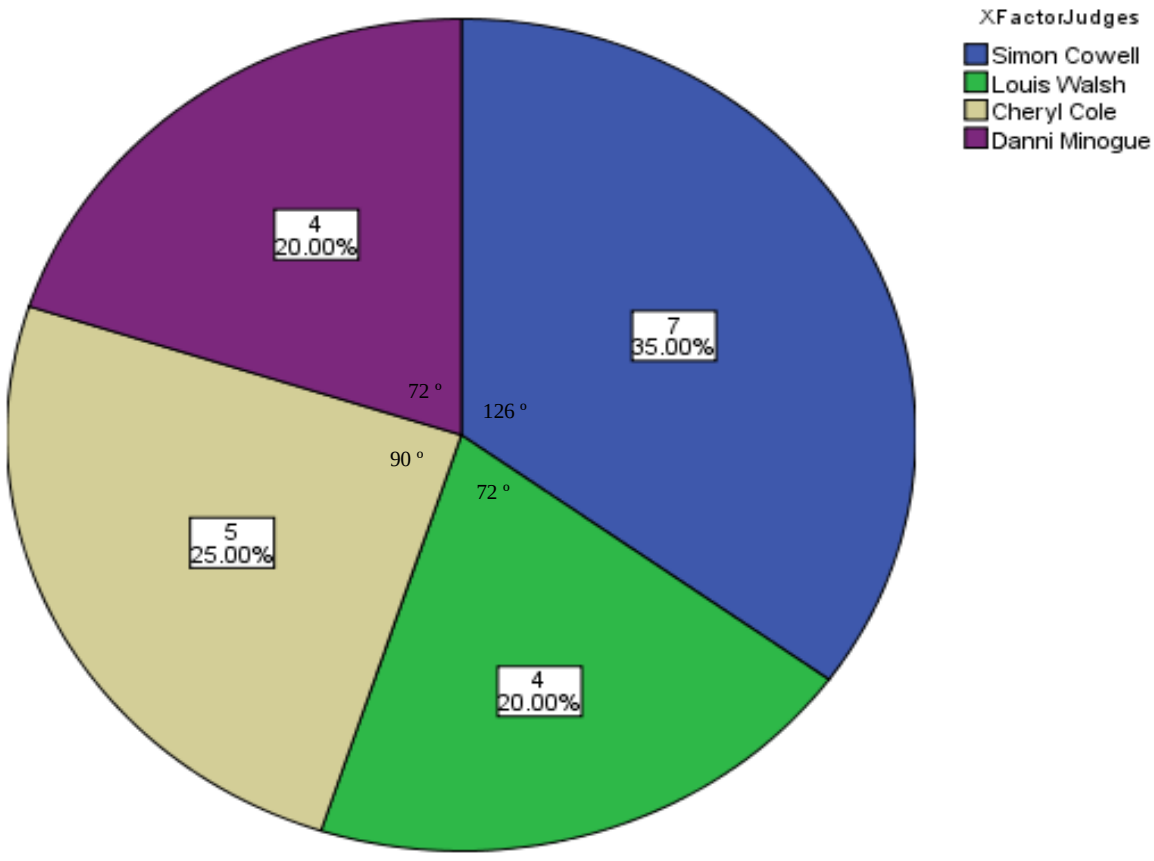
Maths

We looked at categorical data and representing it graphically in bar charts (activity D4). We can also use another type of graph called **pie charts.**

A pie chart is a circle that is divided into sectors. The size of the sectors depends on the frequency of the information.

Remember that there are 360º in a circle.

Let us see how the X Factor activity in D4 can also be represented on a pie chart:



We can see the data is still the same. For example, Simon Cowell is still the most popular with 7 votes. This is 35% of the data and because the data is the biggest this sector also has the largest angle on the pie chart. A pie chart is just another way to show the data using a graph.

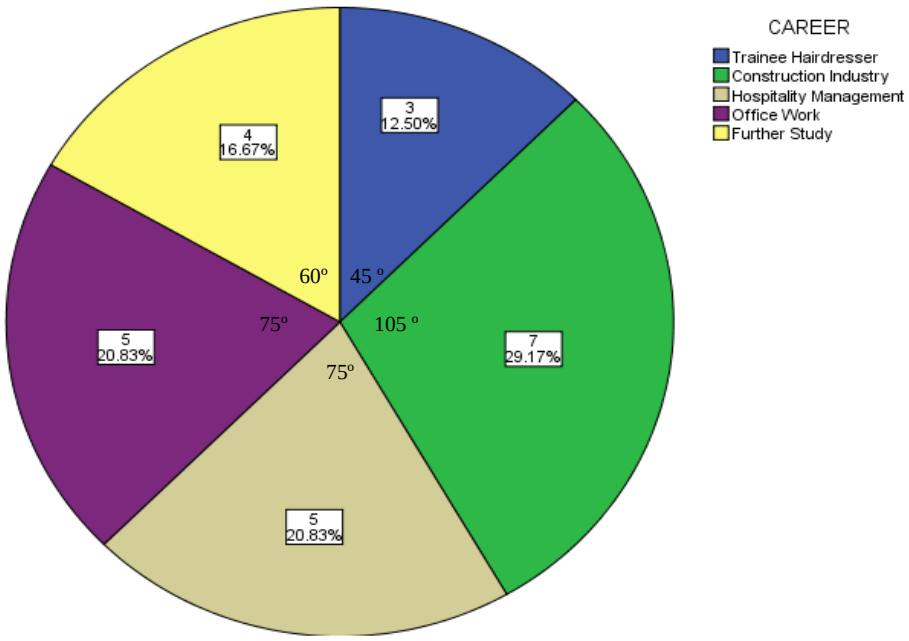
Task 1 Reading Pie Charts

Example

A group of trainees contacts 24 former trainees to ask what they are now doing in work, education or training. They get the following information:

Career	Trainee Hairdresser	Construction Industry	Hospitality Management	Office Work	Further Study
Number of Trainees	3	7	5	5	4

The group could represent this data on a bar chart as in the last activity. Or they could draw a pie chart like this:

