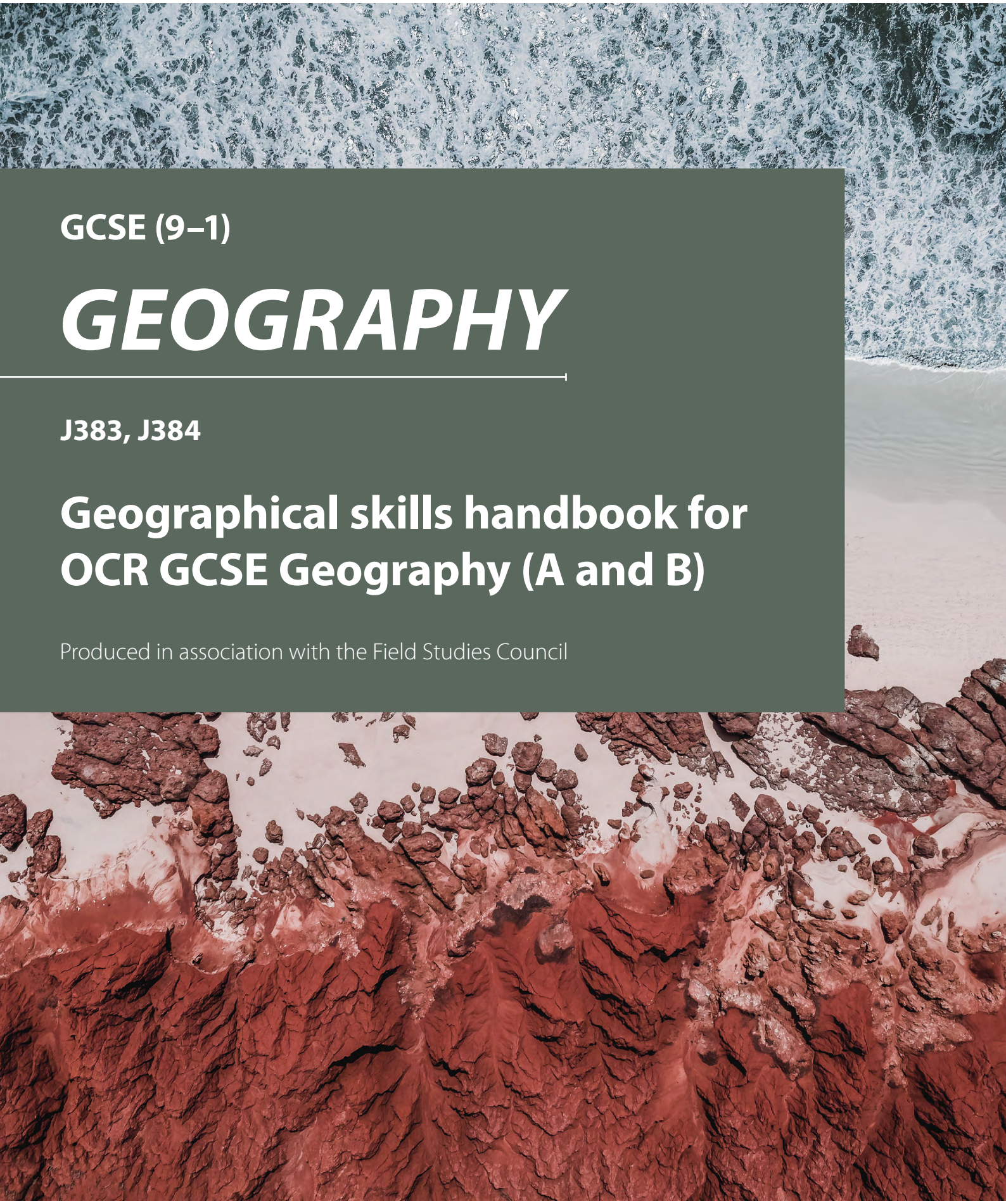
FSC

OCR
Oxford Cambridge and RSA



GCSE (9–1)

GEOGRAPHY

J383, J384

Geographical skills handbook for OCR GCSE Geography (A and B)

Produced in association with the Field Studies Council

Version 1

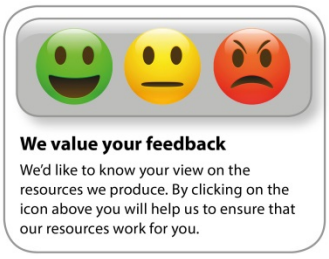
GCSE Geography
Teacher guide

OCR Oxford Cambridge and RSA

OCR may update this document on a regular basis. Please check the OCR website (www.ocr.org.uk) at the start of the academic year to ensure that you are using the latest version.

Contents

FSC



Whether you already offer OCR qualifications, are new to OCR, or are considering switching from your current provider/awarding organisation, you can request more information by completing the Expression of Interest form which can be found here: www.ocr.org.uk/expression-of-interest

Looking for a resource? There is now a quick and easy search tool to help find free resources for your qualification: www.ocr.org.uk/i-want-to/find-resources/

About the author

Janine Maddison has worked for the Field Studies Council (FSC) for the past 6 years. Janine has worked as a field tutor across FSC's 26 learning locations and currently works as an Education Projects Development Officer for the organisation. FSC is an environmental education charity with a mission to create outstanding opportunities that inspire everyone to engage with and care for the environment. FSC is the leading provider of geography fieldwork, welcoming over 70,000 students on geography courses each year.

Introduction

Geographical skills are fundamental to the study and practice of geography, skills are integrated into all aspects of the subject. Learning these geographical skills within the context of the specification will stimulate students to 'think geographically'. It will also provide them with opportunities to apply the skills in a wide range of curriculum or learning contexts including in familiar and novel contexts. Teaching and learning should aim to embed and contextualise the listed geographical skills within the content of the specification.

In order to be able to develop their skills, knowledge and understanding in GCSE Geography, students need to have been taught, and to have acquired competence in, the appropriate areas of geographical skills as indicated in the specifications:

- GCSE Geography A -Geographical Themes (J383) Pages 13-14.
- GCSE Geography B -Geography for Enquiring Minds (J384) Pages 17-18.

Students are expected to demonstrate their ability in four Assessment Objectives. Assessment Objective 4 (AO4) is the assessment of skills for GCSE and is worth 25% of the overall GCSE Geography specifications.

AO4: Select, adapt and use a variety of skills and techniques to investigate questions and issues and communicate findings.

The content of this handbook follows the structure of Geographical Skills within the specifications:

The discussion of each type of geographical skill begins with a brief description and explanation, followed by specific geographical contexts, indicating where these skills can be used in the curriculum. Where appropriate student activities are included to help students practice these skills within a geographical context. A separate student workbook containing all the activities is also available.

Chapter 1: Cartographic Skills

The GCSE Geography A & B specifications state:

With respect to cartographic skills, students should be able to:

1. select, adapt and construct maps, using appropriate scales and annotations, to present information
2. interpret cross-sections and transects
3. use and understand coordinates, scale and distance
4. extract, interpret, analyse and evaluate information
5. use and understand gradient, contour and spot height (on OS and other isoline maps)
6. describe, interpret and analyse geo-spatial data presented in a GIS framework.

Prior Key Stage 3 learning

- build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field
- interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs
- use Geographical Information Systems (GIS) to view, analyse and interpret places and data

1.1 Atlas/OS/Base Maps

Links to the specification content:

OCR A (1.1 Landscapes of the UK)

OCR B (3.2 What influences the landscapes of the UK?)

These geographical skills are covered by students in Key Stage 3, but it does not mean that knowledge should be assumed as this is often an area of challenge for many students. When students use their cartographic skills, their geographical understanding of a location or topic can be greatly increased, as students *extract, interpret, analyse and evaluate information.*

Geography by its very nature is spatial, but we cannot assume that students can 'select, adapt or use' maps effectively, students should be given regular opportunities to engage with maps, building on the skills such as the ones listed below:

- Reading, finding and writing grid references
- Calculating direction, distance, scale, height
- Interpreting symbols and keys

Geographical Context

Figures 1 and 2 show two different maps of Walton-on-the-Naze, Essex at different resolutions.

Figure 1 OS map extract Walton-on-the-Naze (ESRI, 2020)

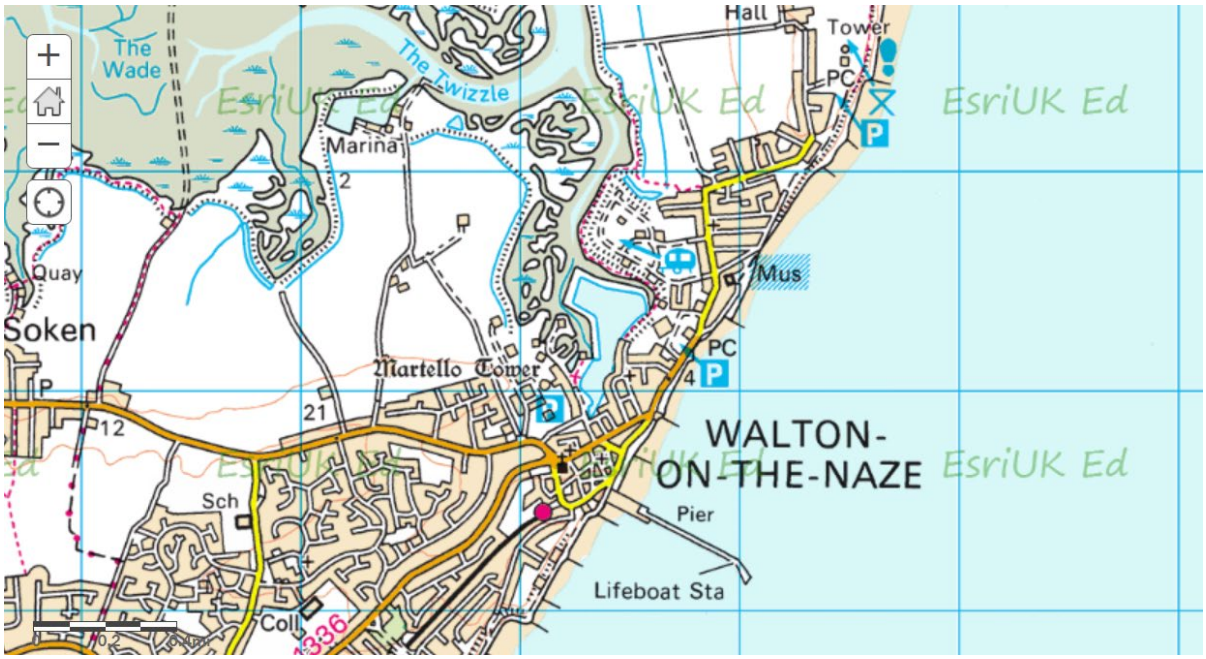


Figure 2 OS map extract Walton-on-the-Naze (ESRI, 2020)

Figure 3 Aerial image of Walton-on-the-Naze (ESRI, 2020)

Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

These map views are useful in helping students to contextualise and apply their geographical learning from the subject content. They can also be used to infer understanding of locations e.g. coastline, settlements, transport links, coastal management strategies, farmland and water sources.

Student activity

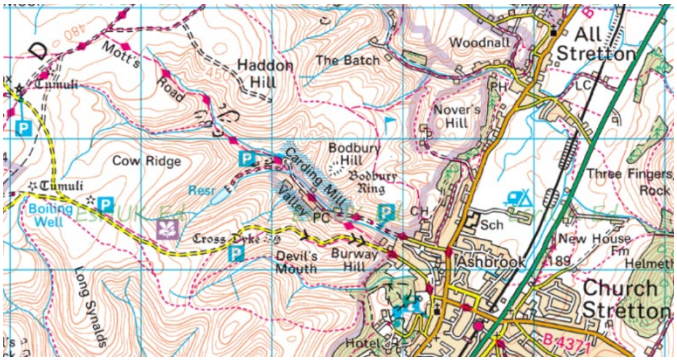
Maps and aerial images contain a wealth of information, it is important to scaffold students' engagement with maps and aerial images to ensure students can focus on the most relevant information present within the maps. One way of doing this is using questions to focus students understanding and interpretation. An alternative approach would be for students to label and annotate the maps / aerial image with key geographical information.

1. Using Figures 1, 2 and 3
    a. What are some of the dominant land uses in this location?
    b. How can the relief of the land be described here?
    c. What size is the main settlement?
    d. What is the length of coastline with residential/commercial buildings behind?
    e. What physical features and amenities are present?
    f. Which direction does this coastline face?

A class can be encouraged to create their own set of questions using a template like the one shown in Figure 4 before beginning to interpret maps and aerial images.

Figure 4 Understanding river landscapes

<table>
<tr><td colspan="3">Write your own question and use the sources to answer them.</td></tr>
<tr><td>What?</td><td></td><td rowspan="2">Map 1: Aerial Image, Carding Mill Valley, Shropshire (ESRI, 2020)
 
Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community</td></tr>
<tr><td>Where?</td><td></td></tr>
</table>

Which?		Map 2: OS Map Extract, Carding Mill Valley, Shropshire (ESRI, 2020)  © Crown Copyright and database rights 2020 Ordnance Survey
How?		

1.2 Choropleth Maps

Links to the specification content:

OCR A (1.2 People of the UK)

OCR B (5.2 Challenges and opportunities for cities)

A choropleth map is a map which uses differences in shading or colouring in defined areas. This shading indicates values of a particular factor e.g. life expectancy in those areas.

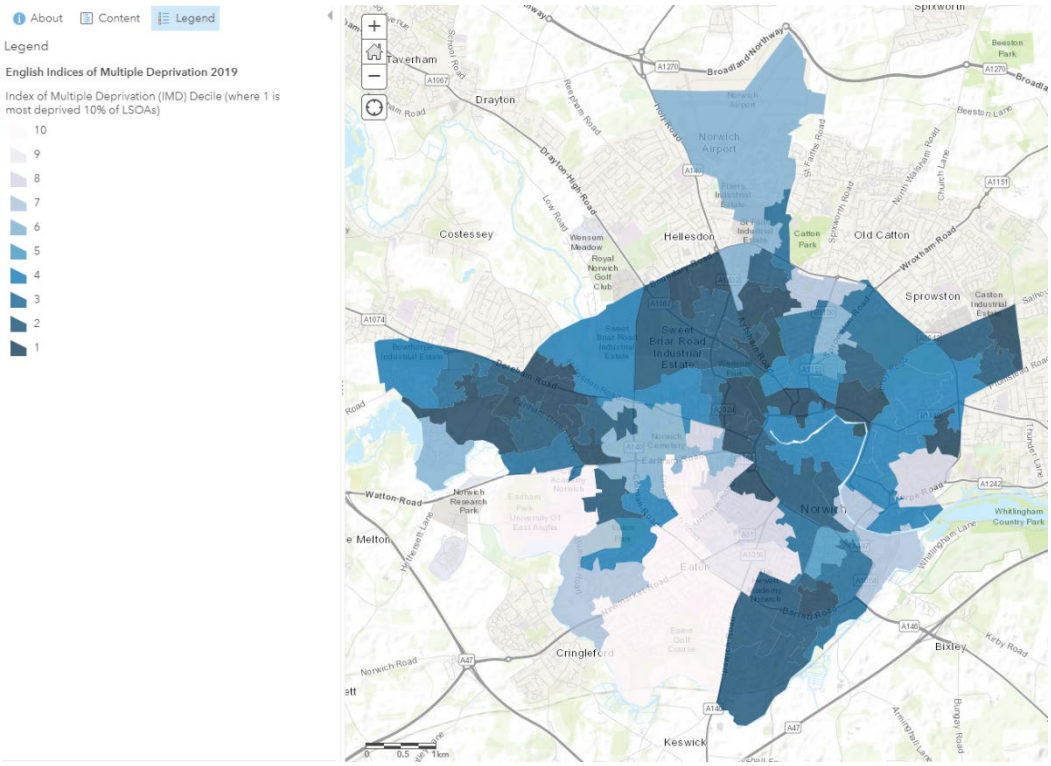
Choropleth maps can be incredibly useful in analysing spatial patterns across a location.

Geographical Context

In Figures 5 and 6 choropleth maps have been used to show Index of Multiple Deprivation (IMD) data across two different locations at different scales.

Figure 5 Index of Multiple Deprivation of at a city level for Norwich, and Figure 6 at a county level for Norfolk.

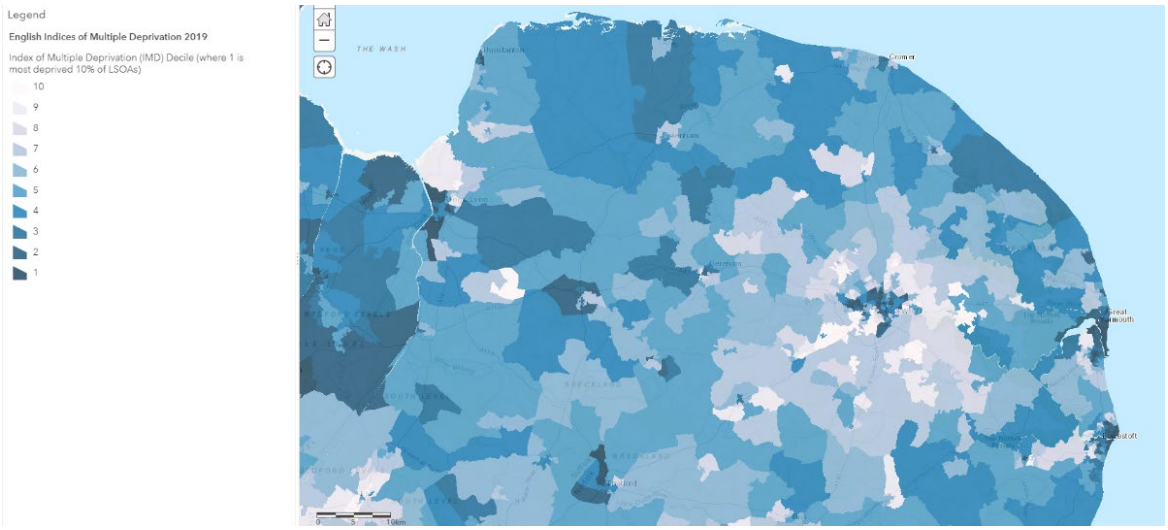
Figure 5 Index of Multiple Deprivation (IMD)- Norwich (ESRI, 2019)



Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, and the GIS User Community

https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019

Figure 6 Index of Multiple Deprivation (IMD)- Norfolk (ESRI, 2019)



Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, and the GIS User Community

https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019

From both maps it is possible to recognise spatial patterns of deprivation across the two locations.

Student activity

For the context in Figures 5 and 6 students may be supported in selecting and analysing data from choropleth maps with the questions from the table below.

1. For a city that you are studying and know well, use Consumer Data Research Centre to access a choropleth map to show Index of Multiple Deprivation (IMD) across the location.

   Use the choropleth map to answer the questions below.

Where are areas of most deprivation located?	
Where are areas of least deprivation located?	
How can the pattern of deprivation be described?	
What other information would be useful to help you analyse and interpret spatial patterns in this data?	

