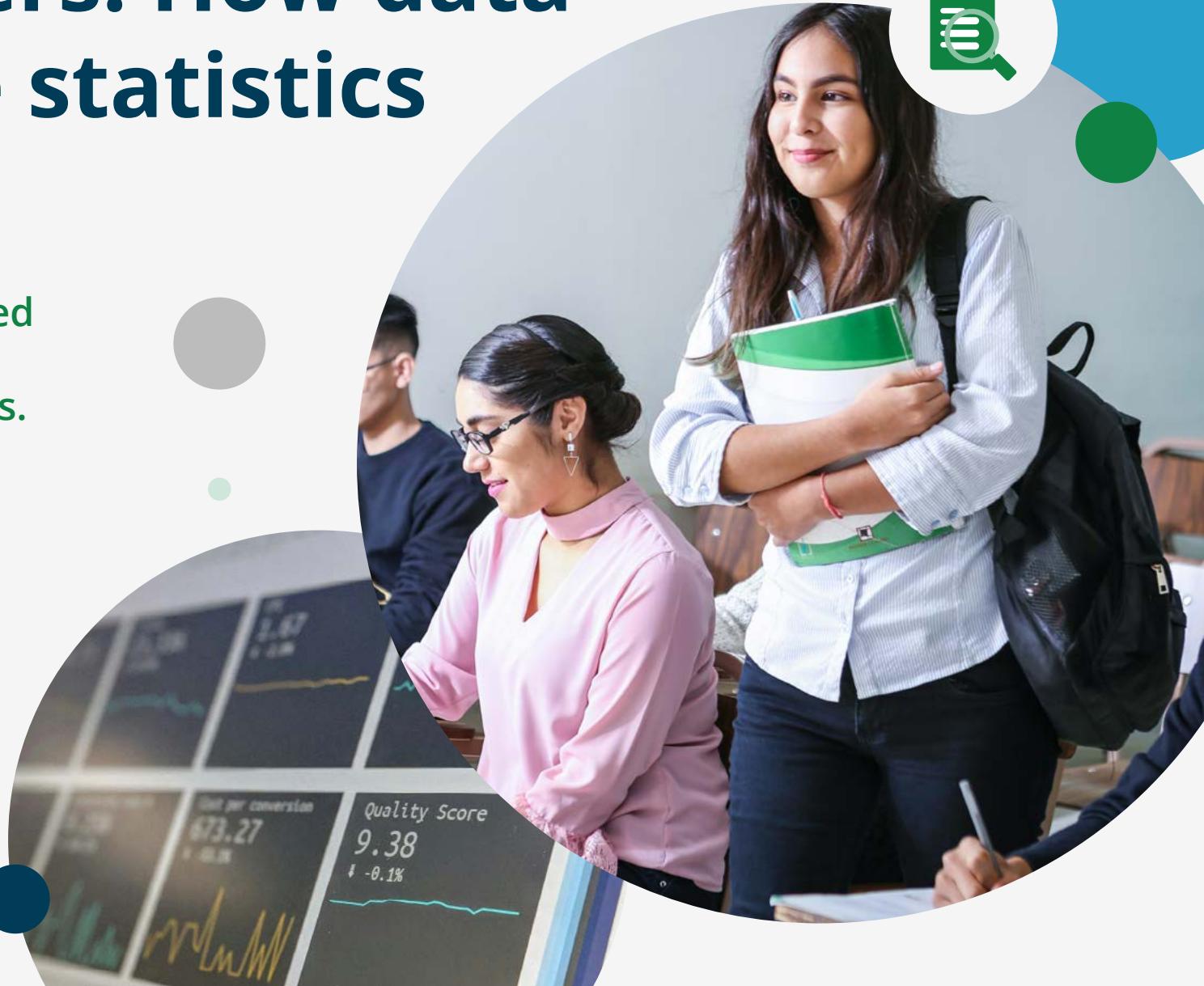


# Navigating numbers: How data are used to create statistics

## Teacher guide

This teacher guidance document is designed to offer support when using the five 'Navigating numbers' toolkits with students.



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## Glossary



# The Office for National Statistics (ONS)

We're an independent producer of official statistics and the recognised national statistical institute of the UK. We collect, analyse and disseminate statistics about the UK's economy, society and population.