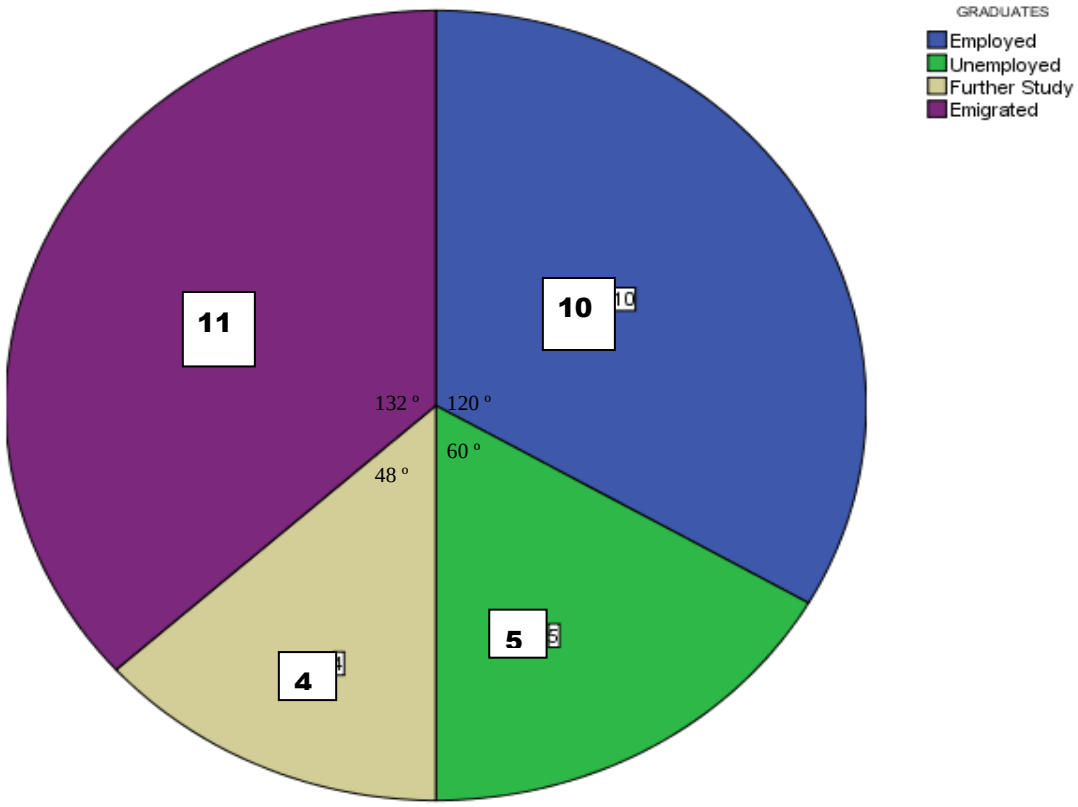


We know there are 360º in a circle. This circle must include all 24 trainees. The group used its knowledge of angles, fractions and percentages to construct the pie chart. We will do this in the next the activity, D6.

We can see from the pie chart that the largest sector is the Construction Industry since 7 out of the 24 trainees now work in that area. The angle is the greatest angle in the circle: 105º.
Why do you think this is?
The wine and brown sectors have the same angle. Why is this?

Now you try this

A small training college for school teachers wanted to see how many of their graduates are working, doing further study, are out of work or have left the country to find work. They made this pie chart to show the information:



- What was the greatest sector? How do you know?

_____

_____

- What conclusions do you draw from the pie chart about the employment of these teachers?

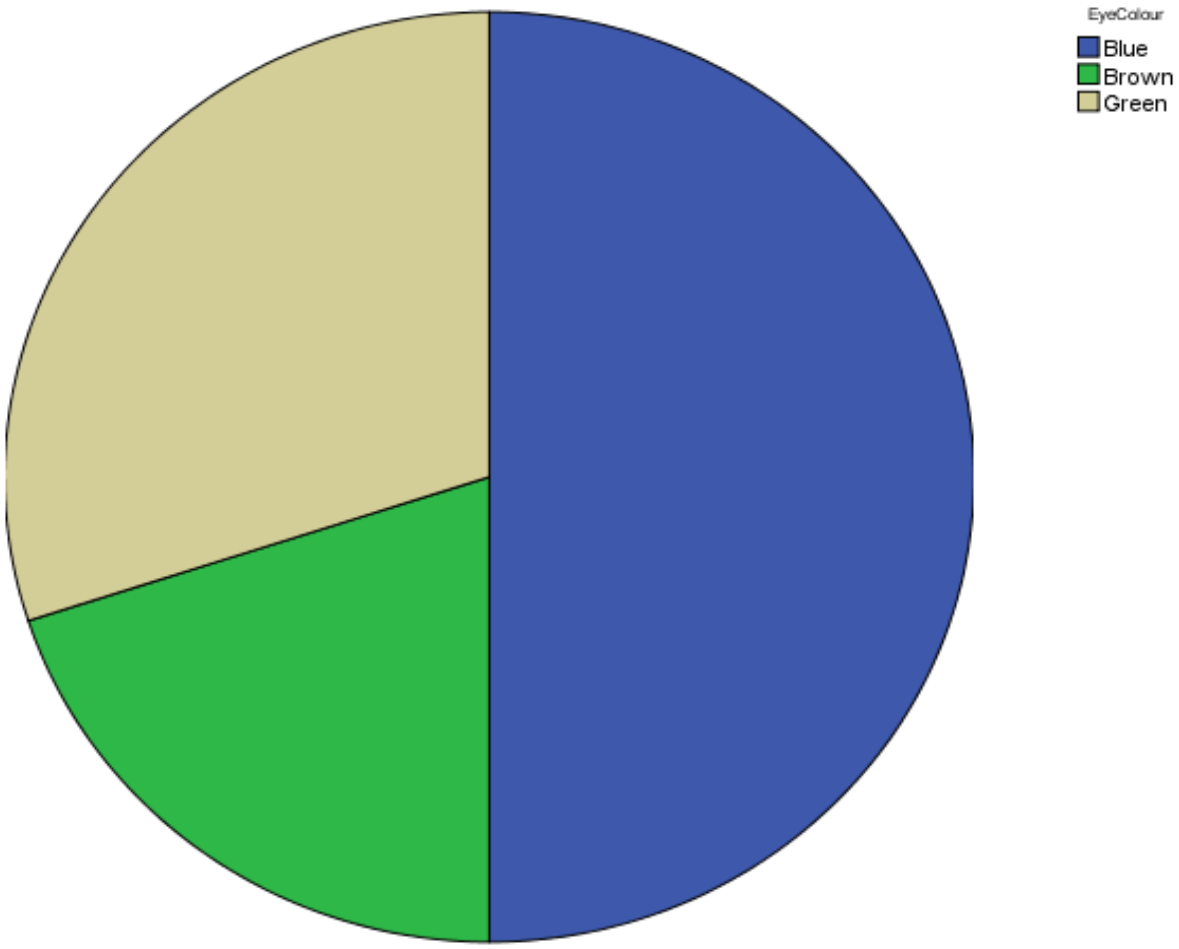
_____

_____

Practise your skills

- Practice sheet D5 will help you develop your skills in interpreting data from a pie chart.