1.3 Desire-line Maps

Links to the specification content:

OCR A (1.2 People of the UK)

OCR B (5.2 Challenges and opportunities for cities)

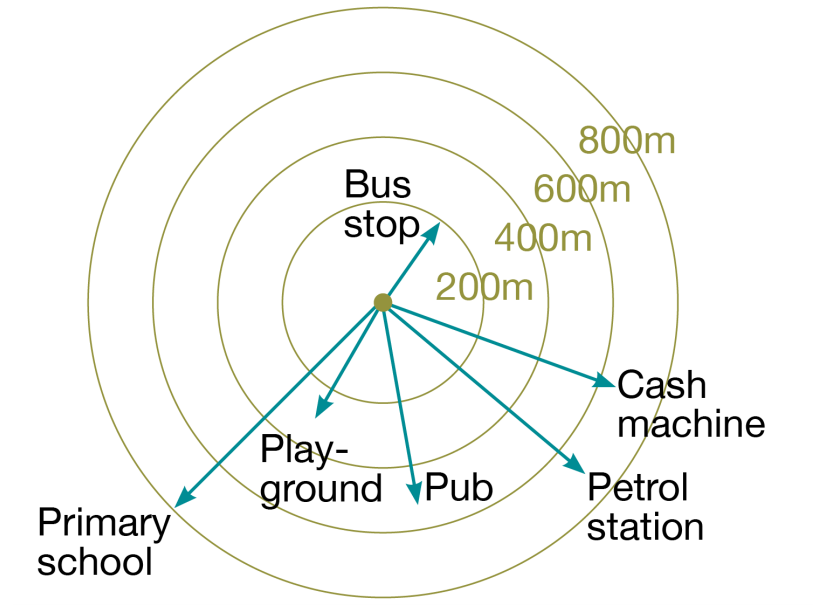
Desire-line maps are used to showcase direction and movement from a location.

Flow-line maps showcase this direction of movement but also quantify this movement using the thickness of line in proportion to the quantity.

Isoline maps aim to join areas of equal value across an area.

Geographical Context

Figure 7 Desire-line map showing the distance – metres (m) and direction - degrees (°) of major services from a central location in a town centre.



This desire-line map can be used to assess a locations access to services, this can subsequently be compared to different places within the same location or can be used to compare towns and cities. Ensuring equal access to services is a 21st Century challenge for cities in the UK.

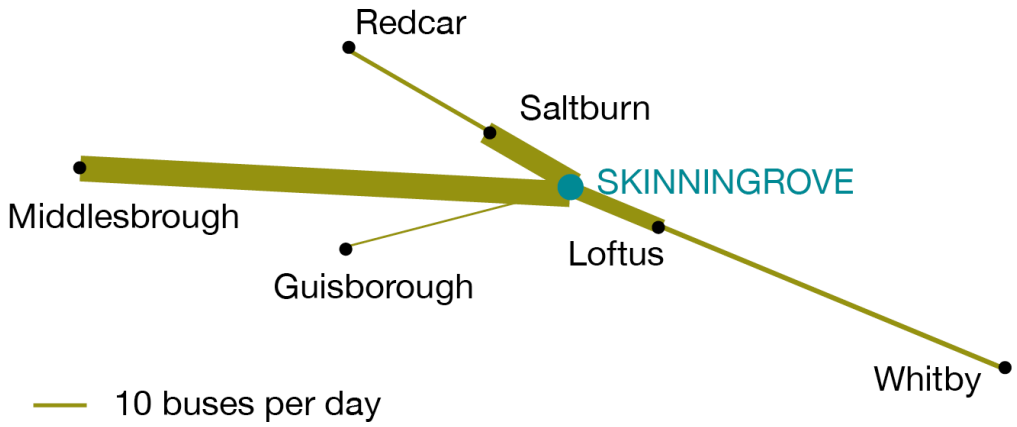
1.4 Flow line Maps

Links to the specification content:

OCR A (1.2 People of the UK)

OCR B (5.2 Challenges and opportunities for cities)

Figure 8 Flow line map of public transport in Skinningrove, a village in North Yorkshire.



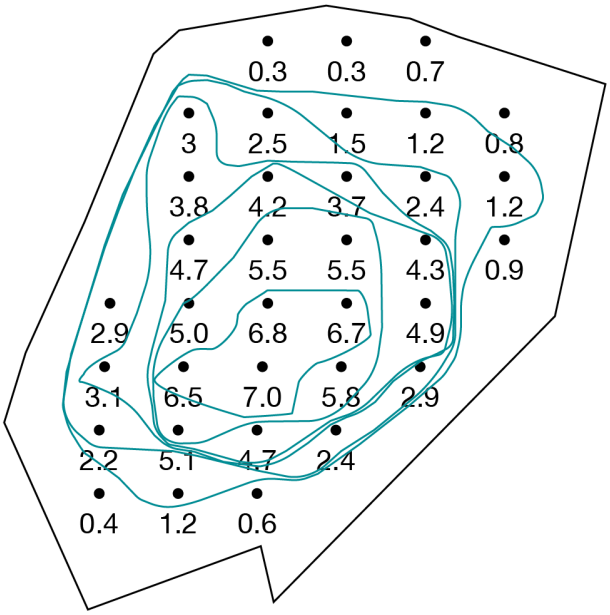
This map shows that Skinningrove is well-connected to the nearby county town of Middlesbrough, with around 40 buses per day to that location (wider flow line). Local smaller towns such as Guisborough and Whitby are less-connected with less than 10 buses a day from Skinningrove (narrow flow line). A flow line map can be used to consider the sphere of influence of this location, how connected it is to its nearest urban hubs, and consequences of counter-urbanisation in a location.

1.5 Isoline Maps

Links to the specification content:

OCR B (1.1 Hazardous weather)

Figure 9 Rainfall – millimetres (mm) in a 12-hour period



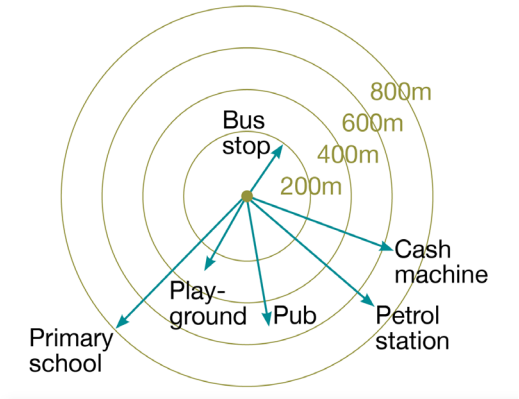
Isolines have been drawn to join places of equal rainfall amounts (mm) collected in the rain gauges.

Analysing the spatial patterns of this rainfall isoline map, a concentric pattern of rainfall (mm) can be observed. With more rainfall in the centre of the area, and less towards the outskirts of this location.

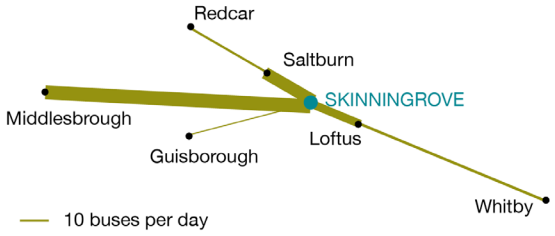
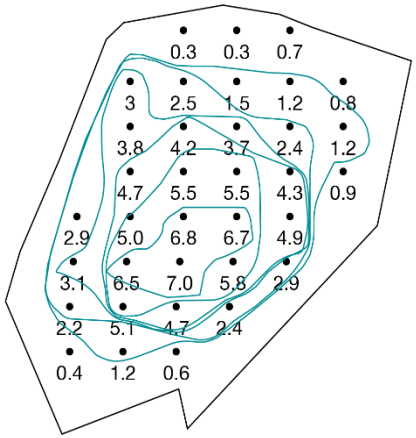
It would be useful to combine this isoline map of rainfall with a map showing land use of this location. This would enable students to explain spatial patterns in rainfall collected in the rain gauges with the presence or absence of vegetation and the effect of interception by vegetation such as trees.

Student activity

1. Use the table below to evaluate the different graphs.

Graph		Advantages of this data presentation	Disadvantages of this data presentation	Can you think of other appropriate contexts?
Desire Line				

GCSE Geography
Teacher guide

Graph		Advantages of this data presentation	Disadvantages of this data presentation	Can you think of other appropriate contexts?
Flow Line				
Isoline				

1.6 Sphere of Influence Maps

Links to the specification content:

OCR A (1.2 People of the UK)

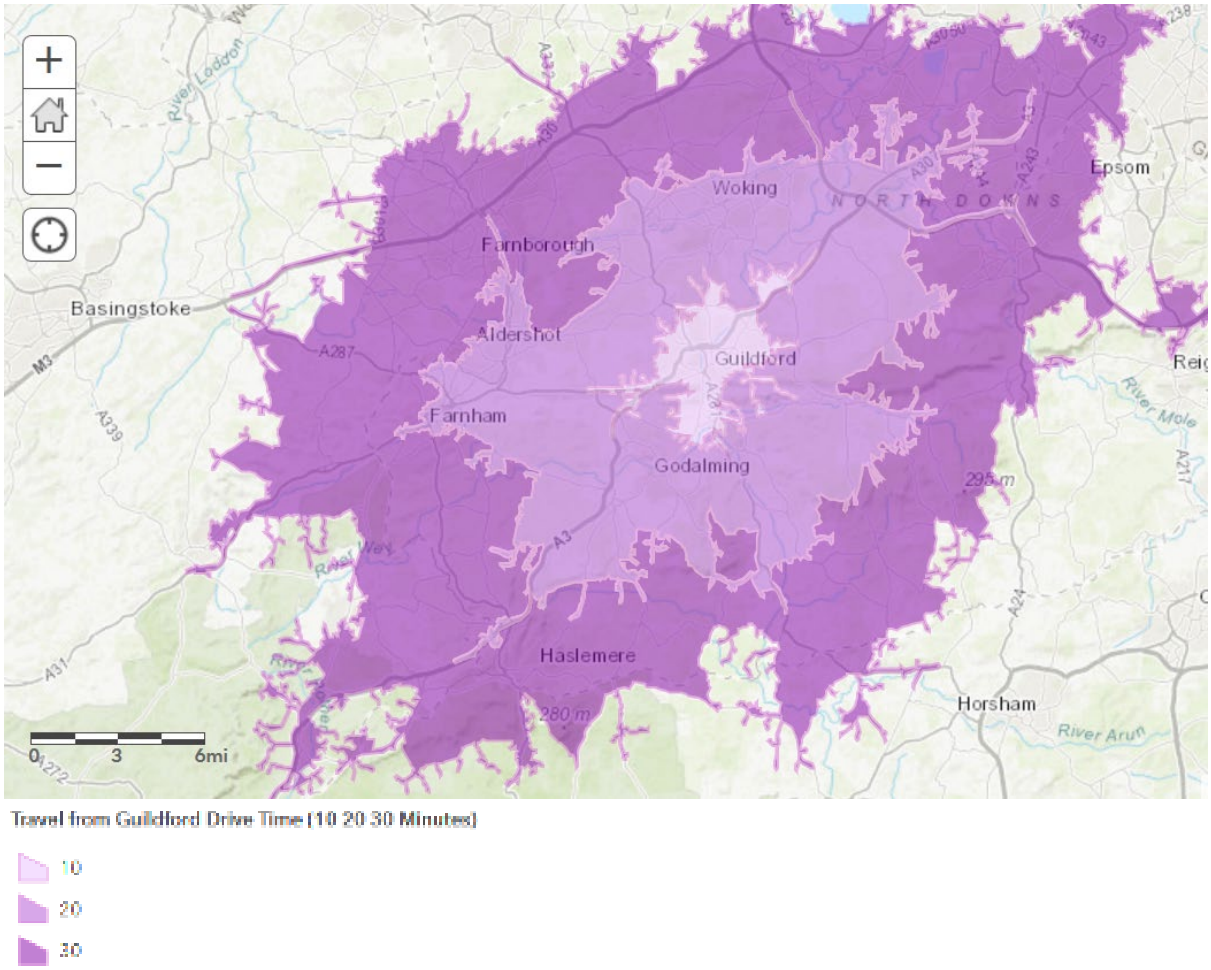
OCR B (Topic 5 Urban futures)

A sphere of influence map shows the influence of a location on the surrounding area based on a specific context. E.g. a large out of town shopping centre will have a larger sphere of influence than that of a local village store.

Geographical Context

Figure 10 Travel time distance from Guildford town centre

This sphere of influence map can help to develop an idea of the impact of Guildford on surrounding populations.



Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, and the GIS User Community

1.7 Sketch Maps

Links to the specification content:

OCR A (1.1 Landscapes of the UK)

OCR B (3.1 and 3.2 Distinctive Landscapes)

Drawing sketch maps of a location from an OS map extract or a photograph is a useful skill for geography students. A sketch map is not a replica of the original but rather a sketch map which shows key features, represented simply that are relevant to what is being studied. Sketch maps should always be accompanied by annotations that add further detail or explanation.

The following steps can be useful when constructing a sketch map:

- Identify from the original map or photograph the key features which are relevant to the sketch map you will be drawing.
- Draw a frame, which your sketch map will be drawn inside. If your frame is larger or smaller than the original map or photograph, a suitable scale will need to be used.
- Gridlines copied from the map, or that split the photograph into four sections can be lightly drawn onto your sketch map, they will help with scale and accurate placement of features from the original.
- Draw in key features from the original map, ensuring only features that are relevant are included.
- Include annotations that add further detail or explanation.
- Add a title and orientation to the sketch map.
- You may wish to use shading or symbols to showcase some of the key features, ensure a key is used to help identify the features.

Geographical Context

A sketch map can be incredibly useful to summarise key features from a location, helping to draw focus to relevant features. An example can be found here: BBC Bitesize Cartographic skills.

Student activity

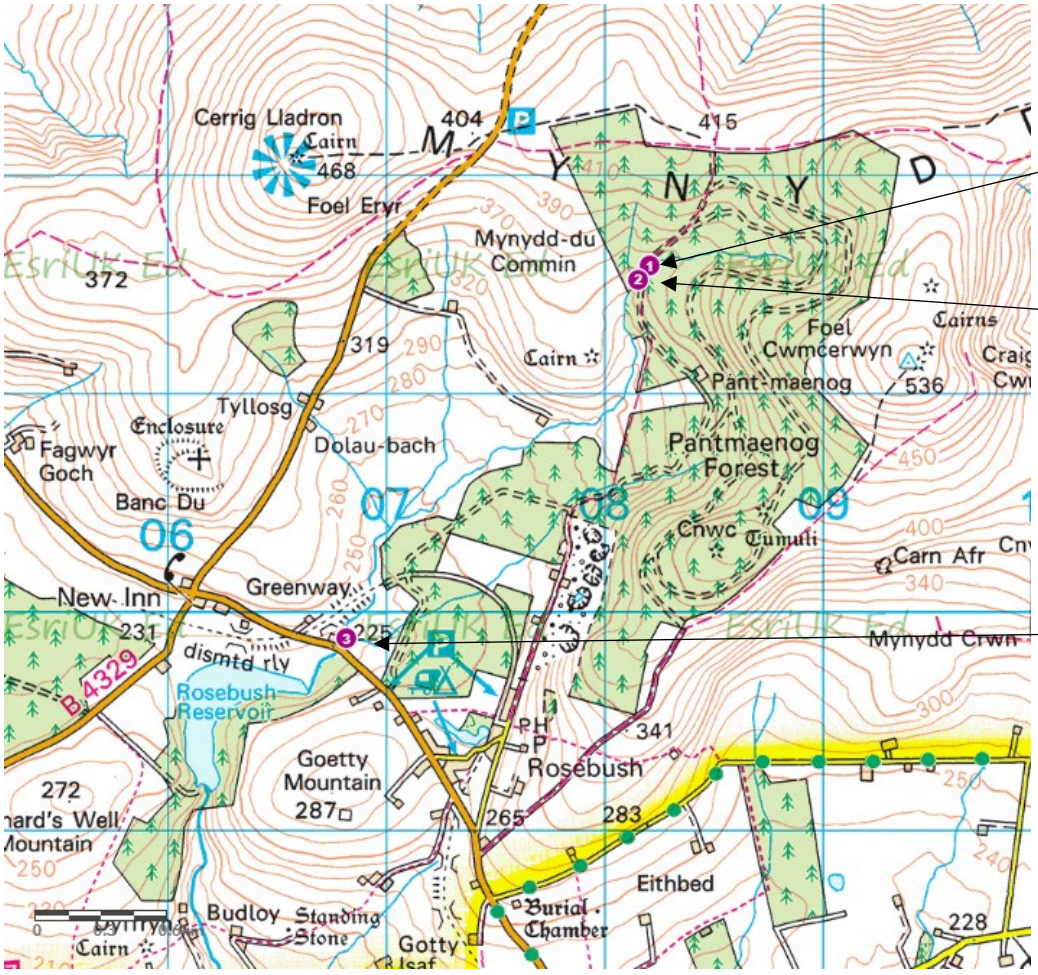
Figure 11 is a map showing the location of 3 fieldwork sites on the River Syfynwy. Site 1 is the site furthest upstream.

Investigation aim: Investigating downstream change.

At each site measurements of channel depth, channel width and flow velocity have been measured at the river.

1. Use the steps above to create a sketch map highlighting key features relevant to this investigation.

Figure 11 Fieldwork sites on the River Syfynwy



Chapter 2: Graphical Skills

The GCSE Geography A & B specifications state:

With respect to graphical skills, students should be able to:

1. Select and construct appropriate graphs and charts, using appropriate scales and annotations to present information.
2. Effectively present and communicate data through graphs and charts.
3. Extract, interpret, analyse and evaluate information.

Prior Key Stage 3 learning (maths)

Students should be taught to:

- describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers)
- construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data
- describe simple mathematical relationships between 2 variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs

When interpreting data in graphical form identifying patterns, trends, correlations and anomalies is a crucial task to aid interpretation. The definitions below show the difference between these four terms.

- Trend- A trend is a general direction of data.
- Pattern- A data set that is following a recognisable form.
- Correlation- a recognised pattern where two variables are connected.
- Anomaly- a data point that deviates from what is expected or what is the general trend of data.

2.1 Bar graphs/Histograms

Links to the specification content:

OCR A (1.1 Landscapes of the UK)

OCR B (3.2 What influences the landscapes of the UK?)

- A key difference between bar charts and histograms are in the type of data each of the graphs should be used for.
- Bar charts should be used when data is discrete. Bar charts have equal gaps between bars to show that each piece of data is discrete.
- Histograms should be used with continuous data. Histograms should be drawn with bars touching, to show that the graph is portraying continuous data.

Geographical context

- Bar charts and histograms have a wide range of uses in Geography. The examples in Figure 12 and 13, show how both bar charts and histograms can be effectively used in the same geographical context.
- Both graphs can be plotted with primary fieldwork data, or from secondary sources and used to show change and characteristics of sediment in a river channel.