The government, charities, community groups, businesses and individuals use these statistics to make informed decisions on important issues that affect us all. This could include everything from healthcare and school places to environmental issues.



# How to use the toolkits

We have designed the toolkits to highlight the importance of statistics in everyday life and to provide opportunities for students to use and interrogate data. This document contains an introduction to the main principles in data and statistics that should be delivered to students before getting started with the five toolkits.

These toolkits are ideal for AS and A-Level geography, maths, business and sociology students. Each toolkit comes with curriculum-linked project ideas for students to use real-world ONS data.

We recommend using one lesson to introduce students to 'the principles of data and statistics' using the accompanying PowerPoint. This will allow them

time to familiarise themselves with the range of tools and datasets, before moving on to each toolkit.

Each toolkit contains a 'project brief' related to geography, maths, business and sociology. We have designed the briefs to be a starting point for students to create their own enquiry-led project, using the tools and datasets provided combined with independent research. Students can carry out their project using a blend of class time as the briefs are designed to be flexible and to fit into the class time you have available. Each brief can also be used as homework or for a short project, or expanded and adapted for coursework or an EPQ.

# Resource contents

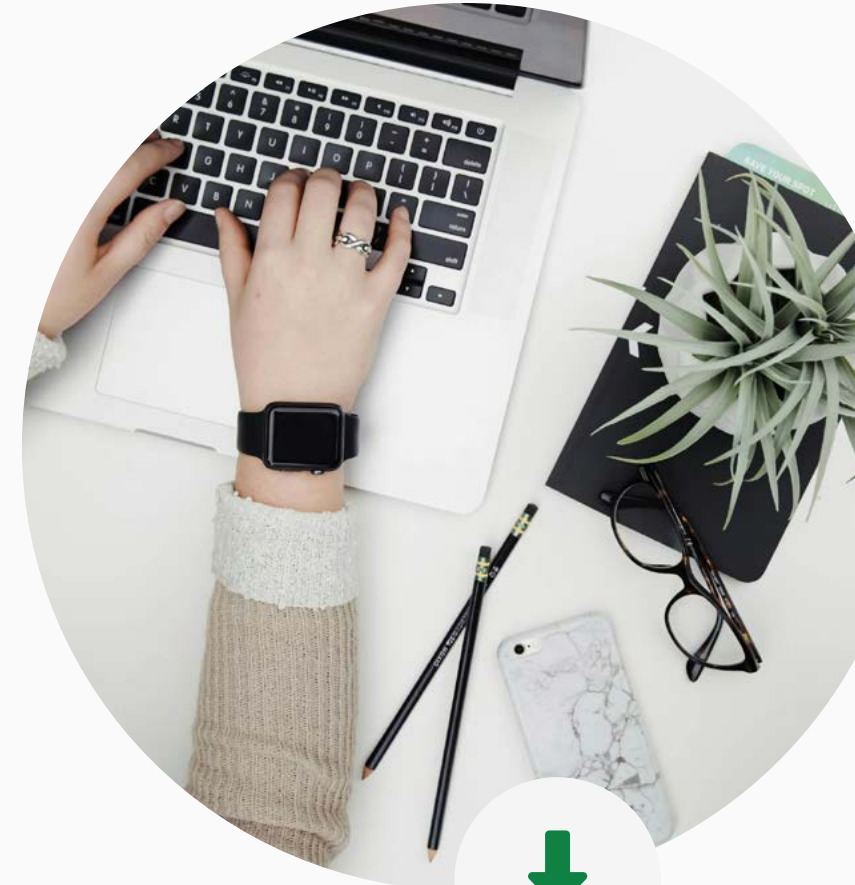
## Introduction to the main principles in data and statistics

This document will introduce students to some common terms and statistical concepts, with real world examples from the ONS.

1. Collecting data and making statistics
2. Sample design and estimation
3. Time series
4. Index numbers
5. Measuring uncertainty
6. Communicating data and statistics

## Downloads

PowerPoint: Navigating numbers: How data are used to create statistics



# Navigating numbers: Gender pay gap

This topic introduces students to the concept of the gender pay gap, considering why and how it's measured.