- Can you make any conclusions based on the following pie chart?



Activity Careers 2 Code D6

This activity links to award learning outcomes 4.2 and 4.4.

Introduction

This activity follows directly on from activity D5 which looks at careers to read and interpret pie charts. This task will help you to understand how to draw pie charts.

Materials you will need

- Ruler, pencil
- Compass, protractor

Learning Outcomes

1. Represent data graphically using pie charts.
2. Interpret data from a pie chart.

Key Learning Points

1. Pie Charts
2. Graphs

What do you need to know before you start?

Maths

We know looked categorical data can be represented graphically on pie charts from activity D5. But how do we draw a pie chart?

Drawing a pie chart

A pie chart is a circle that is divided into sectors.

Remember there are 360º in a circle.

It is important also to know the frequency (number) of items that go into each category in the pie chart.

For example, we saw earlier that 7 out of 20 people rated Simon Cowell as their favourite X Factor judge. In order to know how much of the circle this takes up we first need to see how many degrees one person represents. In this case 1 person represents 18º because 360 divided by 20 is 18. Then we multiply that by 7.

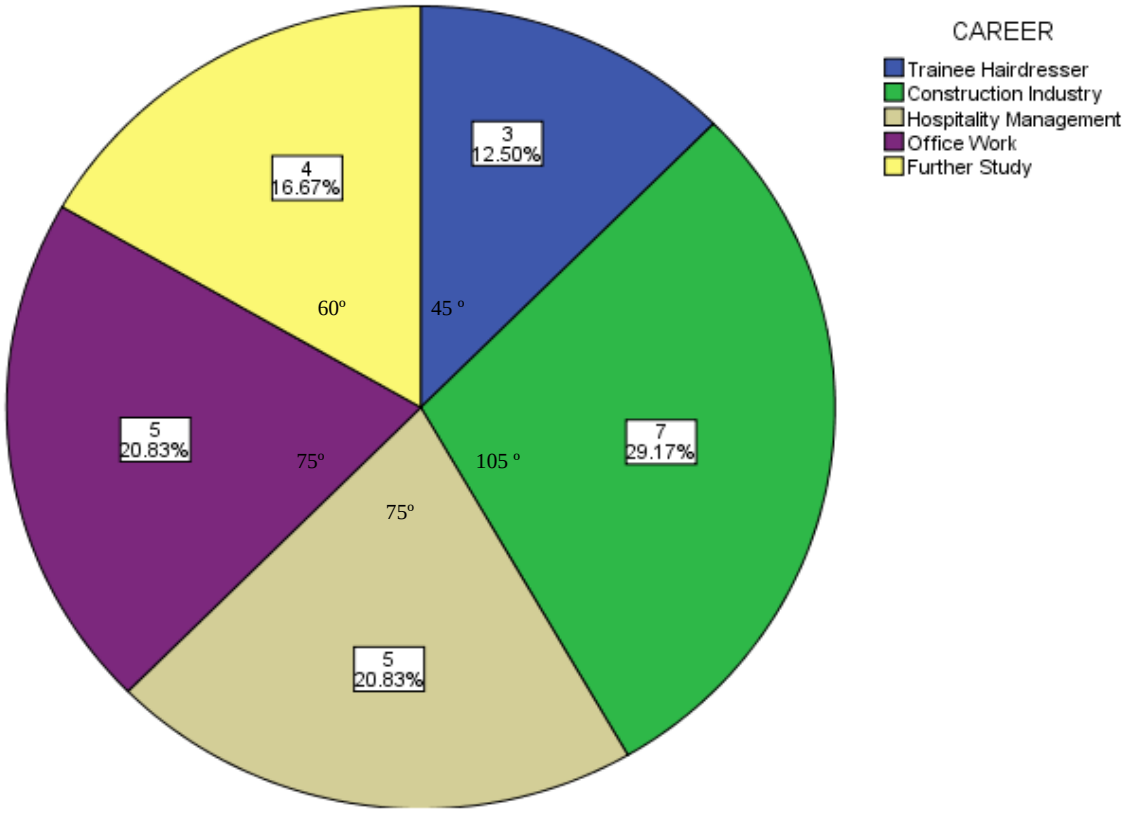
This gives us the angle of the sector. In this case it is 126º. When 18 is multiplied by 7 (the number of people whose favourite judge is Simon Cowell) we get 126º.

This will become clearer in this activity.

Task 1 Drawing Pie Charts

Look again at the **table** and **pie chart** constructed with the data about careers of past trainees (Activity D5):

Career	Trainee Hairdresser	Construction Industry	Hospitality Management	Office Work	Further Study
Number of Trainees	3	7	5	5	4



This is how to construct this pie chart:

- Firstly, we count the number of trainees altogether:

  3 + 7 + 5 + 5 + 4 = 24. So there are 24 trainees altogether.
- We know there are 360º in a circle. This circle must include all the 24 trainees.
- We also need to know how many degrees one trainee will represent on the chart.

  If 24 trainees = 360º

  then 1 trainee = 15º

  360º divided by 24 to get the value for 1 trainee.

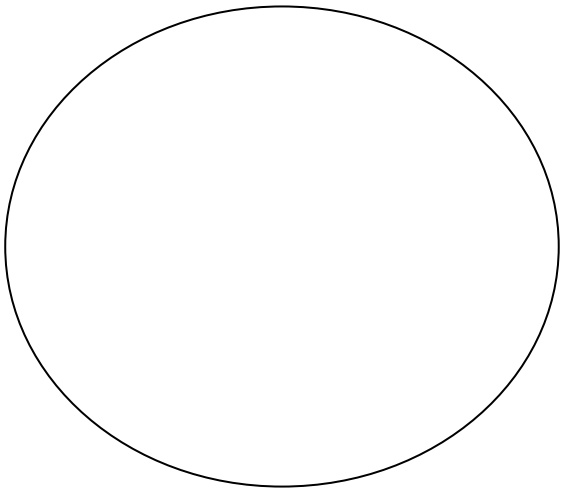
  So, one trainee takes up 15º on the pie chart.

- We need to make up a table since we know there are times when there is more than 1 person in a category. This will affect the angle of the sector.

If there are three trainee hairdressers and we know that one trainee makes up 15º on the pie chart, then three trainee hairdressers make up three times the amount (3 x 15º = 45º).