Figure 12 Bar chart showing mean-cross sectional area (m²) of 5 sites along the River Holford, Somerset

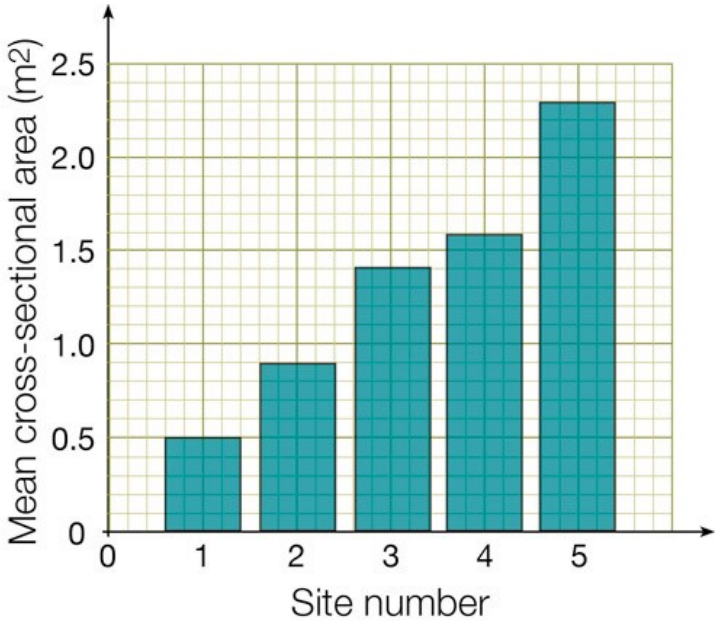
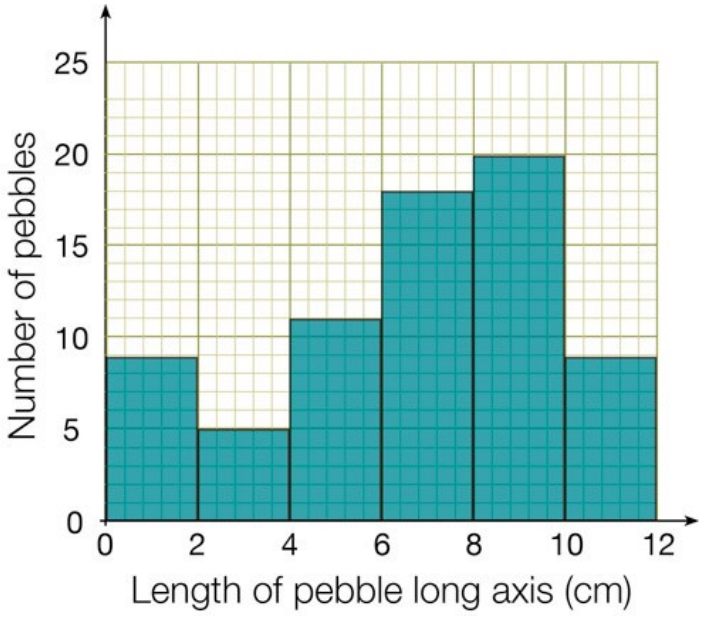


Figure 13 Histogram showing the number of pebbles for a continuous length of axis (cm). Sediment sampled from Site 3 on the River Holford.



Student activity

1. Annotate Figures 12 and 13 describing trends and patterns in the data (e.g. what happens to the data on the graphs – does it increase / decrease? How sharply does this happen and when? When describing your data give information from the graph).

Figure 12 Bar chart showing mean-cross sectional area (m²) of 5 sites along the River Holford, Somerset

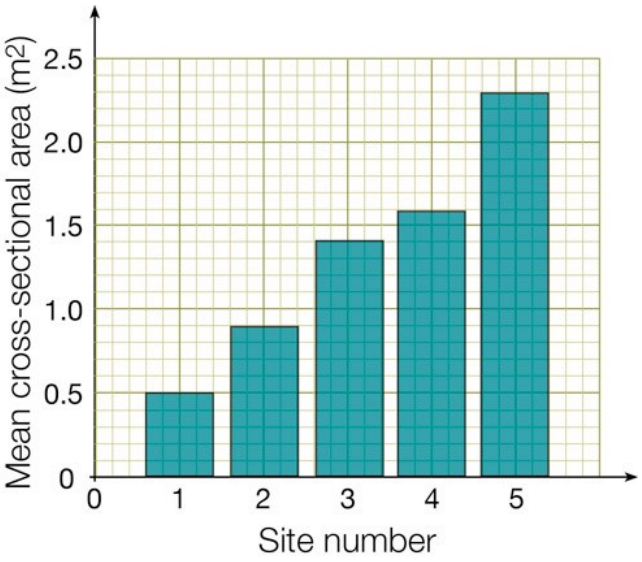
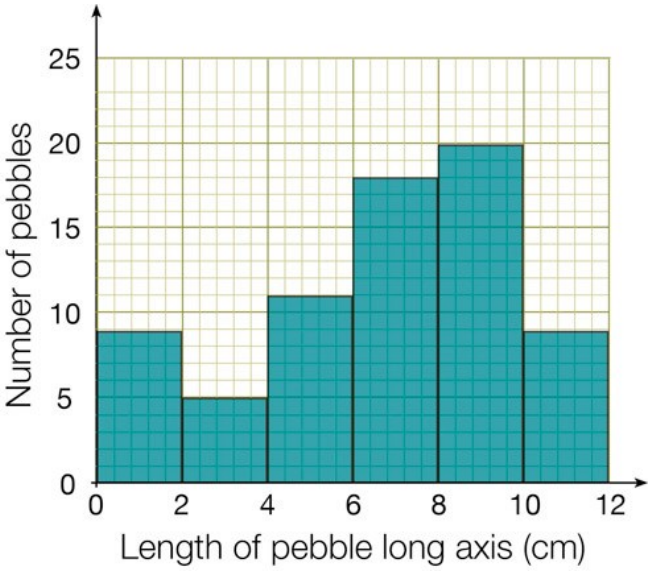


Figure 13 Histogram showing the number of pebbles for a continuous length of axis (cm). Sediment sampled from Site 3 on the River Holford.



2.2 Line/Scatter graph

Line graphs

Links to the specification content:

OCR A (1.1 Landscapes of the UK)

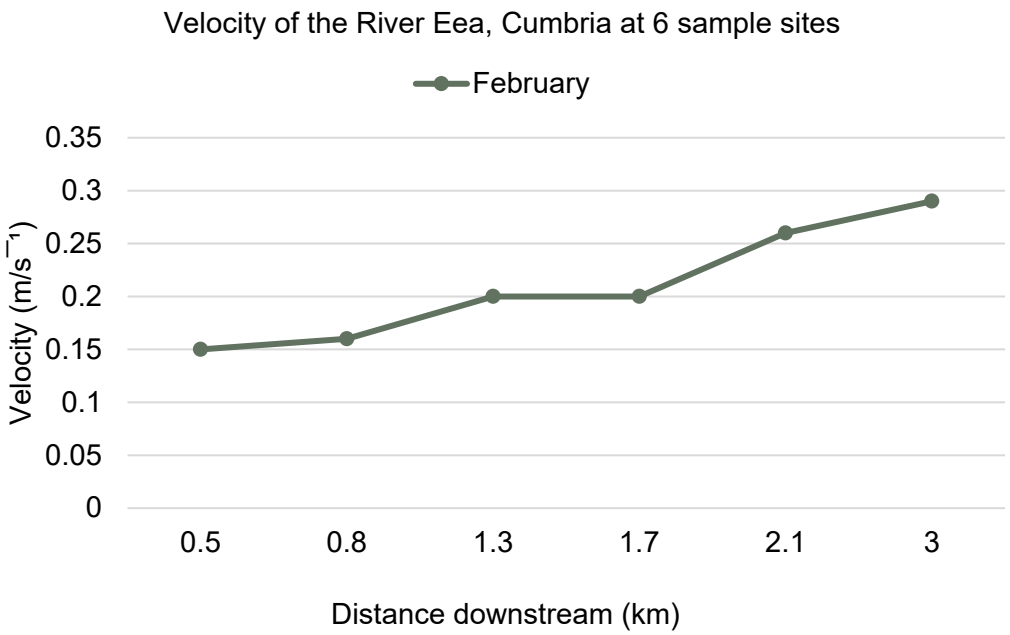
OCR B (3.1 and 3.2 Distinctive Landscapes)

A line-graph is used to represent continuous data. Multiple sets of data can be plotted on the same line graph. E.g. velocity (m/s^{-1}) of a river at different sites for different time of the year.

Table 1 Velocity of the River Eea in Cumbria at 6 sample sites along its course. The velocities have been measured at four different points in the year.

Distance from source of river (km)	Velocity (m/s^{-1})			
	December	February	May	August
0.5	0.14	0.15	0.12	0.03
0.8	0.15	0.16	0.18	0.09
1.3	0.21	0.2	0.19	0.1
1.7	0.21	0.2	0.21	0.13
2.1	0.24	0.26	0.21	0.14
3	0.26	0.29	0.24	0.16

Figure 14 Line graph of change in velocity in the River Eea downstream in February.



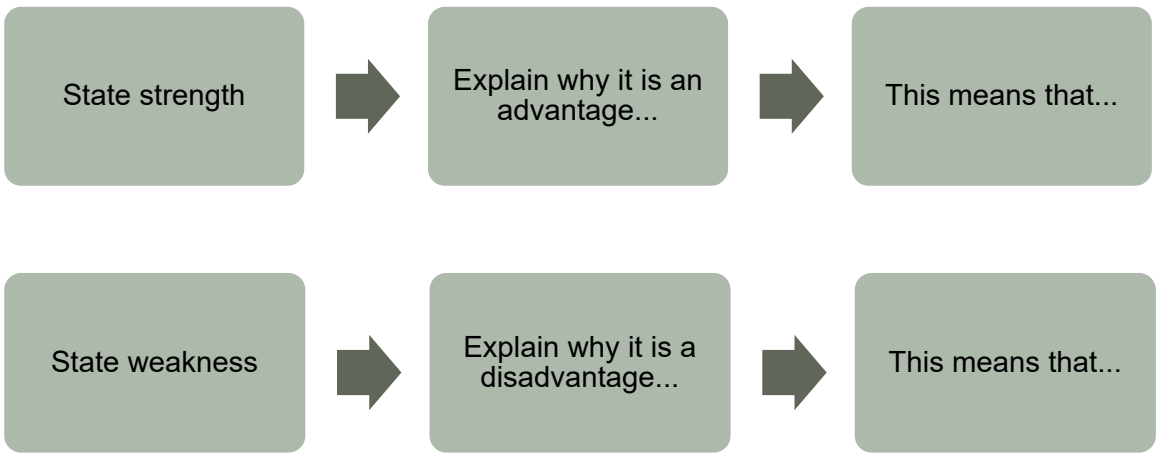
Student activity – Line graphs

1. Use Table 1 and Figure 14.

   Assess the strengths and weaknesses of the data presentation technique shown in Figure 14.

Strengths	Weaknesses

Use the following diagram to help you develop 'chains of reasoning' within your evaluation of the data presentation.



How else could the data in Table 1 be presented?	Why would this be appropriate?

Scatter graphs

Links to the specification content:

OCR A (1.2 People of the UK)

OCR B (Topic 5 Urban Futures)

A scatter graph can be used to consider if there is a relationship between two sets of data. Once points are plotted, a line of best can be drawn from the data. And a judgement of the strength of the relationship can be determined, this is called a correlation.

A line of best fit can be drawn through a scatter graph. A line of best fit should be a straight line that is drawn through the maximum number of points on a scatter graph, aiming to balance an equal number of plots above and below the line of best fit. Examples are shown in Figures 16 and 18.

Figure 15 Scatter graph

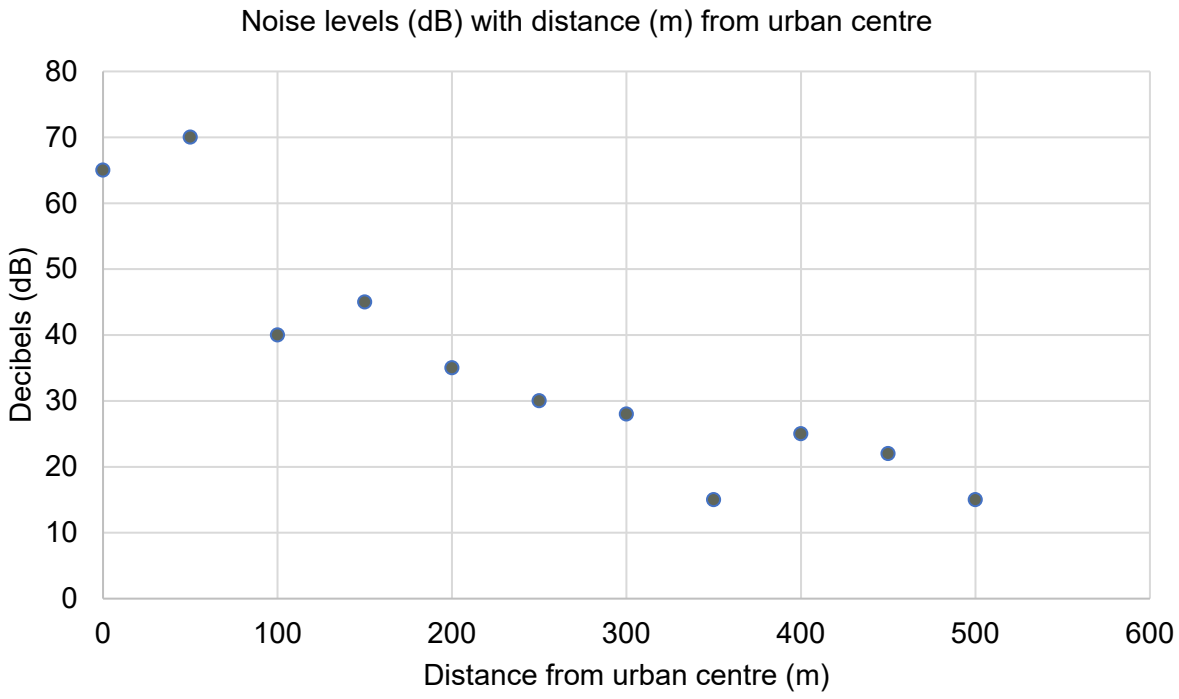


Figure 16 Scatter graph with line of best fit plotted

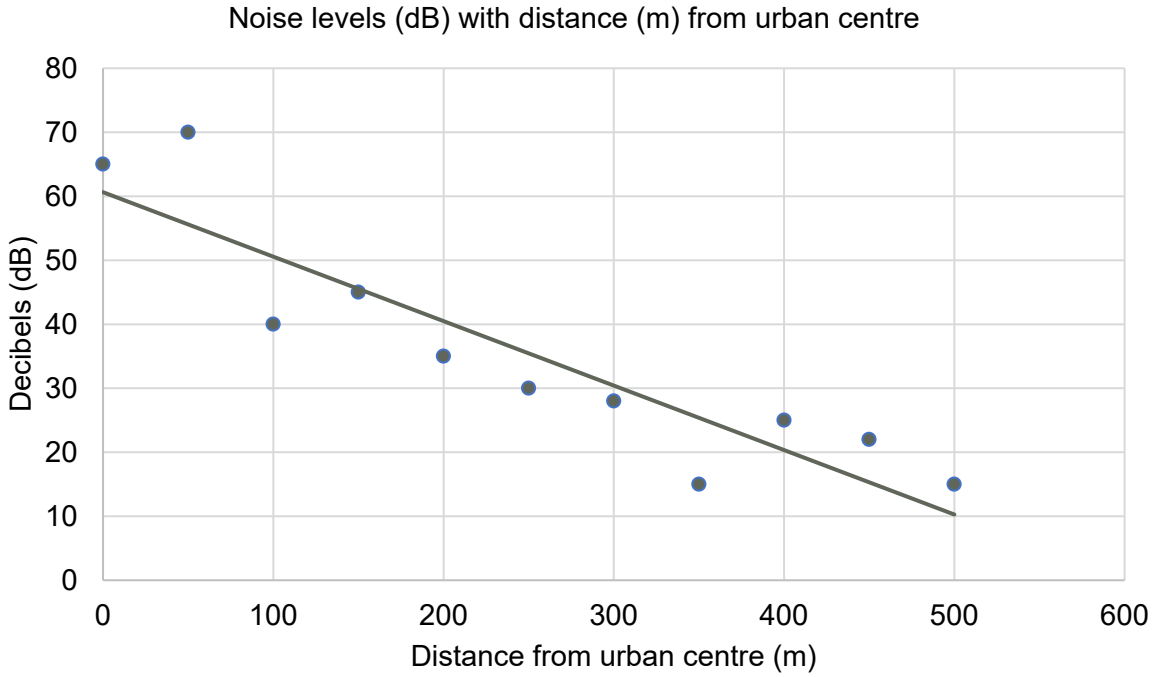


Figure 17 Different types of correlation for two variables plotted against one another

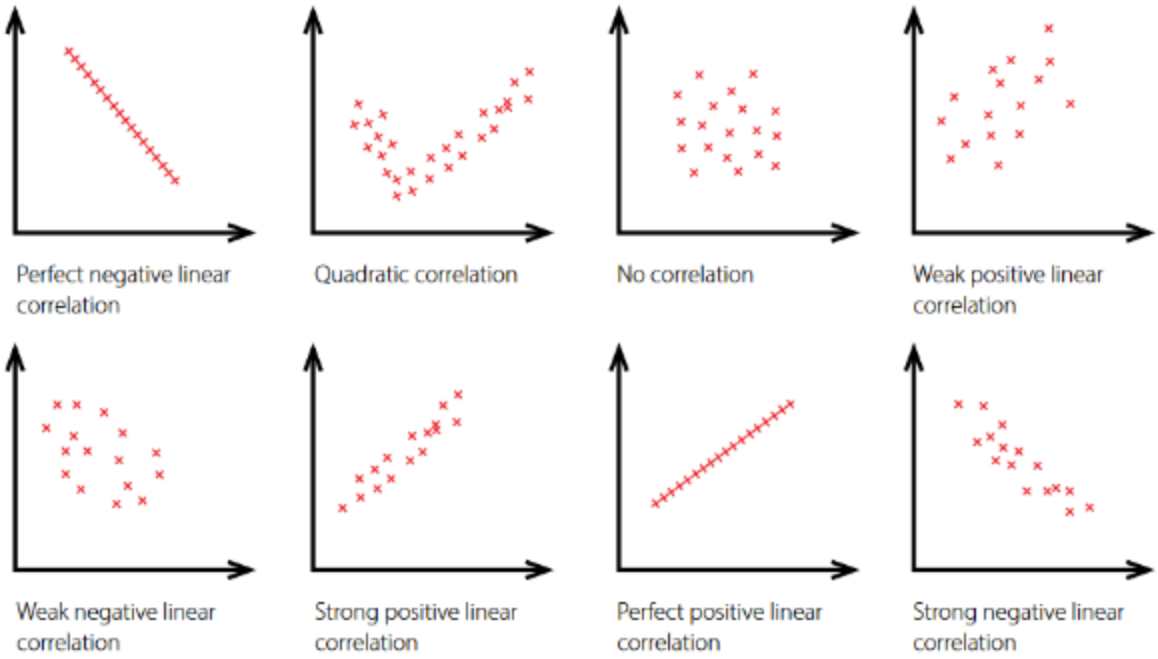


Figure 18 Correlation between House Condition Survey and Index of Multiple Deprivation (IMD)

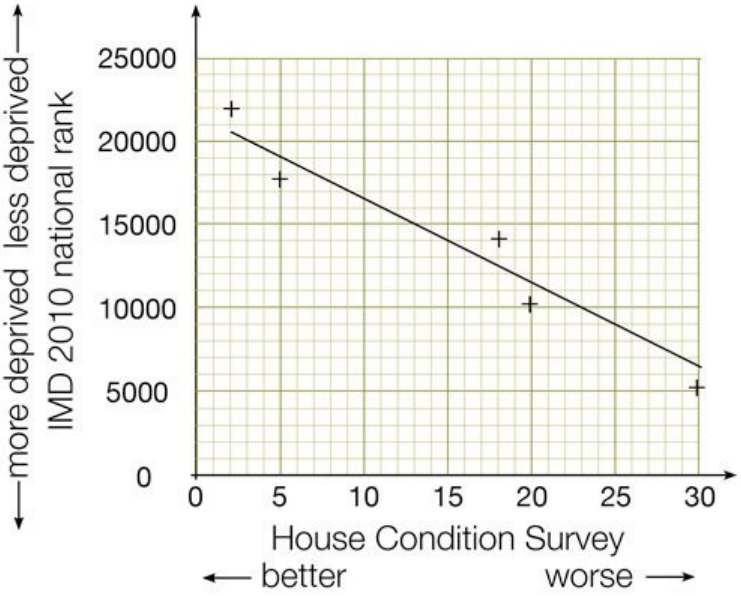


Figure 18 is a scatter graph and line of best fit for House Condition Survey (independent variable) and Index of Multiple Deprivation (IMD) (dependent variable), showing strong negative correlation between these two variables.