Start by working through the PowerPoint with students to explore the topic, before sharing the toolkit. The toolkit includes three project briefs with ideas for how students can use the [Gender Pay Gap explorer tool](#) and real-world data from the [Annual Survey of Hours and Earnings \(ASHE\) dataset](#). Students will have the opportunity to examine data about earnings in order to see trends, outliers and patterns in the data. Ultimately, they will gain an understanding of disparities in pay between genders in the UK.

## Downloads

PowerPoint: Navigating numbers: Gender pay gap

PDF: Student toolkit

This toolkit includes:

- Maths project brief: Data analysis and visualisation
- Geography project brief: Geographical disparities
- Sociology project brief: Attitudes and beliefs



# Navigating numbers: Inflation

This topic introduces students to the concept of inflation, its causes, effects, measurement and implications.

Start by working through the PowerPoint with students to explore the topic, before sharing the toolkit. The toolkit includes three project briefs with ideas for how students can use the [Shopping Price Comparison tool](#) and real-world data from the [Consumer Prices Index including owner occupiers' housing costs \(CPIH\) dataset](#). Students will have the opportunity to examine data about prices and inflation and explore the implications of inflation for consumers, businesses and policymakers.

## Downloads

PowerPoint: Navigating numbers: Inflation

PDF: Student toolkit

This toolkit includes:

- Business project brief: Measuring inflation
- Maths project brief: Inflation data analysis
- Sociology project brief: Impact of inflation



# Navigating numbers: Census

This topic introduces students to the census and its significance in understanding population dynamics.

Start by working through the PowerPoint with students to explore the topic, before sharing the toolkit. The toolkit includes three project briefs with ideas for how students can use [data from the census](#) and the [Build a custom area profile tool](#).

Students will have the opportunity to:

- develop their understanding of how statistical inferences are made about populations
- compare and contrast different places or change in the same place over time
- consider the role of census data in decision-making

## Downloads

PowerPoint: Navigating numbers: Census

PDF: Student toolkit

This toolkit includes:

- Business project brief: Market research
- Maths project brief: Census vs samples
- Sociology project brief: Making comparisons





# Navigating numbers: Health and well-being

This topic introduces students to the Health Index and the potential uses of measuring health and well-being.

Start by working through the PowerPoint with students to explore the topic, before sharing the toolkit. The toolkit includes three project briefs with ideas for how students can use [data from the Health Index](#) and the [Health Index calculator](#). Students will have the opportunity to analyse and interpret trends and patterns within a local area or across different regions, and consider the significance of health as an indicator.

## Downloads

PowerPoint: Navigating numbers: Health and well-being

PDF: Student toolkit

This toolkit includes:

- Business project brief: Using health as an indicator
- Geography project brief: Health disparities
- Sociology project brief: Measuring health



# Navigating numbers: Business, industry and trade

This topic introduces students to the main economic indicators and enables students to explore trends in the UK economy.

Start by working through the PowerPoint with students to explore the topic, before sharing the toolkit. The toolkit includes three project briefs with ideas for how students can use [data about business, industry and trade](#) and the [World trade explorer](#) tool. Students will have the opportunity to analyse and interpret trends and patterns within the UK economy, and to understand the economic relationships between the UK and other countries.

## Downloads

PowerPoint: Navigating numbers: Business, industry and trade

PDF: Student toolkit

This toolkit includes:

- Business project brief: Consumer trends
- Geography project brief: International relations
- Sociology project brief: Global development