Career	Number of Trainees	Angle
Trainee Hairdresser	3	3 x 15º = 45º
Trade Industry	7	7 x 15º = 105º
Hospitality Industry	5	5 x 15º = 75º
Office Work	5	5 x 15º = 75º
Further Study	4	4 x 15º = 60º
Total	**24 trainees**	**360º**

- **Now we can use our compass to draw a big circle. (360º)**



- **We need a protractor to find each of the angles.**

  From the centre of the circle use your protractor to draw 45º, for example, and continue around the circle for each sector until the circle is full.

Now you try this

- Using this same data on careers of past trainees, draw the pie chart yourself using a compass and protractor.

  All sector sizes should be clear and the angle for each sector included. You do not need to put the percentage in but you can write the number of times a person fits into each category. For example, write 3 in the Trainee Hairdresser sector.

Practise your skills

- Practice sheet D6 will help you develop your skills in drawing and interpreting pie charts.

- Collect data amongst your classmates or friends about what career they are interested in working in. Ask at least 10 people. If the person does not know then you can set up a new category to represent this.

  Represent the information you collect in a **frequency table.**

  Then represent the same information in a **pie chart.**

Activity Fashion Code D7

This activity links to award learning outcomes 4.2 and 4.4.

Introduction

Trends in fashion are constantly changing. We can graph trends like this on a graph called a **trend graph**. This activity about fashion will help you to understand this.

Materials you will need

- Ruler, pencil
- Graph paper

Learning Outcomes

1. Understand how numerical data can be graphed.
2. Represent numerical data using trend graphs.

Key Learning Points

1. Trend Graph
2. Graphs

What do you need to know before you start?

In activity D4, D5 and D6 we saw that data can be represented visually using graphs. We also know that the graphical method depends on whether the data is numeric (discrete or continuous) or categorical. We looked at categorical data in the two previous activities. In this activity we look at one way to represent **numeric data**: the **trend** or **line graph**.

A trend graph shows trends in something over time. For example, a trend graph can show the change in temperature in Ireland over a number of months.

Once we have data collected we can represent this change over time.

Task 1 Drawing Trend Graphs

Example

The table below shows the number of leather jackets sold in a particular five day period by a large shop.

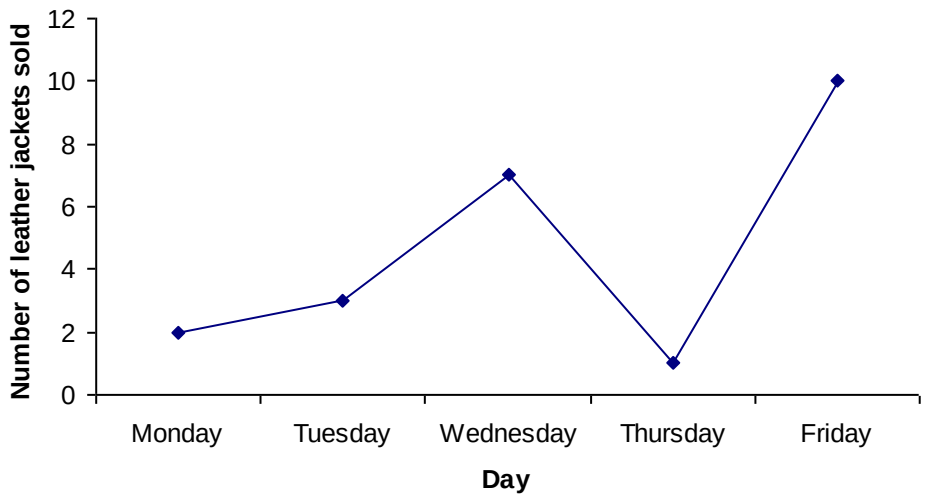
Day	Monday	Tuesday	Wednesday	Thursday	Friday
Leather Jacket Sales	2	3	7	1	10

How can we represent this data on a trend graph?

Solution:

Label the **days** on the x- axis and the **sales** of leather jackets on the y-axis.
Draw a dot on the axis above Monday and across from 2, because two leather jackets were sold on a Monday.

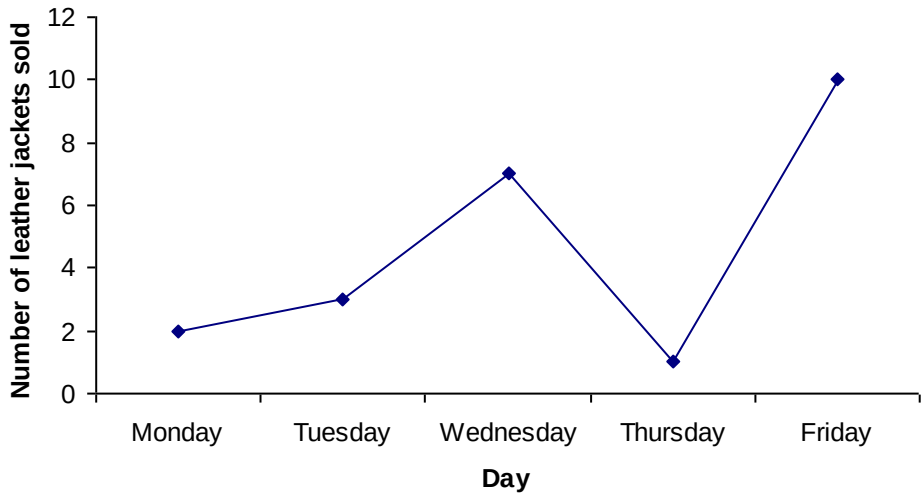
Continue like this until you have plotted the five points. Join each dot to the next dot. This forms the trend line.



Task 2 Reading a trend graph

Look at the trend graph for the sales of leather jackets over 5 days.

1. How many leather jackets were sold during the five days?
2. What percentage of leather jackets were sold on a Wednesday?



Solution

1. There were 23 leather jackets sold during the five days.

2. There were 7 out of a total of 23 leather jackets sold on a Wednesday. 7/23 = 30.4%. 30.4% of leather jackets were sold on a Wednesday.

Now you try this

- The shop is interested in how many sales they made on the weekend also. They sold 12 leather jackets on the Saturday and 5 on the Sunday.

  Represent the data on a trend graph (use graph paper).

  Complete this frequency table first:

Day	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Leather Jacket Sales	2	3	7	1	10		

Practise your skills

- Practice sheet D7 will help you develop your skills in drawing and interpreting trend graphs.

- Look at your training allowance and see what trends exist in how much you spend each day!