2.2 Line/Scatter graph

Scatter Graphs

Student activity

A student is investigating the waste management strategies within Sheffield. As part of their investigation the student has walked along a transect line starting at the train station, into the city centre. The student has used a systematic sampling strategy to locate sites where a litter survey has been conducted.

Definitions of Key Terms

Transect - is a line across an environment, habitat or location where this is an expected change across that environment. This transect line can then be used as locations to sample data from.

Systematic Sampling - Observations or data are taken at regular intervals e.g. every 10m or every 5th person.

E**xtrapolate** - a form of estimation beyond the data that has been collected. The estimation is based on the existing relationship between the data.

Bi-variate Data - is the study of two variables. There may be a relationship or dependence between these variables.

1. Using the data in Table 2 plot a scatter graph, then draw a line of best fit for this data.

   Extrapolate your line of best fit to estimate quantity of litter at a location 600m away from the train station.

Table 2 Results from litter survey conducted along a transect line

Distance from train station into city centre (m)	Quantity of litter items within a 400m² area	Site Description
0	4	Outside train station
50	45	At a cross-roads
100	33	Busy thoroughfare
150	27	Quieter street near offices
200	40	Edge of small green space within city centre.
250	35	Near road with bus stations on
300	20	Side of road
350	10	Side of road
400	5	High Street
450	4	Outside town council building

2. Using the scatter graph, explain trends in the bi-variate data by explaining what it shows including trends, patterns and anomalies.

   You could try using a DEAL scaffold to help structure your answer and explain trends. Use the table below to explain trends in the bi-variate data in Table 2.

Describe	Detailed description of any patterns or differences observed in the data, back up comments by quoting data.	
Explain	Explain these patterns or differences using geographical and locational information	
Anomalies	Pick out any anomalies, errors or oddities in the data, suggest explanations of these.	
Links	Find links between data and the significance of data with reference to the original hypothesis and overarching investigation aim.	

2.3 Pie Charts

Links to the specification content:

OCR A (1.3 UK Environmental Challenges)

OCR B (Topic 8 Resource Reliance)

Pie charts are used to compare proportions of a quantity in different categories.

To create a pie chart:

- Convert raw data into percentages
- Multiply percentage data by 3.6 to get the angle in degrees. These numbers should total 360, which is the number of degrees in a circle. These can be used to draw pie chart segments. A worked exampled is found in the geographical context below.

Geographical Context

United Kingdom (UK) - Carbon Dioxide (CO^2) gas emissions and contributing source can be analysed using the data in Table 3 and the pie chart in Figure 17. Transport and energy supply are the two biggest sources of CO^2 gas emissions.

Table 3 UK greenhouse gas emissions by source 2017

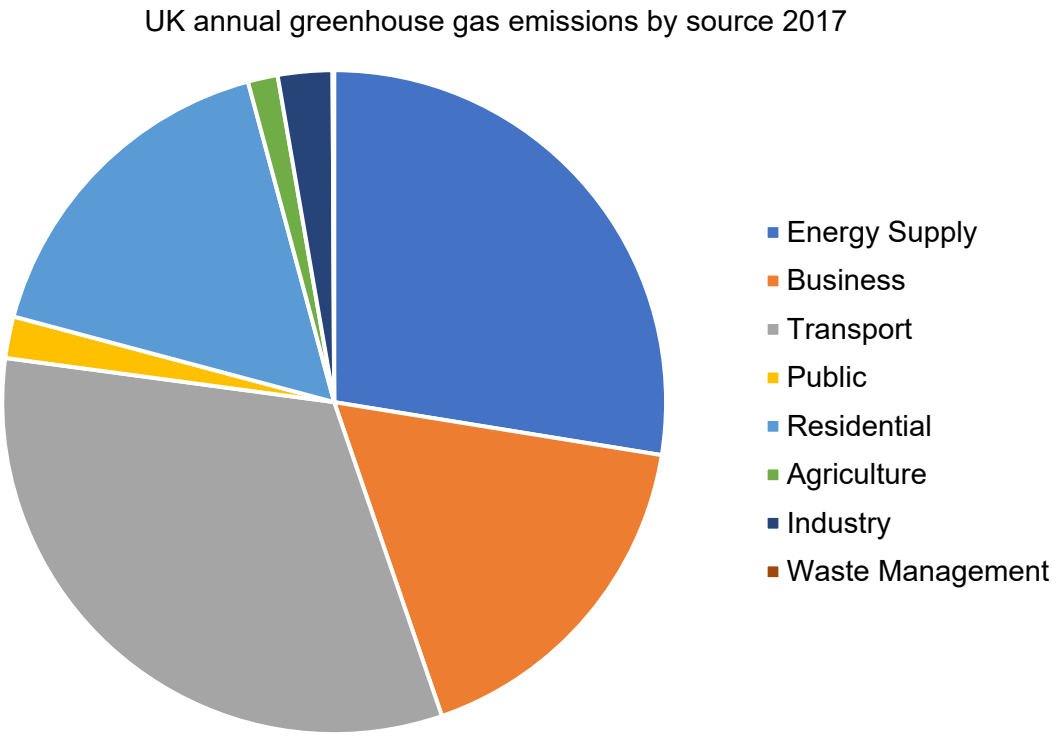
UK greenhouse gas emissions 2017			
Source	**MtCO2e**	**%**	**Multiply % by 3.6**
Energy Supply	106	27.6	99.2
Business	66.1	17.2	61.9
Transport	124.6	32.4	116.6
Public	7.8	2.0	7.3
Residential	64.1	16.7	60
Agriculture	5.6	1.5	5.2
Industry	10.2	2.7	9.5
Waste Management	0.3	0.08	0.3
Total	384.7	100	360

MtCO2e : metric tons of carbon dioxide equivalent

2018 UK Greenhouse Gas Emissions, Department for Business, Energy and Industrial Strategy

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/790626/2018-provisional-emissions-statistics-report.pdf

Figure 19 Pie chart of UK greenhouse gas emissions by source 2017



Student activity

1. Using the data in Table 4, construct a pie chart to show Global Greenhouse gas emissions by economic sector.

Table 4 Global Greenhouse emission by sector 2014

Global greenhouse gas emissions by sector (IPCC, 2014)		
Economic Sector	**%**	**Multiply % by 3.6**
Electricity and heat production	25	
Agriculture, Forestry and Other Landuse	24	
Industry	21	
Transportation	14	
Other Energy	10	
Buildings	6	
Total	100	

https://www.ipcc.ch/site/assets/uploads/2018/05/SYR_AR5_FINAL_full_wcover.pdf

2. Compare the pie chart you have just drawn for global greenhouse gas emissions with UK greenhouse gas emissions by source. What similarities and differences can you find?

2.4 Climate Graphs

Links to the specification content:

OCR A (1.1 Landscapes of the UK)

OCR B (1.1 Hazardous weather)

Climate graphs combine two data sets, and two data presentation techniques in one graph.

Average monthly rainfall (mm) is plotted as a bar chart, and average monthly temperature (°C) is plotted as a line graph.

Geographical context

Table 5- Climate data for two locations in Cumbria

	Blencathra, Cumbria 2017				Keswick, Cumbria Climate Averages	
Month	**Total Rainfall per Month (mm)**	**Number of Rainfall Days**	**Mean Daily Maximum Air Temperature (°C)**		**Mean Temperature (°C)**	**Total Rainfall per Month (mm)**
Jan	109.2	22	6.2		2.2	97
Feb	148.6	22	7.1		2.8	63
Mar	239.8	26	9.9		4.8	72
Apr	39.2	19	10.8		7.4	56
May	64.8	13	16.4		10.4	63
Jun	203	22	16.5		13.6	67
Jul	155.2	25	17.4		14.9	73
Aug	153	24	16.5		14.4	91
Sep	182.4	21	14.6		12.1	100
Oct	195	26	11.7		9.2	104
Nov	167.4	24	8.1		5.1	105
Dec	157	29	6.4		2.9	102

Climate graphs have been drawn for these locations using the data in Table 5.

Figure 20 Climate graph Keswick, Cumbria

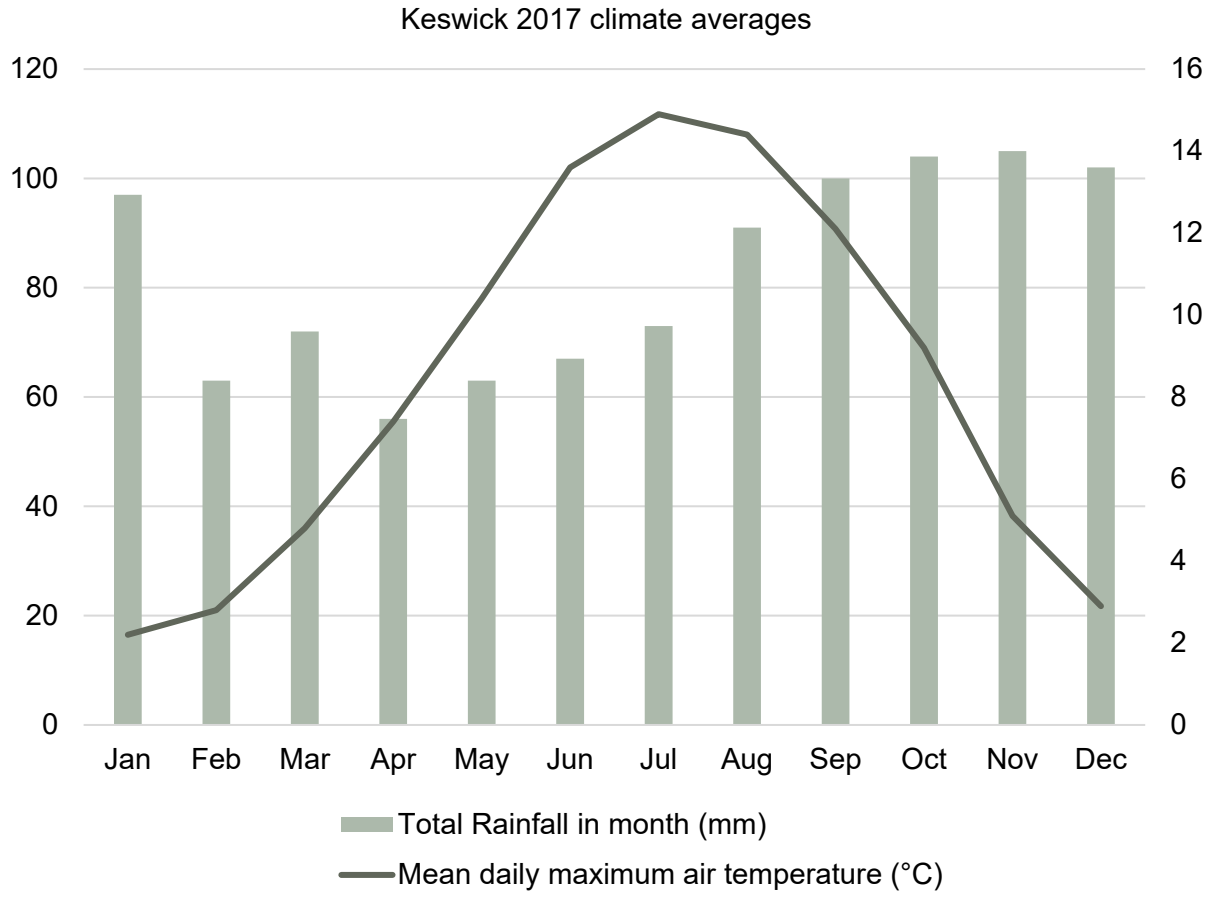
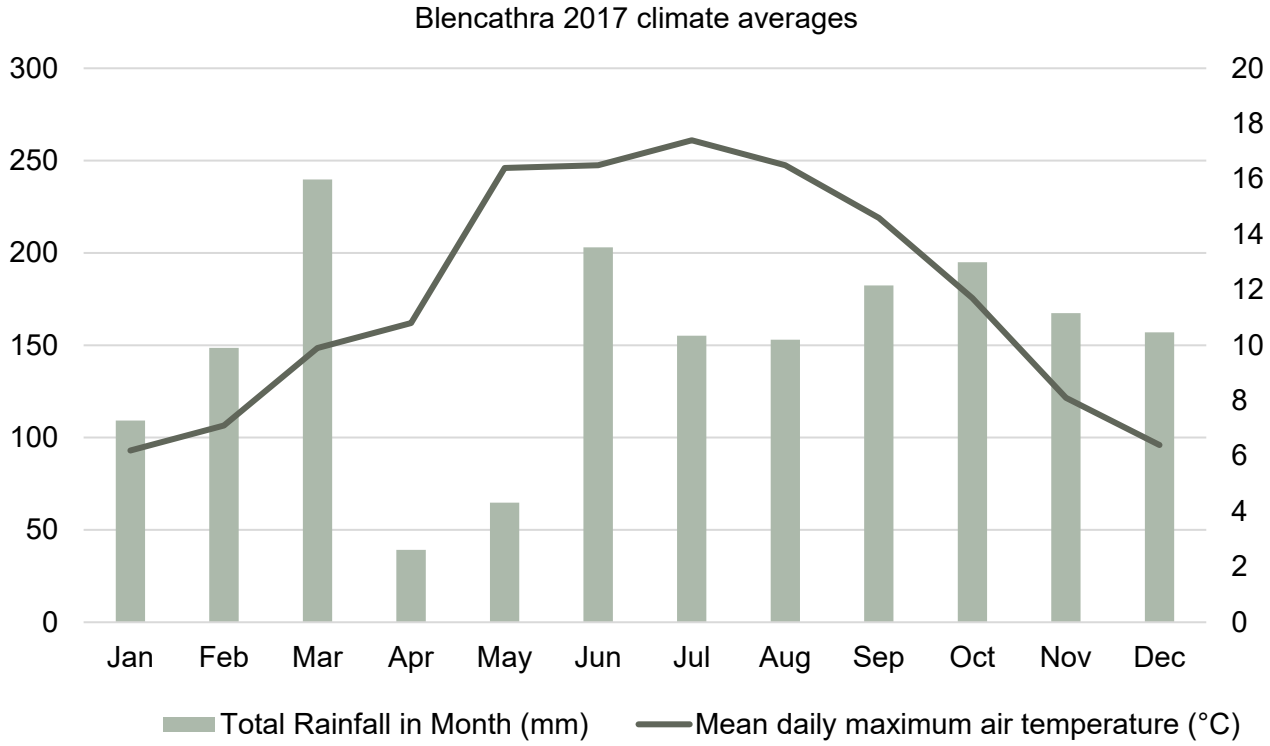


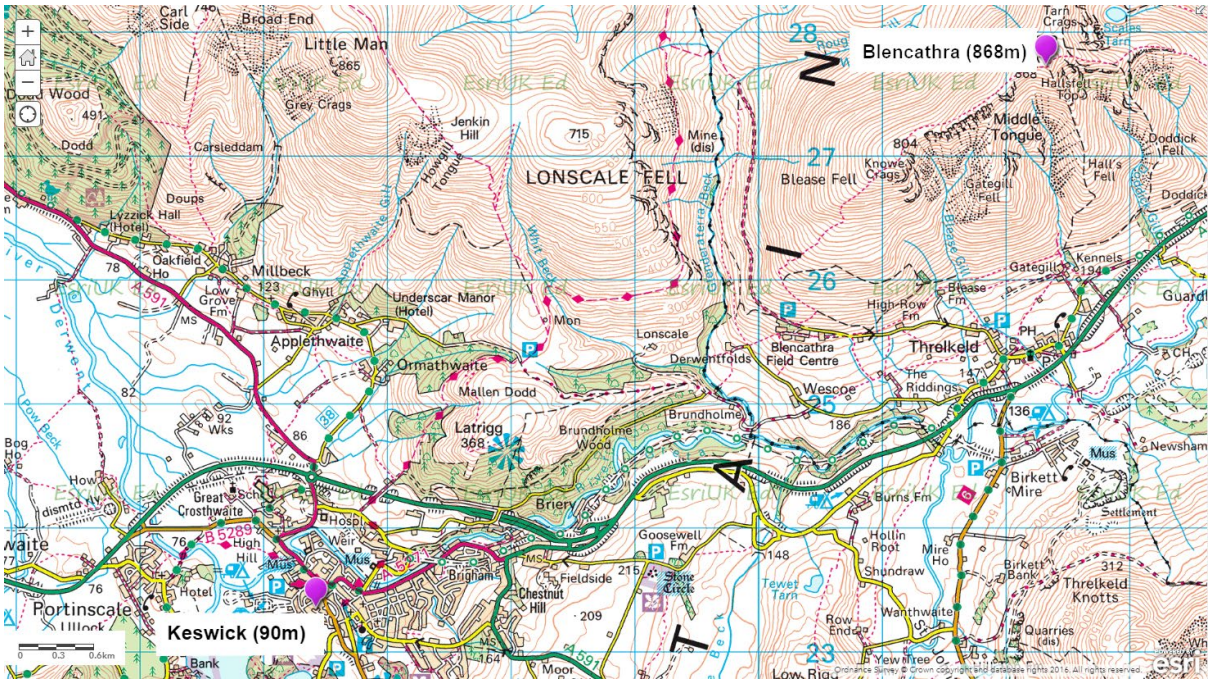
Figure 21 Climate graph Blencathra, Cumbria



Local variation in weather and climate can be described by comparing these graphs

Maps such as the one in Figure 22 and photographs can be used to support students in explaining the data displayed in the climate graphs in Figures 20 and 21.

Figure 22 OS map extract showing the locations of Keswick and Blencathra (ESRI, 2020)



Student activity

National and regional climate data can be accessed from the Met Office.

Table 6 UK annual climate data for 2019.

Month	Mean daily maximum temperature (°C)	Total rainfall per month (mm)
January	6.2	65.1
February	10.0	71.9
March	10.1	129.1
April	12.9	48.7
May	14.6	63.8
June	17.3	107.7
July	20.7	88.9
August	19.9	136.5
September	17.1	122.4
October	12.2	138.8
November	7.9	117.6
December	7.9	138.9

1. Using Table 6 draw a climate graph of UK climate data.

2. Annotate the three climate graphs (Figure 20, 21 and your own) explaining key trends in the data.

2.5 Proportional Symbols

Links to the specification content:

OCR A (1.3 UK Environmental Challenges and 2.2 People of the Planet)

OCR B (Topic 2 Changing Climate and Topic 6 Dynamic Development)

A proportional symbol map uses symbols which are proportional to a quantity which are then located onto a base map.

Constructing a proportional symbols map can be done using a simple GIS or on a paper base map.

If drawing by hand, it is important to calculate an appropriate scale for the proportional symbol.