## Curriculum links: Maths

	AQA	EdExcel	OCR	WJEC
<p><b>Gender pay gap: Data analysis and visualisation</b></p> <p>Students use statistical tools to analyse the data and create visual representations like histograms or box plots.</p>	<p>3.12 L Data presentation and interpretation</p> <p>3.19 The use of data in statistics</p>	<p>Section A: Statistics</p> <p>Topic 1 - Statistical sampling</p> <p>Topic 2 – Data presentation and interpretation</p>	<p>2.C. Use of Technology</p> <p>2. Statistics 2.01</p> <p>Statistical sampline 2.02</p> <p>Data presentation and interpretation</p>	<p>1.5 Welsh perspective</p> <p>Use of data in statistics</p> <p>2.2.2 Data presentation and interpretation</p>
<p><b>Inflation: Inflation Data Analysis</b></p> <p>Students look at historical inflation data in the UK and create graphs and charts to visualize the inflation rates over time.</p>	<p>3.12 L Data presentation and interpretation</p> <p>3.19 The use of data in statistics</p>	<p>Section A: Statistics</p> <p>Topic 1 - Statistical sampling</p> <p>Topic 2 – Data presentation and interpretation</p>	<p>2.C. Use of Technology</p> <p>2. Statistics 2.01</p> <p>Statistical sampline 2.02</p> <p>Data presentation and interpretation</p>	<p>1.5 Welsh perspective</p> <p>Use of data in statistics</p> <p>2.2.2 Data presentation and interpretation</p>
<p><b>Census: Census vs samples</b></p> <p>Students look at census data and sampling to understand how statistical inferences are made about populations.</p>	<p>3.12 L Data presentation and interpretation</p> <p>3.19 The use of data in statistics</p>	<p>Section A: Statistics</p> <p>Topic 1 - Statistical sampling</p> <p>Topic 2 – Data presentation and interpretation</p>	<p>2.C. Use of Technology</p> <p>2. Statistics 2.01</p> <p>Statistical sampline 2.02</p> <p>Data presentation and interpretation</p>	<p>1.5 Welsh perspective</p> <p>Use of data in statistics</p> <p>2.2.2 Data presentation and interpretation</p>

# Curriculum links: Sociology

	AQA	EdExcel	OCR	WJEC
<p><b>Gender pay gap: Attitudes and beliefs</b></p> <p>Students design and conduct a survey to gather data and investigate the impact of social perceptions on the gender pay gap.</p>	<p>AS</p> <p>3.2.1 Research Methods</p> <p>3.2.2.4 Work, Poverty and Welfare</p> <p>A2</p> <p>4.1.3 Theory and Methods</p> <p>4.2.4 Work, Poverty and Welfare</p> <p>4.2.8 Stratification and Differentiation</p>	n/a	<p>2c. Researching and understanding social inequalities: (02) Section A: Research methods and researching social inequalities, Section B: Understanding social inequalities</p>	<p>2.1 AS Units: Unit 2: Understanding Society and Methods of Sociological Enquiry</p> <p>A2 Unit 4: Social Inequality and Applied Methods of Sociological Enquiry</p>
<p><b>Inflation: Impact of Inflation</b></p> <p>Students consider the societal effects of inflation, including its impact on employment, poverty and social inequality.</p>	<p>AS</p> <p>3.2.1 Research Methods</p> <p>3.2.2.2 Families and Households</p> <p>A2</p> <p>4.1.3 Theory and Methods</p> <p>4.2.2 Families and Households</p> <p>4.2.5 Beliefs in Society</p> <p>4.2.8 Stratification and Differentiation</p>	n/a	<p>2c. Researching and understanding social inequalities: (02) Section A: Research methods and researching social inequalities, Section B: Understanding social inequalities</p>	<p>2.1 AS Units: Unit 2: Understanding Society and Methods of Sociological Enquiry</p> <p>A2 Unit 4: Social Inequality and Applied Methods of Sociological Enquiry</p>