  From Monday to the following Sunday keep account of how much money you spend.

  Record the data clearly on a table and then represent this information on a trend graph.

  Use the trend graph to summarise the trend in your spending. Was there a time when you spent the same amount of money on more than one day?

Activity iPod, Phone Calls Code D8

This activity links to award learning outcomes 4.2 and 4.4.

Introduction

Data with a variety of numbers can be represented on a graph called a **histogram**. This activity about iPods and phone calls will help us understand and use histograms.

Materials you will need

- Ruler, pencil

Learning Outcomes

1. Understand how data collected in the form of numbers can be graphed.
2. Interpret data from a histogram.
3. Read and draw a grouped frequency table.

Key Learning Points

1. Histogram
2. Graphical Method

What do you need to know before you start?

Maths

Another way of representing data involving numbers is on a histogram. A histogram is very similar to a bar chart but there are two differences:

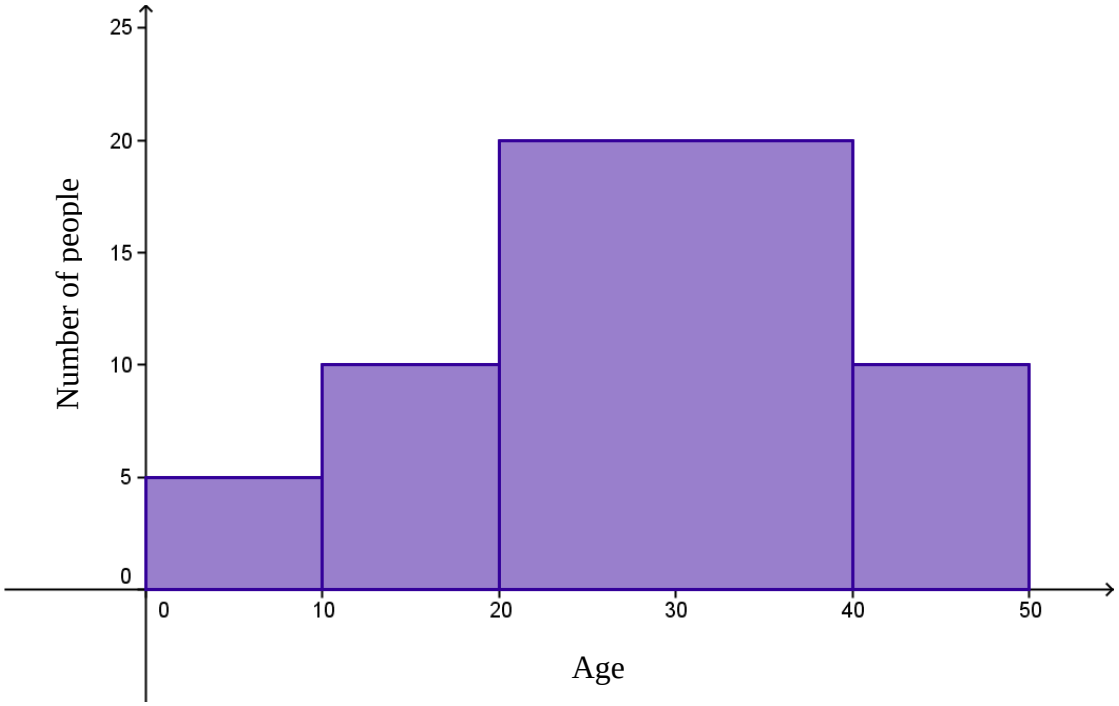
- There are no gaps or spaces between the bars in a histogram.
- The amount of space or area of each of the bars tells us how many items are in that category. In a bar chart we can get this information by looking at the height of the bar.

We always draw a table before we attempt to graph the data. The table we will draw in this activity is a little different to the one we have drawn in the previous activities. That is because we are now dealing with more numbers so we have to group them to make it easier. This will become clearer throughout this activity.

Task 1 Reading Histograms

Example

65 people of various ages took part in a street survey where they were asked if they own an iPod. Once the data was collected a histogram was constructed to represent the results:



We can see there are **no gaps** between the bars.

It is also clear that **the area between the bars differs**. That is, the first bar goes from 0-10, the second one goes from 10-20, the third one increases in area from 20-40 and the final bar is 40-50.

Go on to the next page to see how to interpret the information on this histogram.

Look at the histogram on the previous page.

To interpret the information provided on this histogram, we need to know how to calculate the frequency for each bar: the number of people with an iPod.

Since three out of the four bars are the same width (0-10, 10-20 and 40-50) we can say they are one unit wide. The bar ranging from 20-40 is double the width so we can say it is two units wide.

We will calculate the number of people with an iPod for each bar.

- The first bar (0-10) has a height of 5 and covers one unit: 1 x 5 = 5.
  5 people surveyed between the age of 0 and 10 have an iPod.

- The second bar (10-20) has a height of 10 and covers one unit: 1 x 10 = 10.
  10 people surveyed between the age of 10 and 20 have an iPod.

- The third bar (20-40) has a height of 20 and it covers two units (twice the area of the other bars): 2 x 20 = 40.
  people surveyed between the age of 20 and 40 have an iPod.

- The final bar (40-50) has a height of 10 and it covers one unit: 1 x 10 = 10.
  10 people surveyed between the age of 40 and 50 have an iPod.

Of the people surveyed, why do you think that more between the ages of 20 and 40 own iPods than those of other ages?

In order to represent this information on a histogram, the people conducting the survey needed to **organise the information**. To do this they used a **table**. This is explained in the next task.

Task 2 Understanding Tables

Example

The numbers in the box below represents **the length in minutes of the last phone call made by each member of a group of 22 people.**

5	7	3	14	1	6
20	15	2	13	9	16
11	33	19	22	25	17
30	24	26	28		

We can **put this information into a table** by grouping the minutes together.

The longest phone call lasted 33 minutes and the shortest one lasted 1 minute.

We can put the minutes into groups.

We can decide on the width of these groups (intervals).

See the next page for how to do this.

Solution

Let's sort out our table.

The calls range from 33 minutes to 1 minute. We also know that phone calls between 10 and 20 minutes and between 20 and 30 minutes were most frequent. Knowing this we can use 5 minute intervals for some data and 10 minute intervals for others.

So our intervals can be:

0-5

5-10

10-20

20-30

30-35

We can go through the list of data and see how many phone calls lasted between 0 and 5 minutes, 5-10 and so on.

NOTE: Each piece of data must only be placed in one category or interval only.