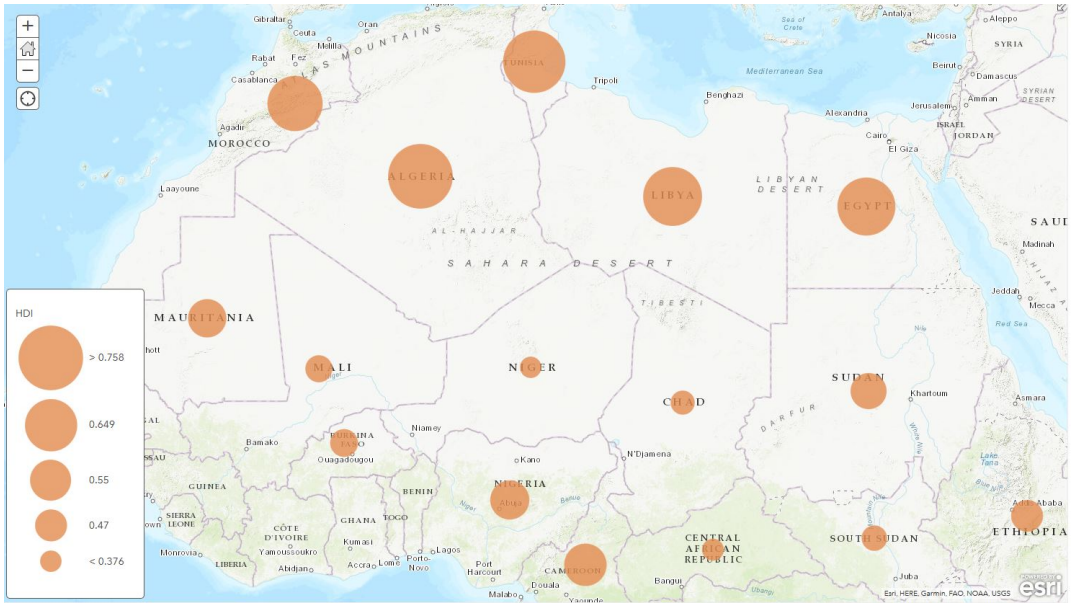
Proportional symbols maps are useful to explain spatial differences in data.

For more info on how to draw a proportional symbol map using a GIS- Geography Fieldwork: Using GIS

Geographical Context

Two proportional symbols maps are shown in Figure 23 and 24.

Figure 23 Human Development Index (HDI) for countries in Northern Africa



Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, and the GIS User Community

Data: UN 2018 http://hdr.undp.org/en/data Creative Commons Attribution 3.0 IGO

HDI takes into account 3 key dimensions.

1. A long and healthy life (measured by life expectancy)

2. Access to education (expected years of schooling- children at school and mean years of schooling- adult population)

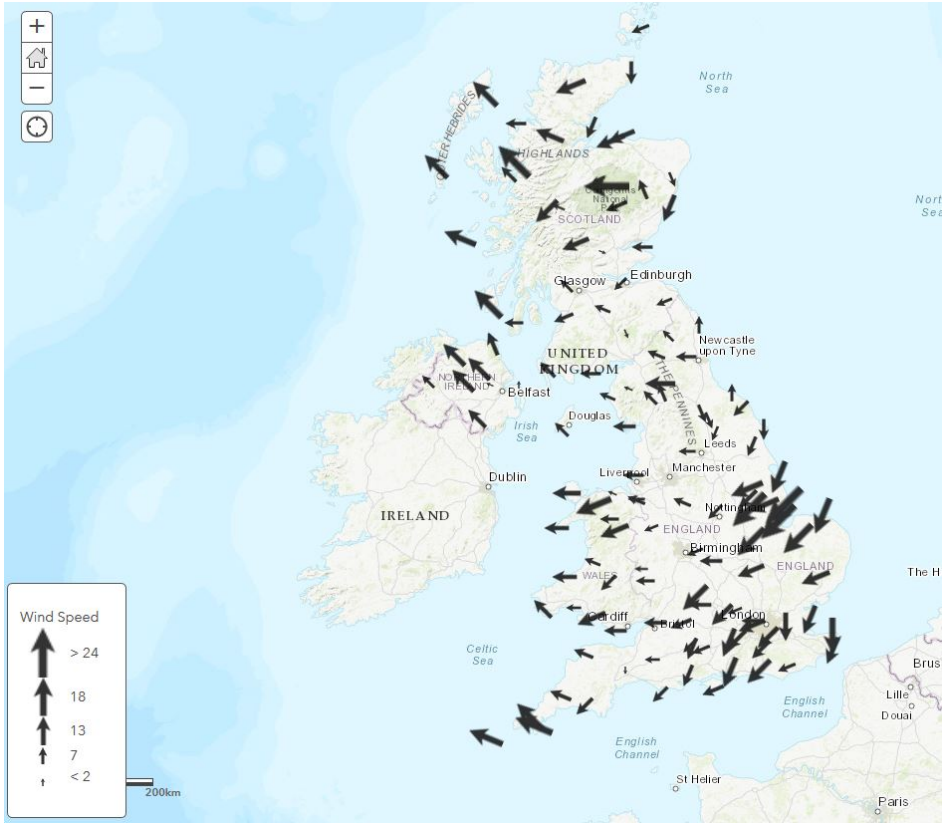
3. Decent standard of living (GNP per capita)

In Figure 23 distinct spatial patterns can be seen in HDI across Northern Africa; higher HDI score (as the circles are larger in size) in countries North of the Sahara desert which have a border with the coast e.g. Algeria, Libya, Egypt, compared to lower HDI scores for countries south of the Sahara desert e.g. Niger, Chad, Mali

Figure 24 is a more complex proportional symbol map. Here two pieces of data have been plotted using the proportional symbols.

Wind speed (m/s^{-1}) is mapped by the size of the arrow and wind direction by the orientation of the arrow. Again, distinct spatial patterns in the direction and strength of wind can be clearly seen in this proportional symbol map.

Figure 24 Wind speed (m/s^{-1}) and direction across the UK



Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, and the GIS User Community

Student activity

1. Evaluate the data presentation methods shown in Figures 23 and 24.

	Figure 23	Figure 24
What does this graph show?		
Advantages		
Disadvantages		
Suggestions to improve the data presentation (e.g. scale, size, labels etc)		

2.6 Pictograms

Links to the specification content:

OCR A (2.3 Environmental Threats to the Planet)

OCR B (Topic 1 Global Hazards)

Pictograms use appropriate symbols to display data, with each symbol corresponding to a set quantity. Pictograms are used for discrete data (separate values) and are useful to show trends in data quickly and simply.

Geographical Context

Figure 25 Number of Atlantic Hurricanes per year in the Atlantic Basin

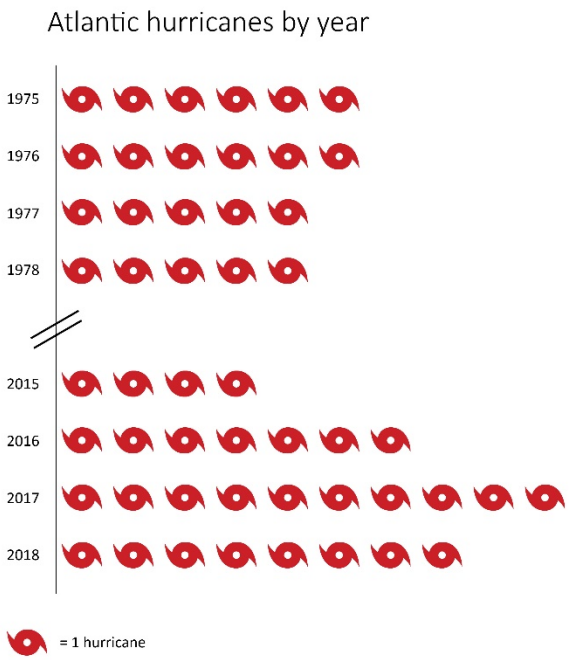
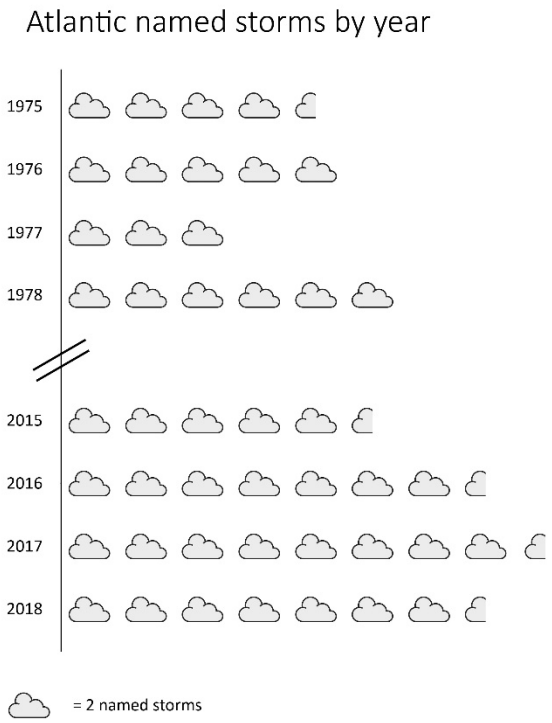


Figure 26 Number of named storms per year in the Atlantic Basin



Source: Hurricane and Tropical Storm Data https://www.aoml.noaa.gov/hrd/tcfaq/E11.html

Student activity

1. Plan an answer to this exam-style question.

   Exam Style Question: Using Figures 25, 26 and your own knowledge. Assess the view that storms and hurricanes in the Atlantic basin are occurring more frequently.

   (6 marks)

2.7 Cross-Section Graphs

Links to the specification content:

OCR A (1.1 Landscapes of the UK)

OCR B (Topic 3 Distinctive Landscapes)

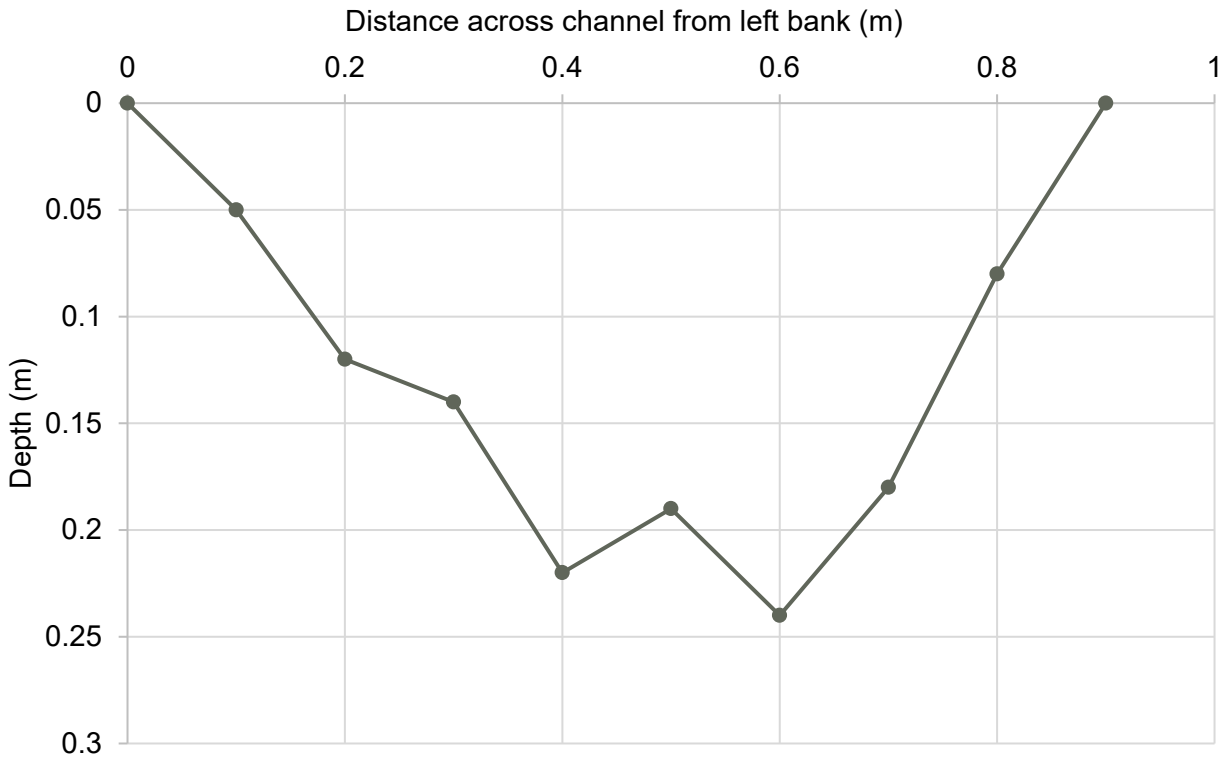
Cross-section graphs are a form of line graph which can show a slice through a landscape or feature.

Geographical Context

Figure 27 represents a cross-section through a river channel. Width (cm) and Depth (cm) measurements have been plotted on the line graph to show the shape of the river channel.

By plotting multiple cross-sections; either side by side or on the same axes, change in a river channel can be seen. This can be useful in showing downstream change in a river or how river channels change in contrasting sections e.g. straight section and a meander.

Figure 27 Cross- section of a river channel



Student activity

1. Using the data in Table 7 draw two cross-sections for Sites 1 and Sites 3 on the River Syfynwy.

Table 7 Width and depth measurements at three sites on the River Syfynwy

Site 1	**Total width (m)**	**1.46**
	Width from left bank (m)	**Depth (m)**
Depth measurement 1	0.24	0.13
Depth measurement 2	0.49	0.13
Depth measurement 3	0.73	0.12
Depth measurement 4	0.97	0.18
Depth measurement 5	1.21	0.16
Site 2	**Total width (m)**	**1.67**
	Width from left bank (m)	**Depth (m)**
Depth measurement 1	0.28	0.26
Depth measurement 2	0.56	0.23
Depth measurement 3	0.84	0.26
Depth measurement 4	1.12	0.25
Depth measurement 5	1.40	0.23
Site 3	**Total width (m)**	**3.59**
	Width from left bank (m)	**Depth (m)**
Depth measurement 1	0.60	0.26
Depth measurement 2	1.20	0.26
Depth measurement 3	1.8	0.29
Depth measurement 4	2.4	0.17
Depth measurement 5	3.0	0.08

2. Use Figures 28, 29, 30 and your own knowledge to explain the changes in cross-sections of the River Syfynwy. Think about whether the river becomes wider and deeper and why this might be. Make sure you observe the landscape around the river channel and think about the geomorphic processes. Going on in the channel.

Figure 28 OS map extract showing the 3 sites sampled on the River Syfynwy, Pembrokeshire (ESRI, 2020)

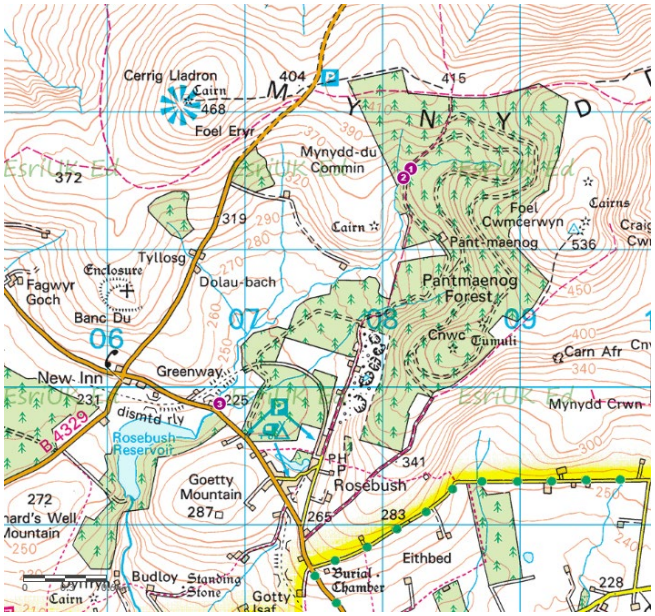


Figure 29 3D Aerial image showing Sites 1 and 2 on the River Syfynwy, Pembrokeshire (Google Earth, 2013)

Figure 30 3D Aerial Image showing Site 3 on the River Syfynwy (Google Earth, 2013)

2.8 Population Pyramids

Links to the specification content:

OCR A (1.2 People of the UK)

OCR B (Topic 7 UK in the Twenty First Century)

A population pyramid is a form of histogram which is used to showcase age and sex data for a particular location. This is referred to as the population structure.

Each individual bar is an age category, and the length of the bar relates to the number of people within that category or the percentage of the population that age range represents.

Geographical Context

Population pyramids can be effectively used to compare population structures of two areas for example cities or countries and for comparing changes in population structure over time.

Figure 31 and 32 compares the population structure of two contrasting countries, United Kingdom and Africa in 2019. Distinct differences in the population pyramids can be explained through differences in birth rates, infant mortality rates, life expectancy rates, economically active and death rates.

Figure 31 Population Pyramid for the United Kingdom, 2019

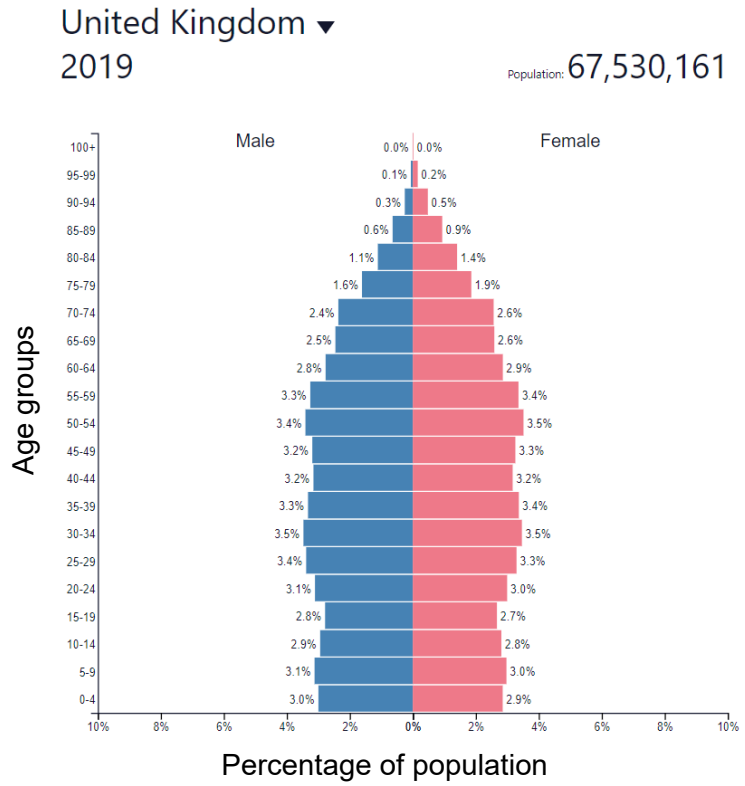
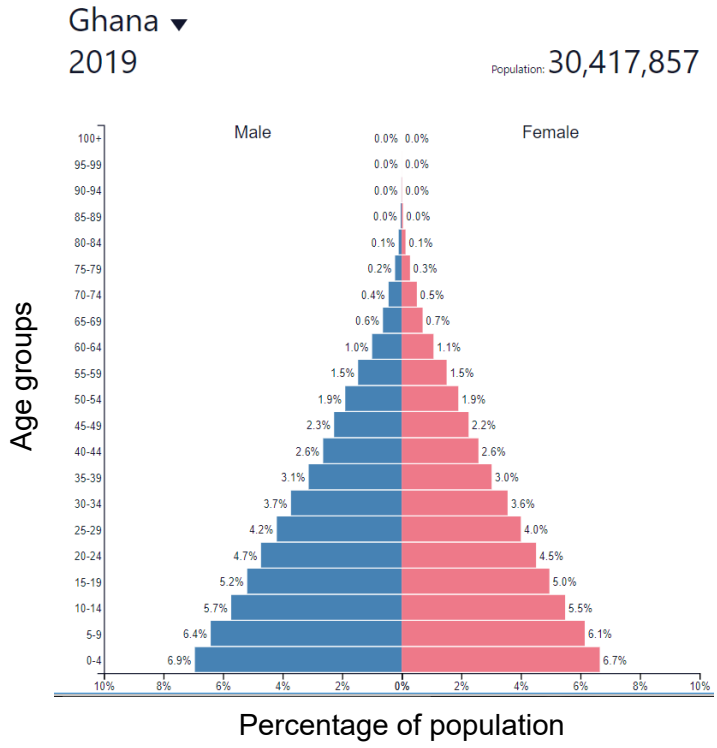


Figure 32 Population Pyramid for Ghana 2019



Source: https://www.populationpyramid.net/

Student activity

Population pyramids for all countries and continents can be found at https://www.populationpyramid.net

1. Using the website above, create a population pyramid for a country that you have used as a Case Study within your GCSE Geography studies.