# Curriculum links: Sociology

	AQA	EdExcel	OCR	WJEC
<p><b>Census: Making comparisons</b></p> <p>Students explore historical and current census data to compare and contrast different places or change in the same place over time.</p>	<p>AS</p> <p>3.2.1 Research Methods</p> <p>3.2.2.2 Families and Households</p> <p>A2</p> <p>4.1.3 Theory and Methods</p> <p>4.2.2 Families and Households</p> <p>4.2.5 Beliefs in Society</p> <p>4.2.8 Stratification and Differentiation</p>	n/a	<p>2c. Socialisation, culture and identity: (01) Section B Option 1: Families and relationships</p> <p>2c. Researching and understanding social inequalities: (02) Section A: Research methods and researching social inequalities, Section B: Understanding social inequalities</p> <p>2c. Debates in contemporary society: (03): Section B Option 2: Education, Section B Option 3: Religion, belief and faith</p>	<p>2.1 AS Units: Unit 1: Acquiring Culture, Section B Families and Households</p> <p>A2 Unit 4: Social Inequality and Applied Methods of Sociological Enquiry</p> <p>2.1 AS Units: Unit 2: Understanding Society and Methods of Sociological Enquiry</p>
<p><b>Health and well-being: Measuring health</b></p> <p>Students design a comprehensive health index measure that reflects various social determinants of health.</p>	<p>AS</p> <p>3.2.1 Research Methods</p> <p>3.2.2.3 Health</p> <p>A2</p> <p>4.1.3 Theory and Methods</p> <p>4.2.3 Health</p> <p>4.2.8 Stratification and Differentiation</p>	n/a	<p>2c. Researching and understanding social inequalities: (02) Section A: Research methods and researching social inequalities, Section B: Understanding social inequalities</p>	<p>AS Units: Unit 2: Understanding Society and Methods of Sociological Enquiry</p> <p>A2 Unit 4: Social Inequality and Applied Methods of Sociological Enquiry</p> <p>A2 Unit 3: Power and Control: Health and disability</p>

## Curriculum links: Sociology

	AQA	EdExcel	OCR	WJEC
<p><b>Business, industry and trade: Global development</b></p> <p>Students investigate how global development is influenced by economic relationships between the UK and other countries.</p>	<p>AS</p> <p>3.2.1 Research Methods</p> <p>A2</p> <p>4.1.3 Theory and Methods</p> <p>4.2.6 Global Development</p>	n/a	2c. Debates in contemporary society: (03): Section A: Globalisation and the digital social world	<p>2.1 AS Units: Unit 2: Understanding Society and Methods of Sociological Enquiry</p> <p>A2 Unit 3: Power and Control: World Sociology</p>

# Curriculum links: Geography

	AQA	EdExcel	OCR	WJEC
<p><b>Gender pay gap: Geographical disparities</b></p> <p>Students research and analyse regional variations in gender pay gaps within the United Kingdom.</p>	<p>Geographical skills</p> <p>3.2 Changing places</p> <p>3.2.2 Changing places</p> <p>3.2.2.3 Quantitative and qualitative skills</p> <p>3.2.2.4 Place studies</p>	<p>Geographical skills</p> <p>Area of study 2: Dynamic Places</p> <p>Topic 4: Shaping Places</p>	<p>2c. Human interactions</p> <p>Topic 2.1 – Changing Spaces; Making Places</p> <p>2e. Geographical and fieldwork skills</p>	<p>Geographical skills</p> <p>AS Unit 2: Changing Places</p> <p>2.1.1 Changing place; changing places</p> <p>2.1.3 Changes over time in the economic characteristics of places</p> <p>Section B: Fieldwork Investigation in Physical and Human Geography</p>
<p><b>Census: Making comparisons</b></p> <p>Students explore historical and current census data to compare and contrast different places or change in the same place over time.</p>	<p>Geographical skills</p> <p>3.2 Changing places</p> <p>3.2.2 Changing places</p> <p>3.2.2.3 Quantitative and qualitative skills</p> <p>3.2.2.4 Place studies</p>	<p>Geographical skills</p> <p>Area of study 2: Dynamic Places</p> <p>Topic 4: Shaping Places</p>	<p>2c. Human interactions</p> <p>Topic 2.1 – Changing Spaces; Making Places</p> <p>2e. Geographical and fieldwork skills</p>	<p>Geographical skills</p> <p>AS Unit 2: Changing Places</p> <p>2.1.1 Changing place; changing places</p> <p>Section B: Fieldwork Investigation in Physical and Human Geography</p>