In two instances there are numbers that could potentially fit into two categories. These numbers are 20 and 30. We will place 20 in the 10-20 category and 30 in the 20-30 category.

Length of call (minutes)	**Tally**	**Number of times the call fits into each category**
0-5	| | | |	**4**
5-10	| | |	**3**
10-20	| | | | | | | |	**8**
20- 30	| | | | | |	**6**
30-35	|	**1**

There were a total of 22 people in the group. We can put this into a **grouped frequency table** similar to the frequency table we used in other activities:

Length of call (mins)	0 -5	5 -10	10-20	20-30	30-35
Number of phone calls	4	3	8	6	1

Now you try this

The following information shows the points scored by 12 players on a basketball team during one game.

2	12	10	18	22	6
26	2	4	6	8	15

- **Complete the following group frequency table:**

Number of points scored	0-3	3 - 6	6-12	12-18	18-24
Number of players					

Did you remember?

- Each piece of data must only be placed in one class or interval only.

Practise your skills

- Practice sheet D8 will help you develop your skills in interpreting data from a histogram and in reading and drawing grouped frequencies.

- Collect data on any topic on your interest: make sure it involves numbers. Represent it in a grouped frequency table. An example could include collecting data on the height of everyone in your class or your family. You need to think about how you should group your data – what factors do you need to consider?

Activity Phone Calls Charity Donations Code D9

This activity links to award learning outcome 4.2 and 4.4.

Introduction

We will use the length of telephone conversations from activity D8 to help us understand how to transform our data into a histogram.

Materials you will need

- Graph paper
- Ruler, pencil

What will you learn?

Learning Outcomes

1. Represent data on a histogram.

Key Learning Points

1. Histogram
2. Graphical Method

What do you need to know before you start?

Maths

You need to be aware of the maths needed in Activity D8 in order to draw a histogram. Remember:

- There are no gaps or spaces between the bars in a histogram.
- The amount of space or area of each of the bars tells us how many items are in that category.
- When drawing a histogram we need to choose class intervals and put them in a grouped frequency table first. Once this is done we can draw the histogram. Remember that the width intervals might be different from each other so be careful when drawing the height of the bar. We will use data from activity D8 to draw a histogram.

Task 1 Drawing a Histogram

Example

We can now draw **the histogram from Activity D8**. We have already completed the grouped frequency table for the length of phone calls made by university students.

We will say that 0-5 is one unit (narrowest bar).

Length of call (mins)	0 -5	5 -10	10-20	20-30	30-35
Number of phone calls	4	3	8	6	1

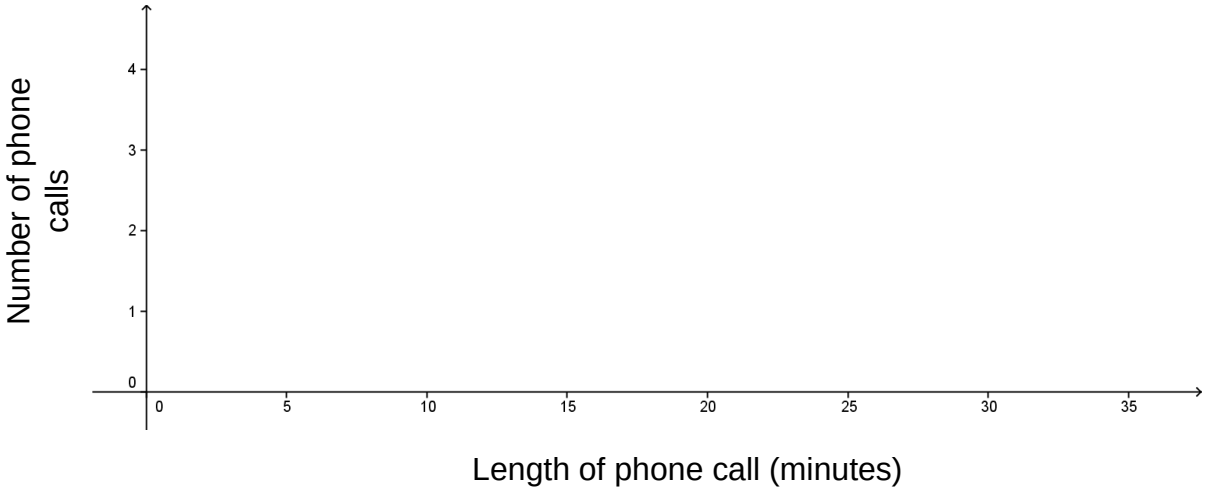
Calculate the height of each bar.

- The first bar (0-5) covers one unit (1 x 4 = 4) and so its height is 4.
- The second bar (5-10) also covers one unit: 1 x 3 = 3.
- The third bar (10-20) two units (twice the area of the other bars). We need to be careful to get the height correct here. Its frequency is 8, because there were 8 phone calls that lasted between 10 and 20 minutes. We need to divide 8 by 2 to get the correct height of 4 (4 x 2 = 8).
- It is the same for the fourth bar (20-30). It must include 6 people but it covers two units, so we must divide 6 by 2 to get a height of 3 (3 x 2 = 6).
- The final bar is back to one unit (1 x 1 =1). Its height is 1 since only one phone call lasted between 30 and 35 minutes.

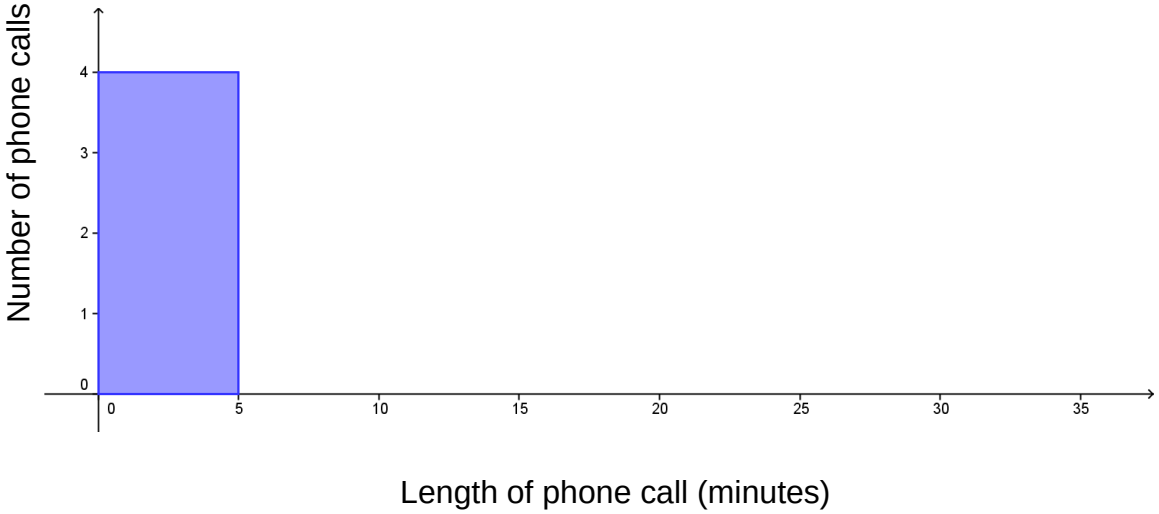
With this information we can draw the histogram accurately. Go on to the next page to see how to do this.