   Add labels to your population pyramid to show the patterns, for example does it have a wide base? This indicates a high birth rate. Thinking about birth rate, death rate, life expectancy, economically active age groups, differences between males and females.

   How does this help your understanding of that country?

2.9 Radial Graphs/Rose Charts

Radial graphs

Links to the specification content:

OCR A (1.1 Landscapes of the UK)

OCR B (Topic 3 Distinctive Landscapes)

Radial graphs are a form of multi-axis graph that enable related data to be plotted on one axis. This type of graph is useful to compare relative strengths of individual components of data.

Geographical context

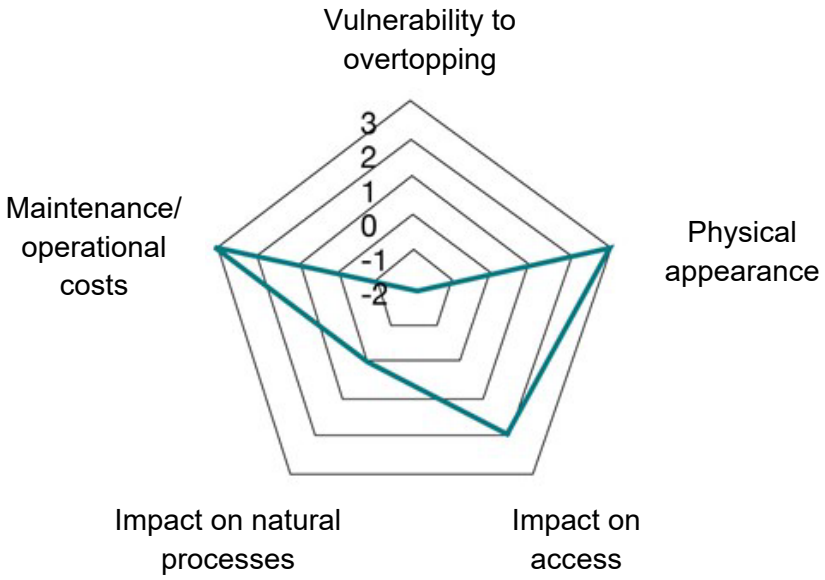
Data collection methods such as Environmental Quality Assessments and Bi-polar Assessments lend themselves well to being plotted on Radial graphs, due to the individual components of those methods.

Table 8- Completed bi-polar assessment of a sea wall.

Coastal Sea Defence: Sea Wall							
	Bi-polar Score						
	Negative					Positive	
Category	-3	-2	-1	0	1	2	3
Vulnerability to overtopping							
Physical appearance							
Impact on access							
Impact on natural processes							
Maintenance/Operational costs							

This data can be plotted onto a radial graph

Figure 33 Radial graph plotted from the bi-polar assessment of the sea wall



Rose Charts

Links to the specification content: Vulnerability to overtopping:

OCR A (1.3 UK Environmental Challenges)

OCR B (Topic 1 Global Hazards)

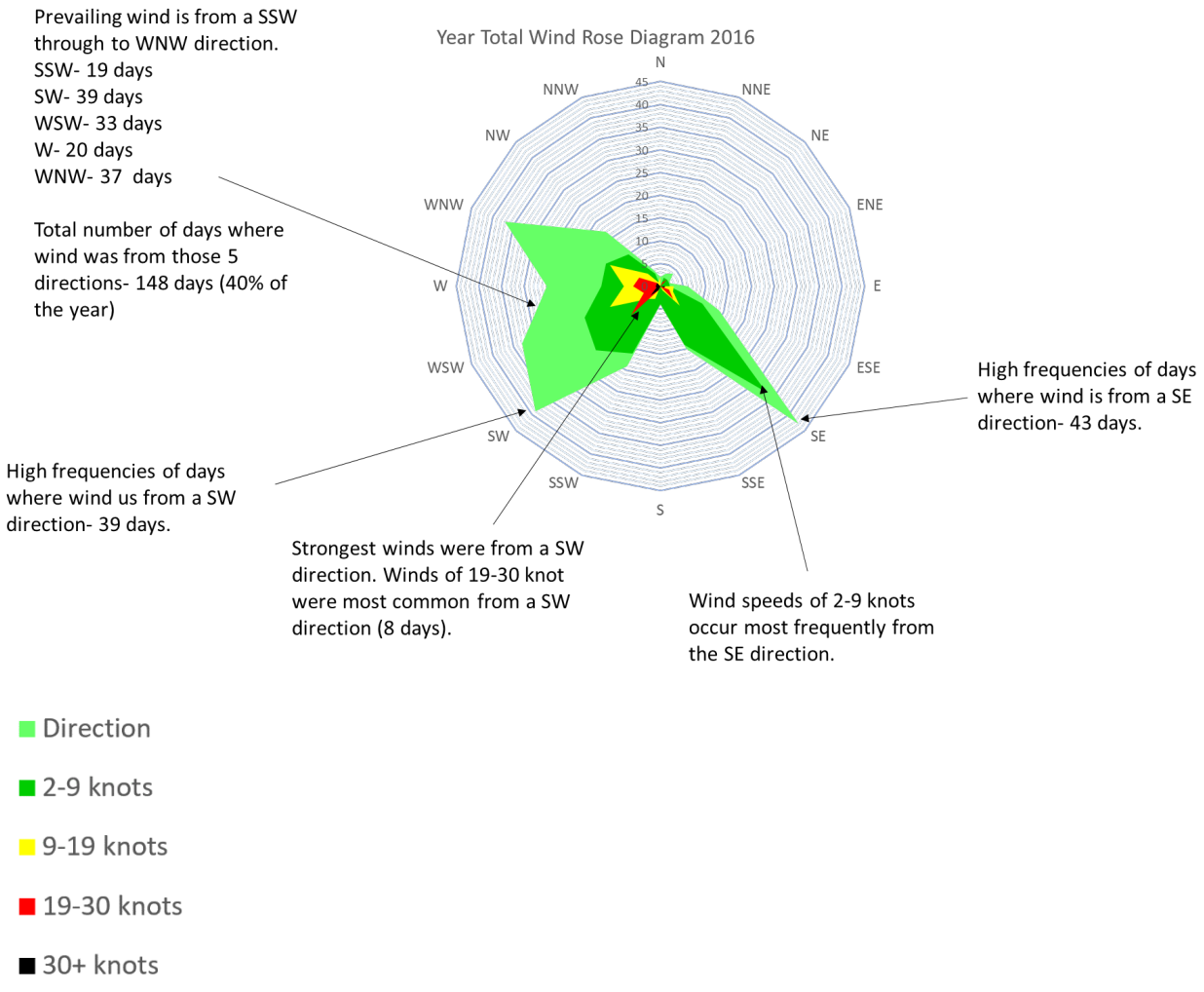
These are similar to radial graphs, but are used with continuous data, rather than the distinctive categories of radial graphs.

Geographical Context

Wind speed and wind direction data has been collected in a location over a year these are then plotted on the rose diagram in Figure 34.

Trends in this data on can be easily seen e.g. prevailing wind direction, and the direction of strongest winds.

Figure 34 Rose Chart showing wind direction and speed (knots)



Student activity

1. Using the Environmental Quality Assessment (EQA) data in Tables 9 and 10 for the locations shown in Figures 35 and 36, a radial diagram has been completed for Site 1. Use the template and data to draw a radial diagram for Site 2.

   Use the images for sites 1 (Fig. 35) and 2 (Fig. 36), to explain what the data shows.

Table 9 EQA data for Site 1

Site 1:						
Poor	**1**	**2**	**3**	**4**	**5**	**Good**
Environmental quality						
Litter & Graffiti Evidence of lots of litter and graffiti /vandalism					X	**Litter & Graffiti** No evidence of litter or graffiti/ vandalism
Open Space Urban environment closed, very little open green space				X		**Open Space** Environment open with access to large green spaces
Housing Small, cramped houses				X		**Housing** Houses look spacious and well placed
Community No sense of community present			X			**Community** Sense of community present
Roads Poorly maintained roads- potholes, no cycle lanes and on-street parking.			X			**Roads** High road quality- lack of potholes, cycle lanes present, off-street parking.
Column totals	**0**	**0**	**6**	**8**	**5**	**Overall total = 19/30**

Table 10 EQA data for Site 2

Site 2:						
Poor	**1**	**2**	**3**	**4**	**5**	**Good**
Environmental quality						
Litter & Graffiti Evidence of lots of litter and graffiti /vandalism		X				**Litter & Graffiti** No evidence of litter or graffiti/ vandalism
Open Space Urban environment closed, very little open green space		X				**Open Space** Environment open with access to large green spaces
Housing Small, cramped houses		X				**Housing** Houses look spacious and well placed
Community No sense of community present				X		**Community** Sense of community present
Roads Poorly maintained roads- potholes, no cycle lanes and on street parking.			X			**Roads** High road quality- lack of potholes, cycle lanes present, off-street parking.
Column totals	**0**	**6**	**3**	**4**	**0**	**Overall total= 13/30**

Figure 35 Site 1

Site 1 Radial diagram showing scores for 5 categories of EQA

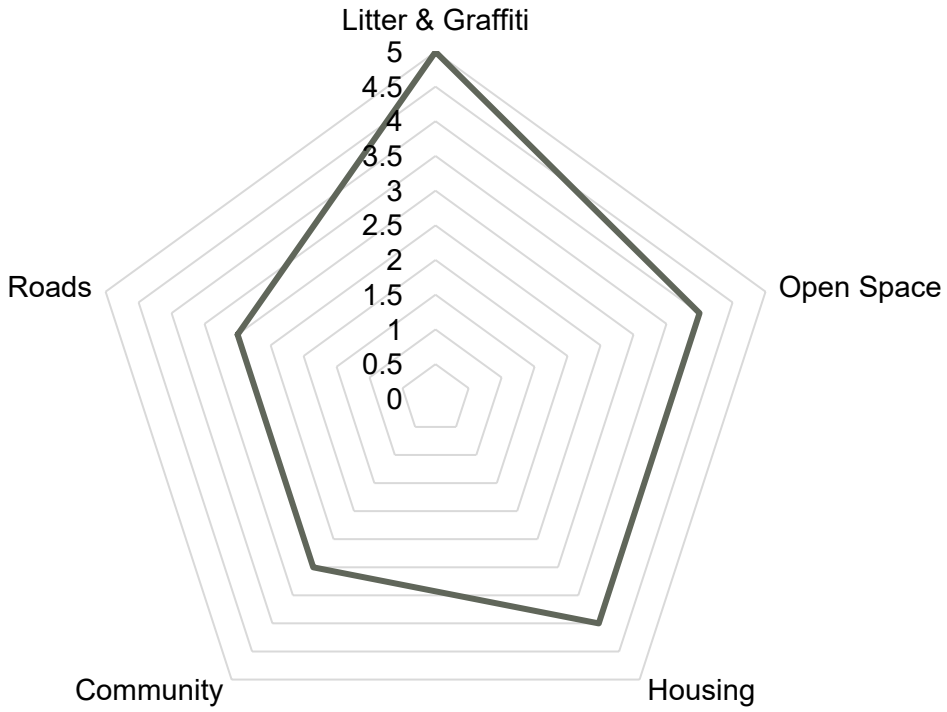
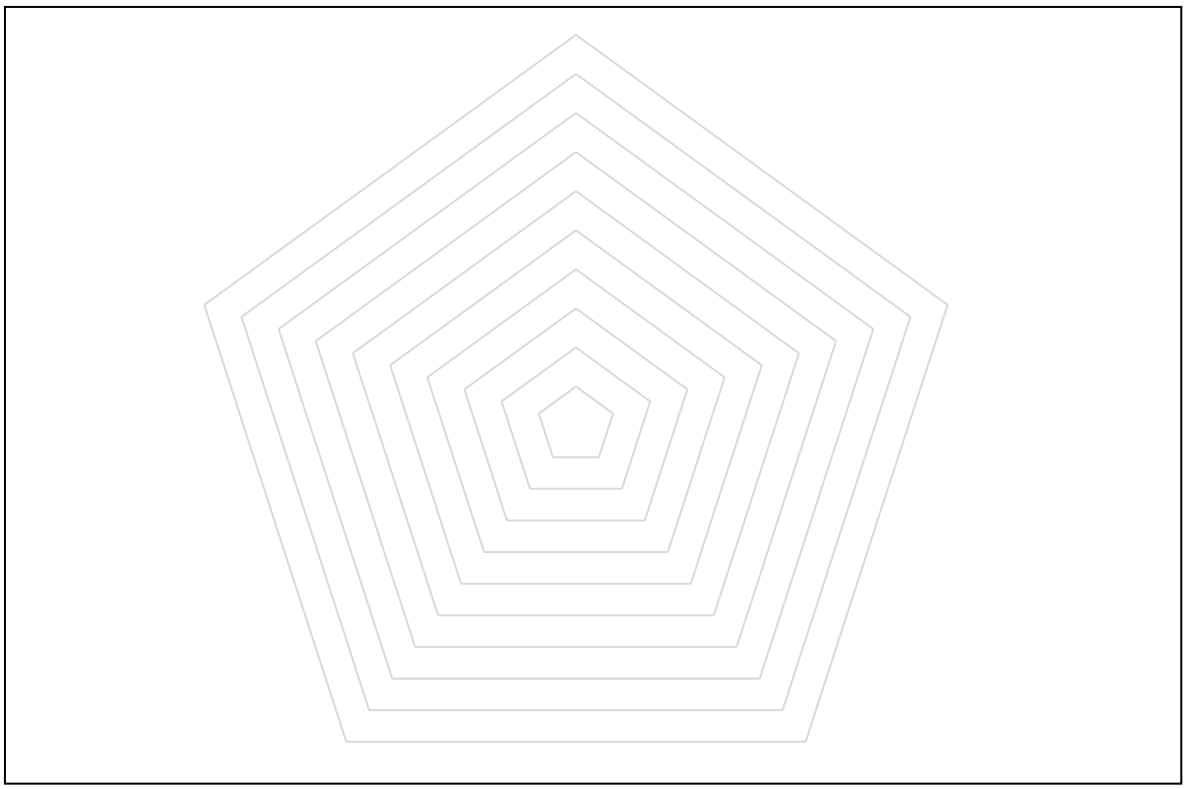


Figure 36 Site 2

Blank radial diagram



Use the images for sites 1 (Fig. 35) and 2 (Fig. 36), to explain what the data shows.

Chapter 3: Numerical and Statistical Skills

The GCSE Geography A & B specifications state:

Demonstrate an understanding of number, area and scale.

1. Understand and correctly use proportion, ratio, magnitude and frequency.
2. Understand and correctly use appropriate measures of central tendency, spread and cumulative frequency including, median, mean, range, quartiles and inter-quartile range, mode and modal class.
3. Calculate and understand percentages (increase and decrease) and percentiles.
4. Design fieldwork data collection sheets and collect data with an understanding of accuracy, sample size and procedures, control groups and reliability.
5. Interpret tables of data.
6. Describe relationships in bivariate data.
7. Sketch trend lines through scatter plots.
8. Draw estimated lines of best fit.
9. Make predictions; interpolate and extrapolate trends from data.
10. Be able to identify weaknesses in statistical presentations of data.
11. Draw and justify conclusions from numerical and statistical data
12. Demonstrate an understanding of the quantitative relationships between units.

Prior Key Stage 3 learning (maths)

- define percentage as 'number of parts per hundred', interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express 1 quantity as a percentage of another, compare 2 quantities using percentages, and work with percentages greater than 100%
- change freely between related standard units [for example time, length, area, volume/capacity, mass]
- use scale factors, scale diagrams and maps
- solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics
- solve problems involving direct and inverse proportion, including graphical and algebraic representations
- draw and measure line segments and angles in geometric figures, including interpreting scale drawings
- describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers)
- construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data
- describe simple mathematical relationships between 2 variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs

3.1 Number/Area/Scale/Units

Calculating area:

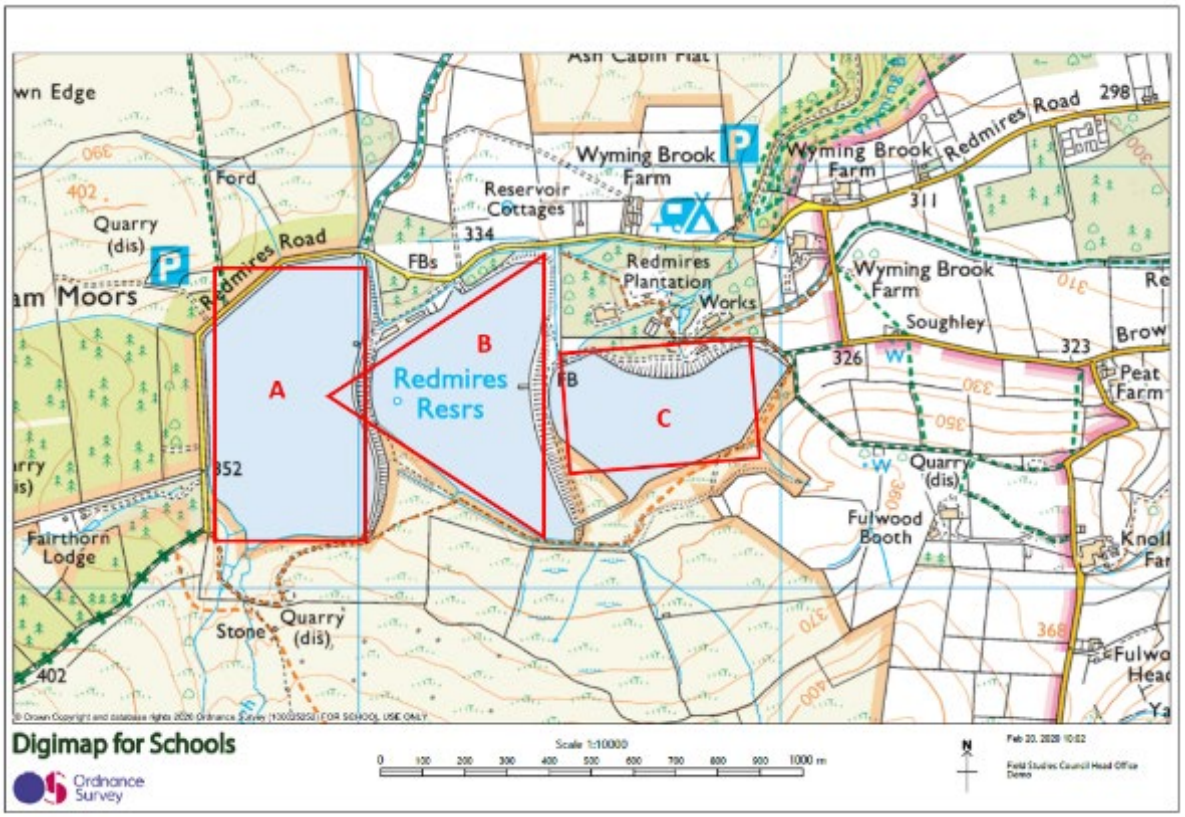
$$Area\ of\ a\ rectangle = length \times width$$

$$Area\ of\ a\ \text{triangle} = \frac{1}{2}\ base \times perpendicular\ height = \frac{1}{2}\ bh$$

Geographical Context

In Geography students may need to calculate areas within photographs or maps. It is important that students are able to use the scale of the map to calculate accurate measurements.