# Curriculum links: Geography

	AQA	EdExcel	OCR	WJEC
<p><b>Health and well-being: Health disparities</b></p> <p>Students map out health disparities within a local area or across different regions.</p>	<p>Geographical skills</p> <p>3.2 Changing places</p> <p>3.2.2 Changing places</p> <p>3.2.2.3 Quantitative and qualitative skills</p> <p>3.2.2.4 Place studies</p>	<p>Geographical skills</p> <p>Area of study 2: Dynamic Places</p> <p>Topic 4: Shaping Places</p>	<p>2c. Human interactions</p> <p>Topic 2.1 – Changing Spaces; Making Places</p> <p>2e. Geographical and fieldwork skills</p>	<p>Geographical skills</p> <p>AS Unit 2: Changing Places</p> <p>2.1.1 Changing place; changing places</p> <p>Section B: Fieldwork Investigation in Physical and Human Geography</p>
<p><b>Business, industry and trade: International relations</b></p> <p>Students look at economic relationships between the UK and other countries through the lens of trade data.</p>	<p>3.2.1.3 International trade and access to markets</p> <p>3.2.1.4 Global governance</p>	<p>Area of study 2: Dynamic Places</p> <p>Topic 3: Globalisation</p>	<p>Topic 2.2 – Global Connections</p> <p>2.2.1 Global Systems: Option A – Trade in the Contemporary World</p>	<p>Geographical skills</p>



## Curriculum links: Business

	AQA	EdExcel	OCR	WJEC
<p><b>Inflation: Measuring inflation</b> Students explore different ways of measuring inflation and their implications for consumers, businesses and policymakers.</p>	<p>3.1.3 Understanding that businesses operate within an external environment 3.7 Analysing the strategic position of a business 3.7.5 Analysing the external environment to assess opportunities and threats: economic change</p>	<p>Theme 2: Managing business activities 2.2 Financial planning 2.5 External influences</p>	<p>Business objectives and strategy: Contingency planning External influences: the market, market size and growth; market forces; Economic Factors</p>	<p>AS Unit 1 Business Opportunities: Markets, Business finance A2 Unit 4 Business in a Changing World: PEST Factors</p>
<p><b>Census: Market research</b> Students act as a business owner and come up with recommendations for expansion, new products, marketing or target audiences.</p>	<p>3.1.3 Understanding that businesses operate within an external environment 3.2.2 Understanding management decision making 3.3 Marketing management: 3.3.2 Understanding markets and customers, 3.3.3 Making marketing decisions: segmentation, targeting, positioning</p>	<p>Theme 1: Marketing and people 1.1 Meeting customer needs, 1.2 Market</p>	<p>External influences: the market, market size and growth Change: Managing Change Marketing within a business environment:</p>	<p>AS Unit 1 Business Opportunities: Business plans, Markets, Market research Unit 2 Business Functions: Marketing A2 Unit 3 Business Analysis and Strategy: Data analysis: Market analysis</p>

# Curriculum links: Business

	AQA	EdExcel	OCR	WJEC
<p><b>Health and well-being: Using health as an indicator</b></p> <p>Students explore the significance of health as an indicator in business decision-making processes and consider how businesses can integrate health-related metrics into their operations.</p>	<p>3.2.2 Understanding management decision making</p> <p>3.4.2 Analysing operational performance, 3.4.3 Making operational decisions to improve performance: increasing efficiency and productivity</p> <p>3.6 Human resource management</p>	<p>Theme 1: Marketing and people</p> <p>1.4 Managing people</p> <p>Theme 2: Managing business activities</p> <p>Theme 3: Business decisions and strategy</p> <p>3.4 Influences on business decisions</p> <p>3.4.4 Business ethics</p>	<p>Business objectives and strategy: Corporate social responsibility (CSR)</p>	<p>AS</p> <p>Unit 2 Business Functions: People in organisations (human resources)</p> <p>Operations management.</p> <p>A2</p> <p>Unit 4 Business in a Changing World: Ethical, legal and environmental factors</p>
<p><b>Business, industry and trade: Consumer trends</b></p> <p>Students investigate consumer trends and compare the economic benefits of using British resources versus engaging in international trade.</p>	<p>3.1.3 Understanding that businesses operate within an external environment</p> <p>3.3 Marketing management: 3.3.2 Understanding markets and customers</p>	<p>Theme 1: Marketing and people</p> <p>1.1.1 The market</p> <p>Theme 4: Global business</p> <p>4.1 Globalisation</p> <p>4.2 Global markets and business expansion</p> <p>4.4 Global industries and companies (multinational corporations)</p>	<p>Business objectives and strategy: Business plan: Decision making</p> <p>External influences: the market, market size and growth; Global Context; International Trade</p>	<p>A2</p> <p>Unit 4 Business in a Changing World: International trade, Globalisation, The European Union</p>

# Glossary of important terms

## Anomaly

An anomaly, in the context of data analysis, refers to a data point or observation that deviates significantly from the expected pattern or norm in a dataset. Anomalies can be indicative of errors in data collection, measurement or genuine unusual events.