Drawing the histogram

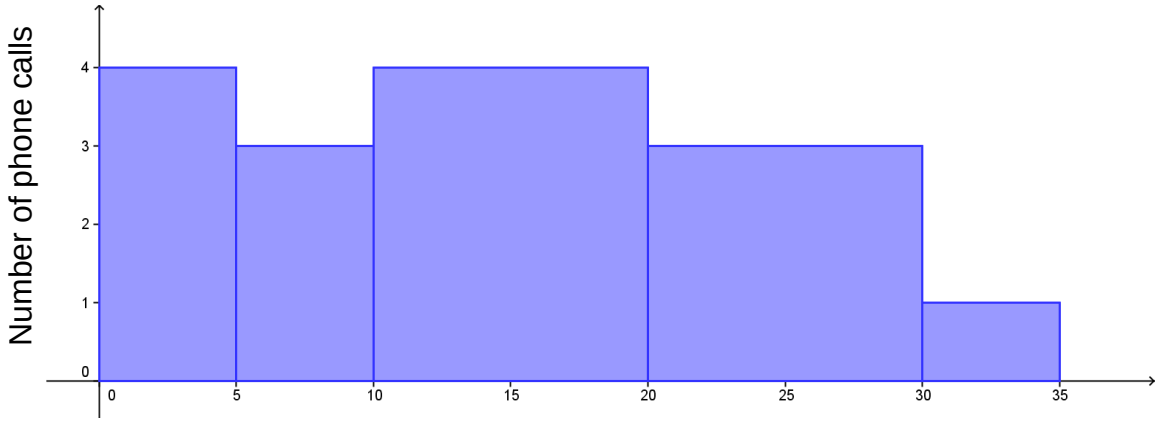
Mark the intervals (minutes) on x- axis. We can mark them in units of 5 up to 35. The frequency goes on the y-axis (number of phone calls). In this case they are marked in units of 1 since the highest bar is only 4.



Using a ruler and pencil go to 4 on the y-axis and draw a horizontal line out until you are above 5 (parallel) on the x-axis. Draw a vertical line from 5 on the x-axis until it meets this line.



Continue until your histogram is finished.



Now you try this

A local charity receives donations to their fund from a number of small town businesses. The table below shows the contributions in Euros.

Amount (€)	10-15	15-20	20-30	30-40	40-45
Number of businesses who contributed	5	3	6	10	2

1. Construct **a histogram based on that information. Use graph paper.**
2. What conclusions can you draw from the histogram?

Practise your skills

1. Practice sheet D9 will help you develop your skills in drawing histograms.
2. Draw a histogram of the data you put into a grouped frequency table in activity D8.

Activity **Profit** **Code D10**

This activity links to award learning outcomes 4.2 and 4.4.

Introduction

We will use the profit made by a number of business people to show how another way in which data can be represented on a graph. We can use the graph to compare the profit made by these business people. We can draw some conclusions about the business peoples' profit.

Materials you will need

- Graph paper
- Ruler, pencil

Learning Outcomes

1. Complete and create a cumulative frequency table based on your knowledge of grouped frequency tables.
2. Represent data on a cumulative frequency curve.

Key Learning Points

1. Cumulative Frequency Curve
2. Graphical Methods

What do you need to know before you start?

Maths

You are already familiar with **frequency tables** and **grouped frequency tables**. We can also use a **cumulative frequency table** to look at a build up of values.

For example, presume we know that one business person made a profit of between €0 and €300 and we also know that two people made a profit of between €300 and €600. Then we can calculate the number of business people who made a profit of less than €300 and less than €600. We do this by adding the values together.

One person made less than €300. Three people made less than €600 since the person who made less than €300 is also in the category for making less than €600. We will work through the tasks to help us understand this better.

From previous activities we know how to draw and plot points on an axis.
Remember, the x value is the first value written and the y value is the second value.
For example, (2, 30) means go to 2 on the x-axis and up to 30 on the y-axis until the lines meet to form the point.

Task 1 Constructing Cumulative Frequency Curves

Consider the following grouped frequency table. This shows the profit made last year by a number of business people.

Profit (€)	0 - 300	300-600	600-900	900-1200	1200-1500
Number of business people	1	2	4	8	12

We can convert this into a cumulative frequency curve by simply seeing how much profit the business people built up from the start. We do this by putting a **less than sign (<)** in front of each value on the table.

- There was no instance where no profit was made.
- 1 person made a profit less than €300.
- 3 people made less than €600 profit (1 made between 0 and 300 and two people made between 300 and 600 as can be seen from the first table).
- 7 people made less than €900 (1+2+4)
- 15 people made less than €1200 (1+2+4+8)
- 27 people made less than €1500 (1+2+4+8+12)

Profit (€)	<0	<300	<600	<900	<1200	<1500
Number of business people	0	1	3	7	15	27

We can see **the table starts with nobody but ends up with everybody (27). The build up is gradual** from one group (such as 0-300) to the next (such as 300-600).

Now you try this

This **grouped frequency table** shows the marks out of 100 achieved by a group of learners.

Marks	0-20	20-40	40-60	60-80	80-100
Number of learners	4	10	22	45	25

Complete the following cumulative frequency table based on the information above.