Figure 37 OS map segment of the area surrounding Redmires Reservoirs. (Digimap 2020)



By approximating the shape of each of the reservoirs; labelled A, B, C; the total area of Redmires reservoirs can be calculated.

Table 11 Calculation of approximate area of Redmires Reservoirs

Reservoir		Map Measurement (cm)	Ground Measurement (m)
A	Length	5.5	550
(Area of a rectangle)	Width	3	300
Area (m²)			165000
B	Base	5.5	550
(Area of a triangle)	Height	4.2	420
Area (m²)			115500
C	Length	3.8	380
(Area of a rectangle)	Width	2.4	240
Area (m²)			91200
Total Area of Redmires Reservoirs (m²)			371700
Map Scale 1:10000			
1cm = 100m			

How many square kilometers (km²) in a square meter (m²)?

1m² is equal to 0.000001km². To convert m² to km², divide by 1000000.

e.g. 371700m² = 0.3717km²

Student activity

1. Using the map extract shown in Figure 38. Calculate the area of Malham Tarn, North Yorkshire.

Figure 38 OS map extract of Malham Tarn, North Yorkshire (ESRI, 2020)

2. Can you think of other opportunities when it would be useful to calculate lengths and areas from maps?

3.2 Proportion/Ratio/Magnitude

Links to the specification content:

OCR A (2.2 People of the Planet)

OCR B (Topic 6 Dynamic Development)

Direct proportion is where two or more quantities increase or decrease in the same ratio. An easy way of understanding this is if two variables a and b are directly proportional to one another then if we double a, we have to double b, if we halve a, we have to halve b etc. A key point to mention to the students is this only applies if we multiply or divide quantities; it doesn't work with addition and subtraction.

For example:
If a is directly proportional to b^2 and we know that when a=6 b=10, how can we find the relationship between them?

We know that when a= 12 (doubling 6) then b^2=200 (doubling 10^2) and so on.

The ratio of a and b^2 is constant. Therefore, we know that:

$$\frac{a}{b^2} = \frac{12}{200} = \frac{6}{100} = \frac{3}{50} = 0.06$$

We can write this more succinctly as:

$A=0.06b^2$

Geographical Context

	Context	Example
Ratio	Map- scale	1:25000 1cm on the map = 25000cm on the ground. 1cm= 250m
Proportion	Age-structures of populations- Youth Dependency	Japan 21:100 → 21 dependents aged 0-14 for every 100 working aged people (15-64) in Japan. 0-14 aged population is ~ 1/5th of 0-64 aged population. Nigeria 81:100→ 81 dependents aged 0-14 for every 100 working aged people (15-64) in Nigeria. 0-14 aged population is ~4/5th of 0-64 aged population
Magnitude	Age-structures of populations- Youth Dependency	Nigeria has a youth dependent population which is 4x as big as Japans.

3.3 Central tendency/spread/Cumulative Frequency/Mean/Mode/Median/Range/Interquartile Range

Links to the specification content:

OCR A (1.1 Landscapes of the UK)

OCR B (Topic 3 Distinctive Landscapes)

The mean, median and mode are all measures of central tendency of a data set. They act as a representative value for the whole data set.

The list below represents 8 data values:

25, 24, 27, 28, 19, 31, 25, 31

The mean is the sum (total) of the data values divided by how many and so:

$$\bar{x} = \frac{210}{8} = 26.25$$

To find the median, the data has to be first ordered in size from the lowest value.

19, 24, 25, 25, 27, 28, 31, 31

The median is the middle value.

19, 24, 25**, 25, 27**, 28, 31, 31

As there are 8 data values there are two 'middle values', which means in this example the middle value is between the data points 25 and 27. So the middle value is 26.

In a formal manner the $\frac{n+1}{2}$ piece of data where n is the number of pieces of data.

In this example there are 8 pieces of data and hence the median lies on the (8+1)/2 piece of data which is the 4.5th piece of data. This doesn't really make sense until you realise that the 4.5th data is halfway between the 4th and 5th items; 25 and 27 and hence the median is 26.

The mode is the easiest to spot and is the most 'popular' items of data, the most frequent item. In the above example there is no single most frequent item of data with 25 and 31 both occurring twice. The data is therefore bimodal (bi means two) with modes 25 and 31.

As a general rule of thumb, the mean is the most useful statistical measure and it uses all of the items of data. If there are outliers however then the median is more representative because it is less sensitive to outliers. If for example a data value of 100 was added above, the mean would change to 34.4 but the median would move to 27, a far more representative measure.

The choice in which to use the mean, median or mode is dependent on the context. Mode is not often used with numerical data, but useful with categorical data (i.e. the most common age category in a questionnaire). Mean is often quoted because it uses all the data, but it is very sensitive to outliers, so median may be more useful.

Geographical Context

River discharge data can be calculated from primary fieldwork data collection of channel width, depth and velocity. Discharge is greatly affected by rainfall events, and therefore displays large temporal change. Long-term data on peak discharge can be found as secondary data for river gauging stations around the UK.

Table 12- Peak discharge (m^3/s) for the past 20 years at Montford Bridge gauging station on the River Severn, Shropshire.

n	Year	Peak Discharge (m^3/s)		Years in rank order of Peak Discharge (smallest to largest)	Peak Discharge (m^3/s)
1	2017-18	255.521		2016-17	178
2	2016-17	178		2002-03	230.449
3	2015-16	358.762		2017-18	255.521
4	2014-15	284.749		2004-05	261.153
5	2013-14	371.416		2014-15	284.749
6	2012-13	333.553		2011-12	292.709
7	2011-12	292.709		2008-09	292.97
8	2010-11	401.533		1999-00	298.77
9	2009-10	313.104		2009-10	313.104
10	2008-09	292.97		2005-06	314.053
11	2007-08	399.196		2012-13	333.553
12	2006-07	394.557		2015-16	358.762
13	2005-06	314.053		2013-14	371.416
14	2004-05	261.153		2006-07	394.557
15	2003-04	410.998		2007-08	399.196
16	2002-03	230.449		2010-11	401.533
17	2001-02	418.915		2003-04	410.998
18	2000-01	473.416		2001-02	418.915
19	1999-00	298.77		1998-99	431.027
20	1998-99	431.027		2000-01	473.416
Total		6714.851			

Source acknowledgement: Data from the UK National River Flow Archive, https://nrfa.ceh.ac.uk

The right-hand columns show the peak discharge data in rank order smallest to largest. Measures of central tendency have been calculated.

Measures of central tendency		
Mean	Mean = $\frac{6714.851}{20}$	335. 74
Median	10.5th piece of data; Mean of the 10th (314.053) and 11th (333.553) value	323.803
Range (Largest value – Smallest value)	Range = (473.416 – 178)	295.416

Student activity

1. Calculate mean, median and range of the discharge data for the data in Table 13. The right-hand side columns are blank to help with ranking peak discharge data from smallest to largest.

Table 13- Peak discharge (m^3/s) for the past 20 years at Canaston Bridge gauging station on the Eastern Cleddau, Pembrokeshire.

n	Year	Peak Discharge (m^3/s)		Years in rank order of Peak Discharge (smallest to largest)	Peak Discharge (m^3/s)
1	2017-18	79.429			
2	2016-17	84.31			
3	2015-16	85.97			
4	2014-15	81.11			
5	2013-14	77.25			
6	2012-13	91.37			
7	2011-12	75.56			
8	2010-11	64.67			
9	2009-10	102.00			
10	2008-09	80.94			
11	2007-08	87.24			
12	2006-07	80.07			
13	2005-06	93.31			
14	2004-05	67.89			
15	2003-04	79.51			
16	2002-03	78.59			
17	2001-02	68.51			
18	2000-01	111			
19	1999-00	72.76			
20	1998-99	94.47			
Total		**1575.959**			

Source acknowledgement: Data from the UK National River Flow Archive, https://nrfa.ceh.ac.uk

Measures of central tendency		
Mean		
Median		
Range **(Largest value – Smallest value)**		

2. Using the calculated measures of central tendency. Compare discharge between Montford Bridge gauging station on the River Severn in Shropshire to the gauging station at Canaston Bridge on the Eastern Cleddau in Pembrokeshire.

   Visit The National Rivers Flow Archive for access to data from gauging stations all over the UK. National River Flow Archive

Inter-quartile range (IQR)

Is another measure of central tendency, it is similar to calculating the range, but does not take into account any outliers in the data.

Interquartile range(IQR) = Upper Quartile (UQ)- Lower Quartile (LQ)

To calculate IQR data must be first sorted into rank order, highest to lowest. The upper and lower quartile rank positions are calculated using the formulae below:

$$UQ = \frac{3(n+1)}{4}\ th\ value$$

$$LQ = \frac{(n+1)}{4} th\ value$$

Geographical Context

Interquartile range can be used in any geographical situation where a comparison of data sets is useful.

Table 14 Sediment data (length of axis a in cm) collected from two locations in Saundersfoot Bay.

	Size of sediment (length of axis a in cm)	
n	**Location A**	**Location B**
1	5.2	6.2
2	7.6	6.2
3	8.8	6.3
4	9.3	6.5
5	9.8	8.3
6	11.4	8.8
7	11.8	9.2
8	12.6	10.1
9	13.9	11.3
10	18.1	13.2
11	21.5	14.6
Mean	12.5	9.15

	Position	Location A	Location B
LQ	3rd value	8.8	6.3
Median	6th value	11.4	8.8
UQ	9th value	13.9	11.3
IQR	(UQ-LQ)	5.1	5

This data was collected to help inform the geographical investigation:

Investigation of the impact of longshore drift on sediment size in Saundersfoot Bay.

Whilst initial measures of central tendency such as the mean highlight differences in the data, IQR looks at the spread of the data, and can compare the overlap in IQR between the two datasets at Location A and Location B.

This data can be plotted on dispersion graphs or on a box and whisker diagram.

Figure 39- Box and whisker diagram of Location A and B, Saundersfoot Bay, Pembrokeshire

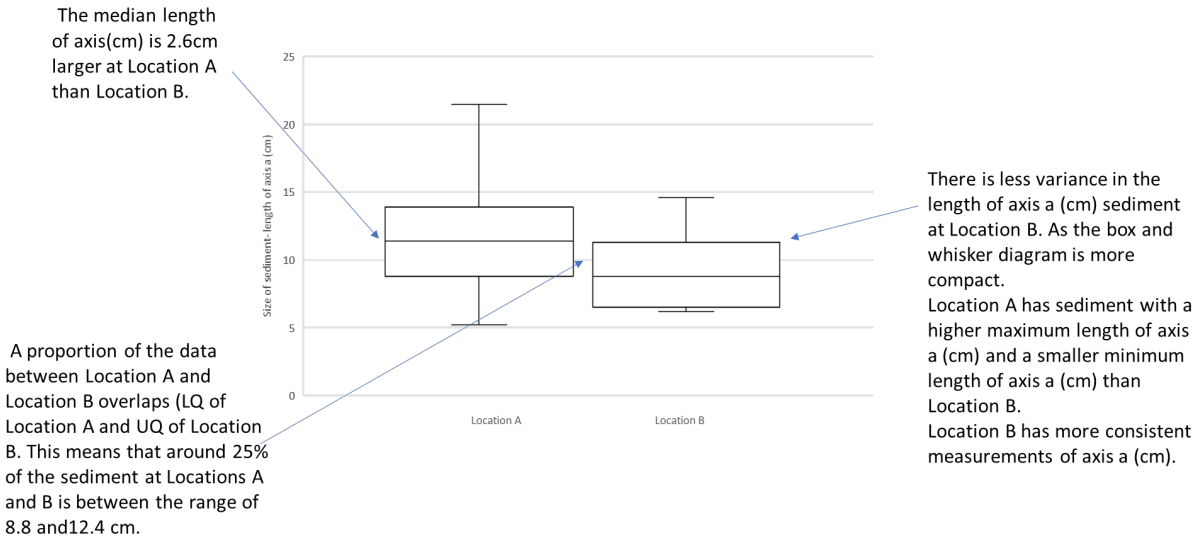


Figure 40 Aerial photograph of fieldwork locations A and B in Saundersfoot Bay

Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Student activity

1. Using Figure 39, 40 and your own knowledge. Describe and explain the differences in sediment size between Location A and Location B.

Figure 39 Box and whisker diagram of Location A and B, Saundersfoot Bay, Pembrokeshire

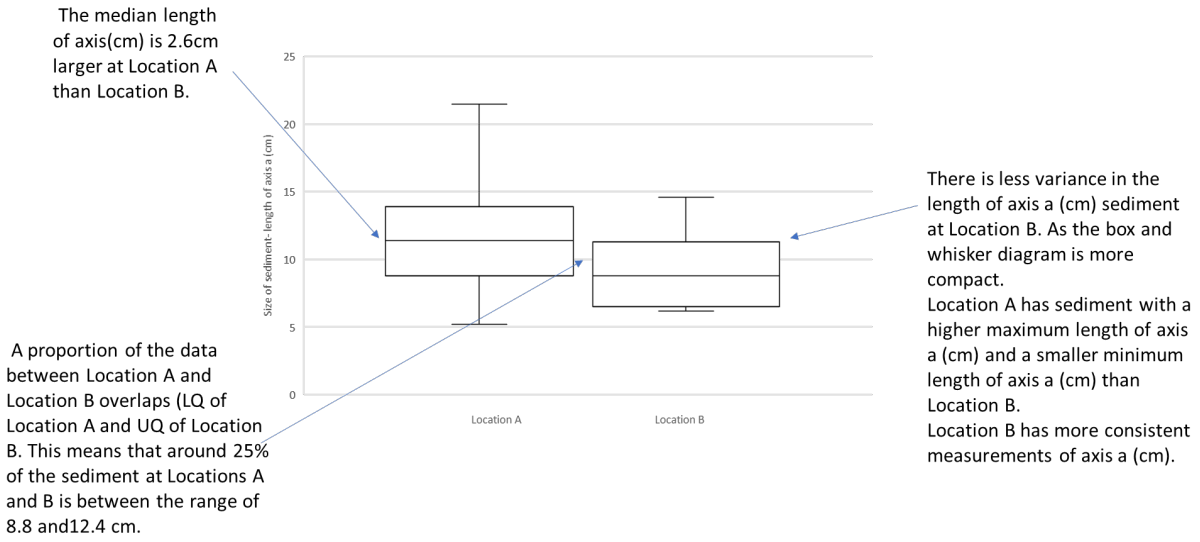


Figure 40 Aerial photograph of fieldwork locations A and B in Saundersfoot Bay

Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

3.4 Percentages/Increase/Decrease

Links to the specification content:

OCR A (1.2 People of the UK)

OCR B (Topic 7 UK in the 21st Century)

Percentages are a way of describing what proportion of a whole is represented.

To find a percentage, write the percentage as a fraction and then multiply it by the amount.

e.g. Find 82% of 260

$$\frac{82}{100} \times \frac{260}{1}$$

$$\frac{82 \times 260}{100}$$

$$\frac{21320}{100} = 213.20$$

$$82\% \; of \; 260 = 213.20$$

To calculate one number as a percentage of another, divide the numbers and multiply by 100.

e.g. If you scored 20 out of 30 on a test, your percentage would be calculated by:

$$\frac{20}{30} \times 100 = 66.6\%$$

Geographical Context

Raw fieldwork data like the data in Table 15 can be converted into percentages to help with data analysis.

Percentages can be calculated like the example below:

At location A - What percentage of total transport was by bicycle over the 5 minute period?

$$\frac{6}{40} \times 100 = 15\%$$

Table 15 Traffic Count at Location A

Mode of transport	Number in 5-minute period at Location A	%
Car	27	67.5
Taxi	1	2.5
Bus	3	7.5
Lorry/HGV	3	7.5
Bicycle	6	15
Total	40	100

Student activity

1. A landuse survey has been carried out along a 2km transect in Shrewsbury town centre. The data is recorded in Table 16.

   Calculate the percentage for each type of land-use.

   Hint – you need to work out the total first.

   Table 16 Landuse Survey, Shrewsbury Town Centre

Category	Type of land-use	Number of buildings with that land-use	%
R	Residential	28	
I	Industrial	3	
C	Commercial	67	
E	Entertainment	13	
P	Public Building	2	
O	Open Space	6	
T	Transport	3	
S	Services	15	
	Total		

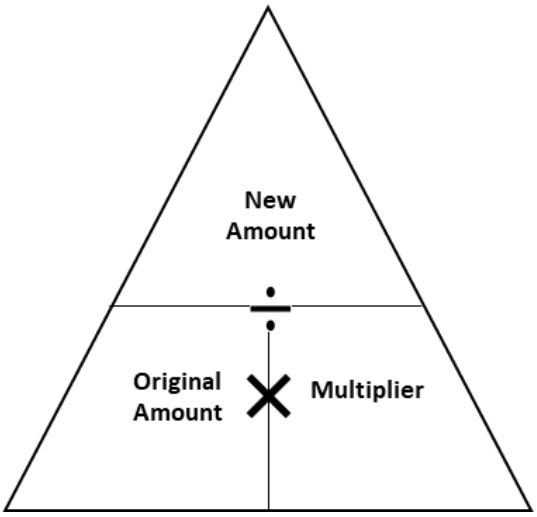
Percentage Change

Calculating percentage change is a useful mathematical function to compare old and new values, it shows the degree of change over time.

The key is to understand that the multiplier 1 represents a change of 0%. A multiplier of 1.43 therefore represents an increase of 43% whilst a multiplier of 0.83 represents a decrease of 17% (note that it is the difference between the multiplier and 1 which is the change – it isn't a percentage decrease of 83%). Amounts and percentages can then be found using a very simple formula.

$$Original\ Amount\ x\ Multiplier = New\ Amount$$

The formula can be stated in a formula triangle and then applied to situations where the percentage change is required.



2017 GDP trillions US $	2018 GDP trillions US $		Multiplier	% change in GDP
12.14	13.6	Multiplier = $\frac{New\ amount}{Original\ amount}$	1.12	This represents a percentage increase of 12%
11.8	10.5		0.89	This represents a percentage decrease of 11%

Another way of calculating percentage change is to:

- Work out the difference between the two values
- Divide the difference by the original number
- Multiply the answer by 100

Geographical context

Percentage change is useful in considering temporal (time) or spatial change in geography. The example shown in Table 17 shows percentage changes in migration calculated using the two different methods above.

Table 17- Change in Migration Numbers 2001 to 2011

Migration Numbers	2001 Census	2011 Census	Multiplier	%	+/- % change
UK	4,600,000	7,500,000	1.63	63.0	+

Country of birth	2001 Census	2011 Census	Difference	%	+/- % change
India	456,000	694,000	238,000	52.2	+
Poland	58000	579,000	521,000	898.3	+
Pakistan	308,000	482,000	174,000	56.5	+
Republic of Ireland	473,000	407,000	66000	14.0	-
Germany	244,000	274,000	3000	12.3	+
Bangladesh	153,000	212,000	59000	38.6	+
Nigeria	87000	191,000	104,000	119.5	+
South Africa	132,000	191,000	59000	44.7	
United States	144,000	177,000	33000		
Jamaica	146,000	160,000			

Source: Open Government Licence v3.0
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/internationalmigration/articles/internationalmigrantsinenglandandwales/2012-12-11

Student activity

1. Calculate the missing steps within Table 17 to calculate Percentage Change in numbers of migrants in the UK from South Africa, United States and Jamaica.