## Census

The census is a count of every household in England and Wales which has been undertaken by the Office for National Statistics every 10 years.

## Central Limit Theorem

The Central Limit Theorem says that, regardless of the shape of the population, the sampling distribution of the mean will always be normally distributed, as long as the sample size is large enough.

## Cluster Sample

A sampling method where the population is divided into groups or clusters, and then a random selection of clusters is chosen. All individuals within the selected clusters are included in the sample. This method is often more practical and cost-effective when the population is geographically dispersed.

## Convenience Sample

A convenience sample is a non-random sampling method where individuals or items are selected based on their availability and accessibility to the researcher. This method is quick and easy but may lead to biased results as it may not represent the entire population accurately.

## Composite Measure

Combining individual variables that are related to a specific concept or construct of interest.

## Correlation

A measure of the strength and direction of the linear relationship between two variables.

## Data

Raw facts, numbers or symbols that represent quantities, symbols or measurements. Data can be qualitative, which is descriptive, or quantitative, which is numerical.

# Glossary of important terms

## Demographic

Demographic refers to statistical data relating to the population and particular groups within it, such as age, gender, income, education and ethnicity. Demographic information is often used for market research, social analysis and policymaking.

## Descriptive Statistics

Methods used to summarise and describe features of a dataset, such as mean, median, mode, range, variance and standard deviation.

## Distribution

The pattern of variation in a dataset, often represented graphically as histograms, box plots or probability distributions.

## Index

In the context of statistics, an index refers to a composite measure that combines multiple variables into a single numerical value to represent a broader concept or phenomenon. Indexes are commonly used to summarise complex data sets and facilitate comparisons across different groups or over time.

## Margin of Error

The margin of error is a measure of the uncertainty or precision associated with a sample statistic. It indicates the range within which the true population parameter is likely to lie. A smaller margin of error indicates greater precision in the estimate.

## Normal Distribution

A bell-shaped distribution characterised by a symmetric, unimodal curve. Many natural phenomena follow this distribution.

## Outlier

An observation that lies an abnormal distance from other values in a dataset.

## Population

The entire group of individuals or items that the researcher is interested in studying.

# Glossary of important terms

## Random Sample

A random sample is a subset of individuals or items chosen from a larger set, the population, in such a way that every individual or item has an equal chance of being selected. This method helps to minimise bias and ensure the sample is representative of the population.

## Regression Analysis

A statistical technique used to model the relationship between one or more independent variables and a dependent variable.

## Sample

A subset of the population selected for study.

## Sampling Bias

Sampling bias occurs when a sample is not representative of the population due to systematic errors in the sampling process. This can lead to inaccurate conclusions and generalisations about the population.

## Sampling Error

Sampling error is the difference between a sample statistic, such as the sample mean or proportion, and the corresponding population parameter. It occurs because a sample is only a subset of the entire population and may not perfectly represent it.

## Standard Deviation

Standard deviation measures the dispersion or spread of data points in a dataset around the mean, or average. A low standard deviation indicates that the data points tend to be close to the mean, while a high standard deviation indicates that the data points are spread out over a wider range.

## Stratified Sample

A sampling method where the population is divided into distinct subgroups or strata, and then samples are randomly selected from each subgroup. This method ensures representation from each subgroup in the sample, allowing for more accurate analysis of each subgroup's characteristics.

# Glossary of important terms

## Time Series

A time series is a sequence of data points collected or recorded at successive points in time. Time series data is often analysed to identify patterns, trends and seasonal variations over time.

## Variable

A characteristic or attribute that can vary and be measured, such as age.

## Variance

A statistical measure of the dispersion or spread of a set of data points around their mean value. It quantifies how much the data points in a dataset differ from the mean. Mathematically, variance is calculated as the average of the squared differences between each data point and the mean.

## Weighting

Weighting is a technique used in statistical analysis to adjust the contribution of different observations in a sample to make them more representative of the population. It involves assigning different weights to observations based on certain characteristics or factors.