Marks	<0	<20	<40	<60	<80	<100
Number of learners						

Task 2 Drawing Cumulative Frequency Curves

Take this cumulative frequency table from Task 1:

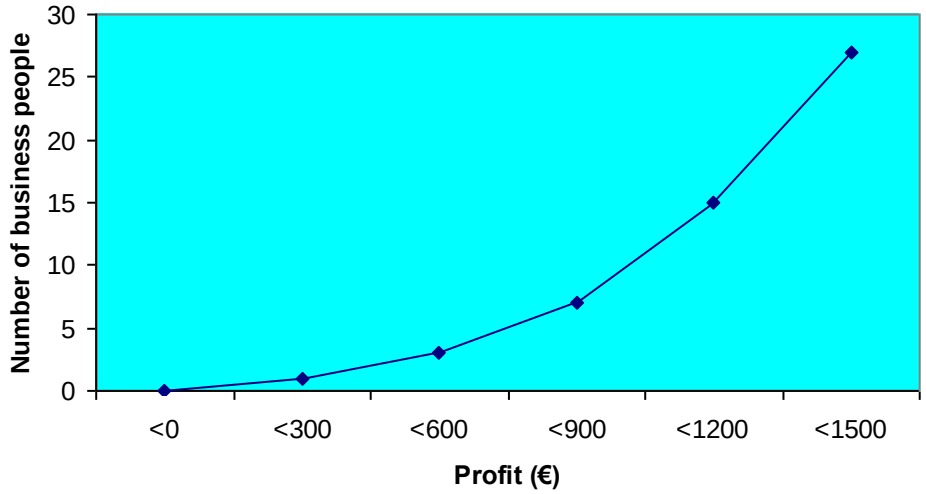
Profit (€)	<0	<300	<600	<900	<1200	<1500
Number of business people	0	1	3	7	15	27

We can **draw the data curve** by plotting points.

The points we need to plot are:

(0,0), (300,1), (600,3), (900,7), (1200,15) and (1500,27).

Once this is done we can join the dots by hand to form a curve.



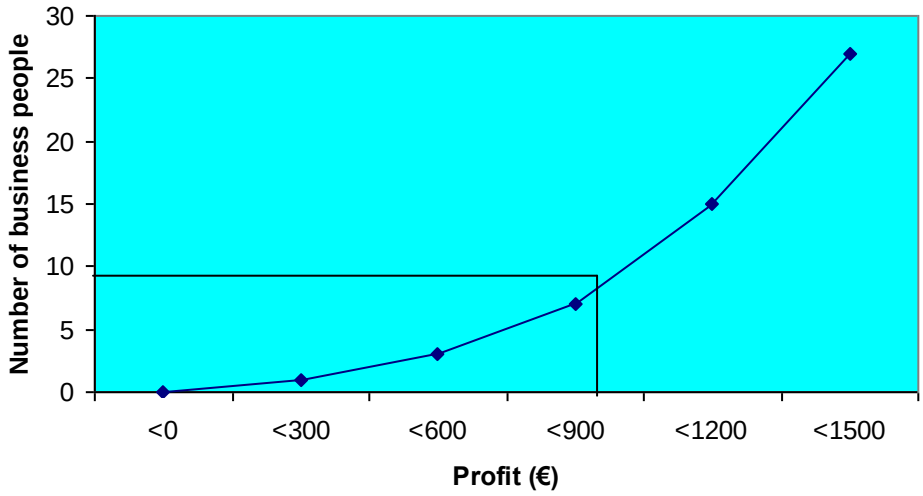
Go to the next page to see how to read and interpret the graph.

Interpreting the graph

Example

Estimate the profit made by the ninth person.

You can do this by going to 9 (approximately) on the number of business people axis (y-axis) and drawing a line to the graph using a ruler. When you reach the graph draw a line down to touch the profit axis (x-axis). The reading is approximately €975 which is the estimated profit of the ninth business person.



Now you try this

- Can you estimate the profit made by the 20th business person and the 25th business person?

- How does the profit of the 27th business person compare to the profit of the 20th business person?

Practise your skills

- Practice sheet D10 will help you develop your skills of reading and drawing cumulative frequency curves.

- Can you give one example of data that could be plotted on a cumulative frequency curve other than the ones used in task 1 and 2?

Activity **Soccer** **Code D11**

This activity links to award learning outcome 4.3 and 4.4.

Introduction

We often hear sports commentators talk about the **average** number of goals scored by a player or a team in any season. What exactly does this mean?

We will use the topic of soccer and goals scored to understand the concepts of **mean, median** and **mode**.

Learning Outcomes

1. Understand the need for measuring data
2. Calculate the mean, mode and median.

Key Learning Points

1. Mean/Average
2. Mode
3. Median

What do you need to know before you start?

Maths

We often hear the term **average**. For example, we hear about the average number of people who attend the All-Ireland final every year, the average life expectancy of people living in under developed countries, the average age that babies start to walk, and so on. What exactly does average mean?

Average is a measure of a set of values.

It is measured in three main ways:

1. **Mean:** This involves adding up all the values and dividing by the total number of values.
2. **Median:** This is the middle number which can be found once the values are organised in order.
3. **Mode:** This is the number that occurs most often.

Task 1 Calculating the mean

The soccer player Fernando Torres had this scoring pattern in his last games:

1 goal

2 goals

3 goals

No goal

1 goal

What is his **mean** number of goals scored for those five games?

This is how to find that out:

We need to add up all his goals and divide it by the total number of games:

1 +2 +3 + 0 +1 = 7

7 divided by 5 = 1.4

1.4 is the mean number of goals Torres scored for those five games. This means that he was **averaging** 1.4 goals a game.

Now you try this.

A first year class in school is made up of six students aged 12, fifteen students aged 13 and one student aged 14.

Find the mean age of the class.

Task 2 Calculating the median and mode

- Another measure of data is the **median**.

The wages earned by soccer plays is known to be very high. We can take the wages of a number of Premier League soccer plays in England per week and calculate the median wage earned by these players.

Suppose seven Premier League players earn the following weekly wages:

£110,000, £100,000, £110,000, £120,000, £90,000, £75,000 and £88,000

To **find the median value** place these in order of size starting from smallest to largest:

£75,000 £88,000, £90,000, £100,000, £110,000, £110,000, £120,000

The middle value is £100,000.
That is, out of these seven Premier League players, the median income per week is £100,000.

- The number that occurs most often is called the **mode**.

Using the Premier League players' wages we can see that the mode is £110,000 because it occurs twice and every other number only occurs once.

Now you try this

A family wishes to see look at their income and calculate the mean hourly rate of pay for the household, the median value and the mode.

- Using the following data, help the family work out the mean, median and mode. Explain to your tutor what your answer means.

Number of people in family	Hourly Rate
1	€7.50
2	€15.00
1	€25
2	€35

Remember:

Each person needs to be taken accounted for so if two people earn €15 an hour, €15 be taken into account twice.

Practise your skills

- Practice sheet D11 will help you develop your skills of mean, median and mode.

- Find out the time it takes each of the trainees in your group to get to the training centre. What is the **average** time taken?

  What is the **median** time?

  What is the **mode**?

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