Table 17 Change in Migration Numbers 2001 to 2011

Migration Numbers	2001 Census	2011 Census	Multiplier	%	+/- % change
UK	4,600,000	7,500,000	1.63	63.0	+

Country of birth	2001 Census	2011 Census	Difference	%	+/- % change
India	456,000	694,000	238,000	52.2	+
Poland	58000	579,000	521,000	898.3	+
Pakistan	308,000	482,000	174,000	56.5	+
Republic of Ireland	473,000	407,000	66000	14.0	-
Germany	244,000	274,000	3000	12.3	+
Bangladesh	153,000	212,000	59000	38.6	+
Nigeria	87000	191,000	104,000	119.5	+
South Africa	132,000	191,000	59000	44.7	
United States	144,000	177,000	33000		
Jamaica	146,000	160,000			

Source: Open Government Licence v3.0
https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/internationalmigration/articles/internationalmigrantsinenglandandwales/2012-12-11

3.5 Designing data collection sheets and understanding of accuracy, sample size, reliability, control groups

Data Collection Sheets

Designing data collection sheets can be done on paper or electronically using programmes such as Microsoft Word or Microsoft Excel.

Data Collection sheets will usually have the following information on them:

- Independent variable: This is the thing you are changing e.g. Distance along a transect; Different sample sites
- Dependent variable(s): This is the thing you are counting, measuring, or observing e.g. number of vehicles, depth of the river channel (m)
- Site/Location
- Date/Time
- Space for notes

It is important to consider whether the data being collected is quantitative or qualitative.

Quantitative data: Are measures of values or counts represented by numbers.
Qualitative data: Is non-numerical data and is represented by words or categories.

In practice data collection sheets, have space for the collection of quantitative and qualitative data. Examples of data collection sheets are shown in Figures 41, 42 and 43.

Figure 41 Data Collection sheet for Investigating downstream change on the River Tillingbourne.

Date: *12th October 2019*	**River Tillingbourne**						
	Width (m)	**Depth (m)**			**Flow rate (s)**		
		1	**2**	**3**	**1**	**2**	**3**
Site 1	*0.9*	*0.063*	*0.08*	*0.10*	*22*	*18*	*16*
Site 2	*1.2*	*0.1*	*0.125*	*0.12*	*14*	*16*	*18*
Site 3							
Site 4							
Site 5							
Notes: *Site 1 had some artificial run-off from a drainage ditch.* *Site 2 was located downstream of a confluence.*							

Figure 42 Investigating the quality of the built environment in Shrewsbury

Bi-polar Assessment= Negative to Positive Scale							
	-3	**-2**	**-1**	**1**	**2**	**3**	
Much litter					*x*		**No litter**
Paths poorly maintained						x	**Paths well maintained**
Area is undesirable					*x*		**Area is desirable**
Unwelcoming feel				*x*			**Welcoming feel**
Notes:	*Data collected: Friday 7th February, 13:10.* *An outdoor food and craft market is taking place.*						

Figure 43 Investigating the impact of independent shops on Shrewsbury.

Location: *Shrewsbury High Street, Market Square*		**Observation**
What to record?		**Notes**
Social Environment	**How many people?**	*~60-100 people*
	Social characteristics Demographics	*Middle Aged* *Elderly* *Parents with young children* *Dressed smart, casual.*
	How are people arranged in the environment?	*People are browsing, standing at market stalls or walking up and down the rows.* *Small groups of family/friend groups are clustered together.* *Older males are sat on benches to the side.*
	What are people doing?	*Browsing the stores.* *Buying goods and food items.* *Talking and socialising.*
Feelings, hunches and impressions	*This is a regular, popular market. Good at this market are more expensive than local supermarkets/ and shops. But customers seem to be enjoying the friendly, unique, goods from these small market stalls. This market is promoting the branding of Shrewsbury- 'The Original One Off'.*	

Student activity

One of the fieldwork skills in the GCSE specifications is to look critically at the data you collect and how you collected it, see Table 18 below as an example.

Table 18 Summary of strengths and weaknesses of Figure 41.

Figure 41 – data collection sheet **Investigating downstream change on the River Tillingbourne.**	**Strengths**	**Weaknesses**	**Improvements**
	• Units are included. • These units remain in the headings. • Space for site notes is useful for qualitative descriptions. • Measurements taken more than once (flow rates), can calculate an average.	• Depth measurements do not have consistent level of precision. Different number of decimal places. • Are there enough depth measurements? Will this show the • Doesn't show the intervals between the depth measurements for each site	• Ensure data is collected to the same level of precision. • Take photographs to help explain what the data shows • Make sure there is enough data to present i.e. width and depth measurements to draw a cross section.

1. Evaluate the **data collection tables** in Figures 42 and 43.

Figure 42 **Investigating the quality of the built environment in Shrewsbury**	**Strengths**	**Weaknesses**	**Improvements**
Figure 43 **Investigating the impact of independent shops on Shrewsbury.**	**Strengths**	**Weaknesses**	**Improvements**

Sampling Strategies

Sampling is the process of collecting data from some sites or people in order to obtain a perspective on the population as a whole.

Sample= A limited number of things, such as a group of 100 people or 50 pebbles on a beach.

Population= Total number of things, such as all residents of a city or all pebbles on a beach.

There are 3 types of probability sampling

The aim of probability sampling is to select a sample which is representative of the population.

- Random sampling - This is where each member of the population is equally likely to be included.
- Stratified sampling - This is where a proportionate number of observations is taken from each part of the population.
- Systematic sampling - This is where observations are taken at regular intervals, such as every 10 metres or every 5th person.

Sample Size

Deciding how many samples are needed; the sample size; is a difficult concept for students to grasp.

Two important considerations are:

- Size of the total population (e.g. length of the river, school population)
- Time available to collect the data (e.g. 4 hours of data collection)

The sample size of a data set should be representative of the wider population.

e.g. 5 questionnaires of staff at a supermarket with a workforce of 1200 would not be representative.

e.g. measuring 10 pebbles on a beach that is 2km in length would not be representative.

Student Activity

See 2.2 Scatter graph Student Activity

3.7 Identifying weaknesses/Justifying conclusions

Students must be able to justify a choice of data presentation or data analysis technique. By asking themselves:

- why it was chosen,
- why it was appropriate,
- weigh up the relative strengths of that technique compared to others.

For any of the graphical or numerical skills used, the resulting data presentation and data analysis technique itself must be critically reflected upon. Students should be able to:

- consider how appropriate it was,
- how it helped them to reach reliable conclusions,
- suggest improvements to data presentation and data analysis techniques used.

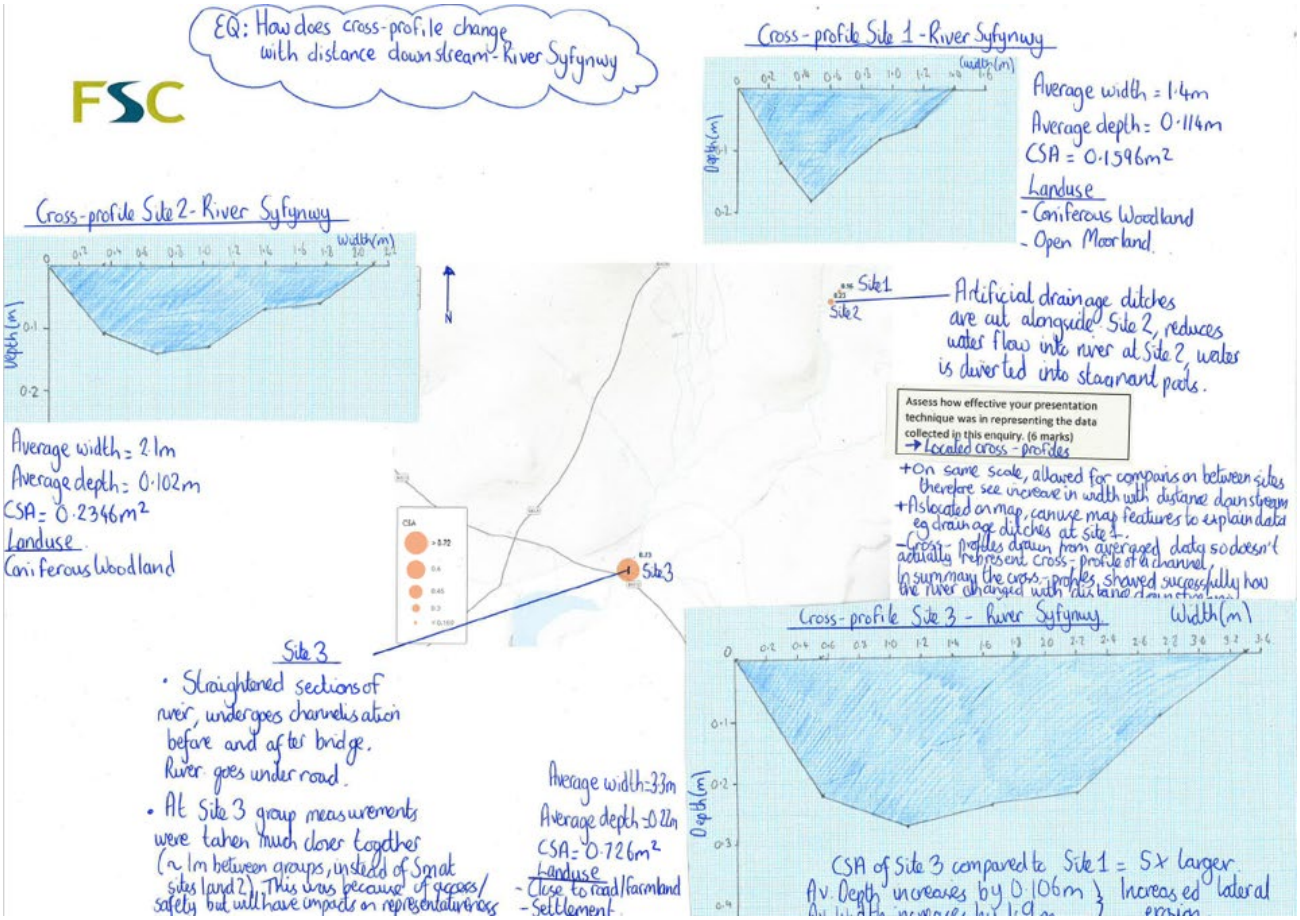
An example where this has been done is shown in Figure 42. Here a student has created a one-page summary document that:

- Presents data
- Analyses data
- Draws conclusions
- Identifies strengths and weakness of the data presentation

Student activity

Students could be encouraged to complete something similar for a fieldwork enquiry they have carried out:

Figure 44 Fieldwork Summary



Chapter 4: Qualitative Data

The GCSE Geography A & B specifications state:

With respect to formulating enquiry and argument, students should be able to:

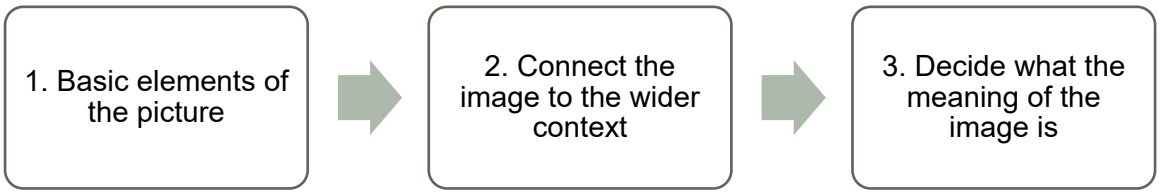
1. deconstruct, interpret, analyse and evaluate visual images including photographs, cartoons, pictures and diagrams
2. analyse written articles from a variety of sources for understanding, interpretation and recognition of bias

4.1 Interpret, Analyse and Evaluate visual images- Photos/Cartoon/Pictures/Diagrams

Geographical Context

Students need to build the skills interpret meaning from visual images. Visual images can be incredibly useful in building an understanding of a location.

A 3-step process can be used to help:



Student activity

1. Using the 3-step process to help, annotate Figure 45 with your interpretation of this image.

Figure 45 Marketing Campaign for Great Britain [The GREAT Britain campaign]

Source: https://www.visitbritain.org/great-britain-campaign-0

4.2 Written Sources

Students need to build the skills to analyse written sources for understanding. They should be able to interpret meaning from these sources and consider the impact of bias.

One way of doing this is through simple coding of the information using simple categories.

Geographical Context

Figure 46 What are the challenges and opportunities present within Manchester? Opportunities & Challenges are identified and highlighted in the sources below.

"Youthful, diverse, energetic and bursting with character; Manchester is one of the most exciting places to visit in the UK right now where everybody and anybody is very warmly welcomed.

Known throughout the world as the birthplace of the industrial revolution, Manchester has a proud history in science, politics, music, arts and sport. And today the city combines this heritage with a progressive vision to be a city that delivers surprise and delight in equal measures.

Manchester city centre is jam-packed with unique and eclectic restaurants, bars, shops, museums, galleries, hotels and places to stay whilst the surrounding Greater Manchester boroughs offer a patch-work of visitor experiences including quaint market towns, traditional pubs and beautiful green spaces and waterways to be explored on foot or bike. The city region is easily navigated, with great transport links both in and around Greater Manchester.

Furthermore, a packed calendar of world-class events and festivals – from the landmark Manchester International Festival to the enchanting Manchester Christmas Markets– mean there's always another reason to visit Manchester."

Official Tourist Board for Manchester & Greater Manchester
www.visitmanchester.com (A)

"From the roof terrace of Manchester's newest office block the scale of the city's resurgence becomes clear. A forest of skyscrapers stretches towards the hills beyond, with another thicket visible at Salford Quays, the Northern home of the BBC. Next door, machines smash into 1960s office blocks to make way for a new building. Below, workers complete the £180m revamp of St Peter's Square, with its refurbished Grade II listed library and town hall."

Andrew Bounds, Financial Times, 29 April 2015, on the view from the centre. (B)

"Why is Manchester so bad for your health?

If you live in Manchester, make the most of today - in fact, make the most of every day. Because the statisticians say that you have the lowest life expectancy of anyone in England and Wales. Figures released last week show that if you are a man, you probably won't reach 70 (compare that with Dorset, where men can expect to notch up an average of 79.6 years). If you are a woman, the news is not much better: you will live an average of just 76.3 years (in west Somerset, women can expect to live an extra 7.2 years on top of that)."

Helen Carter, The Guardian, 2002 (C)

Based on the sources above, Table 19 summarises some of the challenges and opportunities present in Manchester. Questions that a student may wish to consider based on these challenges and opportunities along with considerations into the bias of the sources have also been included.

Table 19 Analysis of Manchester sources

Challenges	Opportunities
Inequality Social Challenges Environmental impact of development	Economic Investment Diverse Unique Character
• What could be contributing to the low life-expectancy of Manchester? • Are there spatial patterns of life-expectancy across Greater Manchester? • How does life-expectancy correlate with other others such as unemployment rate, Index of Multiple Deprivation. • Is economic investment equal across Manchester? • Are any areas or people being left behind?	• How would local people describe the character of Manchester? • How much does tourism contribute to Greater Manchester's economy? • What benefits do the economic investment bring to the people of the area?

Source	Author, Perspective, Potential for Bias
A	Visit Manchester website which is the official tourism website for Greater Manchester. Content from this website has been written to inform and persuade tourists to visit and spend money in Greater Manchester.
C	Former Guardian Northern correspondent. Written in 2002. Need Life Expectancy statistics from 2011 Census. Does not consider a personal or qualitative perspective of lived experience in Manchester.

4.2 Written Sources

Student activity

1. Using the same categories above (Opportunities & Challenges) Complete an additional analysis of the source in Figure 47.

   Space has been provided within Table 19, add your summary from analysing Figure 47.

   Figure 47 Holiday brochure article

> The South Downs Way is a stunning, yet challenging, walk through the beautiful countryside of South East England. For mile after mile, you will find rolling hills where you feel totally removed from the bustling coastal towns and cities just a few miles away. The trail is well marked and, as in the area in the photograph, you will also find it is well worn by the number of walkers who have been before you.
>
> Along the trail, you will find beautiful little villages where a welcoming tea shop or pub is an added bonus to your journey. As the trail is some length, it can be revisited a number of times or you can make use of the small hotels, bed and breakfasts or campsites along the route and take as long as you like to enjoy this delightful scenery. BUT be warned – you will not be the only person walking this route and, in June and July particularly, you will need to plan your route and book your accommodation well in advance to avoid disappointment.

Table 19 Analysis of Manchester sources

Challenges	Opportunities
Inequality Social Challenges Environmental impact of development	Economic Investment Diverse Unique Character
• What could be contributing to the low life-expectancy of Manchester? • Are there spatial patterns of life-expectancy across Greater Manchester? • How does life-expectancy correlate with other others such as unemployment rate, Index of Multiple Deprivation. • Is economic investment equal across Manchester? • Are any areas or people being left behind?	• How would local people describe the character of Manchester? • How much does tourism contribute to Greater Manchester's economy? • What benefits do the economic investment bring to the people of the area?

Source	Author, Perspective, Potential for Bias
A	Visit Manchester website which is the official tourism website for Greater Manchester. Content from this website has been written to inform and persuade tourists to visit and spend money in Greater Manchester.
C	Former Guardian Northern correspondent. Written in 2002. Need Life Expectancy statistics from 2011 Census. Does not consider a personal or qualitative perspective of lived experience in Manchester.

Further resources

The following resources are recommended to further support the development of Geographical Skills in GCSE Geography students:

BBC Bitesize Geographical Skills

RGS Data Skills in Geography

GEO Geography Education Online (Geographical Association)

FSC Geography Fieldwork

ESRI UK

The ArcGIS for Schools Bundle includes:

- Fieldwork apps and data to support NEA and Independent Investigation
- Ordnance survey maps in 2D and 3D
- High quality maps at both a local and global scale in 2D and 3D
- Data analysis tools and presentation tools including StoryMaps
- Living Atlas – curated maps and data for the world
- Curriculum focussed Resource Centre with text book case studies
- Online training resources
- MOOCs, online tutorials and webinars
- GeoMentors – support from GIS professionals

Sign up for your free school ArcGIS Online account https://schools.esriuk.com/sign-up/

Did you know?

OCR Resources: *the small print*

OCR's resources are provided to support the delivery of OCR qualifications, but in no way constitute an endorsed teaching method that is required by OCR. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources. We update our resources on a regular basis, so please check the OCR website to ensure you have the most up to date version.

Our documents are updated over time. Whilst every effort is made to check all documents, there may be contradictions between published support and the specification, therefore please use the information on the latest specification at all times. Where changes are made to specifications these will be indicated within the document, there will be a new version number indicated, and a summary of the changes. If you do notice a discrepancy between the specification and a resource please contact us at: resources.feedback@ocr.org.uk.

OCR acknowledges the use of the following content: N/A

Whether you already offer OCR qualifications, are new to OCR, or are considering switching from your current provider/awarding organisation, you can request more information by completing the Expression of Interest form which can be found here: www.ocr.org.uk/expression-of-interest

Please get in touch if you want to discuss the accessibility of resources we offer to support delivery of our qualifications: resources.feedback@ocr.org.uk

Looking for a resource?

There is now a quick and easy search tool to help find **free** resources for your qualification:

www.ocr.org.uk/i-want-to/find-resources/

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our **Customer Support Centre**.

General qualifications

Telephone 01223 553998
Facsimile 01223 552627
Email general.qualifications@ocr.org.uk

www.ocr.org.uk

Cambridge Assessment

CERTIFIED ISO 9001 UKAS MANAGEMENT SYSTEMS 001