

TEACHER'S NOTES

Maths Level 1

Chapter 6

Working with data and averages

SECTION I Working with data

- 1 Collecting, recording and representing information
- 2 Interpreting data from tables and tally charts
- 3 Interpreting bar charts and pie charts
- 4 Interpreting pictograms and line graphs
- 5 Remember what you have learned

SECTION J Working with mean and range

- 1 Understanding mean
- 2 Understanding range
- 3 Remember what you have learned

Maths Level 1

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Chapter 6: Working with data and averages

Use these free pilot resources to help build your learners' skill base

We are delighted to continue to make available our free pilot learner resources and teacher notes, to help teach the skills learners need to pass Edexcel FS Mathematics, Level 1.

But use the accredited exam material and other resources to prepare them for the real assessment

We developed these materials for the pilot assessment and standards and have now matched them to the final specification in the table below. They'll be a useful interim measure to get you started but the assessment guidance should no longer be used and you should make sure you use the accredited assessments to prepare your learners for the actual assessment.

New resources available for further support

We're also making available new learner and teacher resources that are completely matched to the final specification and assessment – and also providing access to banks of the actual live papers as these become available. We recommend that you switch to using these as they become available.

Coverage of accredited specification and standards

The table below shows the match of the accredited specification to the unit of pilot resources. This table supersedes the pilot table within the teacher notes.

Coverage and Range	Exemplification	Learner Unit
Extract and interpret information from tables, diagrams, charts and graphs	<ul style="list-style-type: none"> Tally charts Pie charts Pictograms Bar charts Line graphs Conversion graphs Mileage charts 	I1 Collecting, recording and representing information I2 Interpreting data from tables and tally charts I3 Interpreting bar charts and pie charts I4 Interpreting information from pictograms and line graphs Mileage charts are covered in G6
		I5 Remember what you have learned
Collect and record discrete data and organise and represent information in different ways	<ul style="list-style-type: none"> Design a data collection sheet 	This is covered in our new publishing (see below)
	<ul style="list-style-type: none"> Identify information from a table Calculate with information from a table 	I2 Interpreting data from tables and tally charts
Find mean and range	<ul style="list-style-type: none"> Mean of discrete data Range of discrete data 	J1 Understanding mean J2 Understanding range
		J3 Remember what you have learned

Where to find the final specification, assessment and resource material

Visit our website www.edexcel.com/fs then:

- **for the specification and assessments:** under **Subjects**, click on **Mathematics (Levels 1–2)**
- **for information about resources:** under **Support**, click on **Published resources**.

6

Working with data

(pages 95–118 in the learner materials)

Performance	Coverage and Range	Unit Objectives
Learners can:	Learners can:	
<ul style="list-style-type: none"> ■ Understand practical problems in familiar and unfamiliar contexts and situations, some of which are non-routine ■ Identify and obtain necessary information to tackle the problem ■ Select mathematics in an organised way to find solutions to practical problems for different purposes ■ Apply mathematics in an organised way to find solutions to practical problems for different purposes ■ Use appropriate checking procedures at each stage ■ Interpret and communicate solutions to practical problems, drawing simple conclusions and giving explanations 	<ul style="list-style-type: none"> ■ Extract and interpret information from lists, tables, diagrams, charts and graphs ■ Collect and record discrete data and organise and represent information in different ways ■ Find mean and range 	<p>I1 Collecting, recording and representing information</p> <p>I2 Interpreting data from tables and tally charts</p> <p>I3 Interpreting bar charts and pie charts</p> <p>I4 Interpreting information from pictograms and line graphs</p> <hr/> <p>I5 Remember what you have learned</p> <hr/> <p>J1 Understanding mean</p> <p>J2 Understanding range</p> <hr/> <p>J3 Remember what you have learned</p>

Approaches to teaching

This section covers the skills necessary for learners to be able to work efficiently with data. The unit focuses on the delivery of working with interpreting data from tables, charts and graphs, collecting, organising and representing data and calculating mean and range. The questions set allow the learner to practice the full range of skills being taught. The table identifies the coverage and range from the functional skills standards: mathematics level 1 which are covered in this section.

I1 Collecting, organising and representing information

The main idea is to enable learners to organise raw data into tables using tally marks and to remember the essential features of different graphs and charts. This will enable them to work out which type of graph is most suitable for displaying a given set of data. Learners need to understand that, without an axis label, the numbers on the axis of a graph are meaningless and that a pie chart without a key cannot be interpreted.

When teaching learners how to draw bar charts and line graphs, it is crucial to focus on the skills around choosing appropriate scales, ensuring learners understand why allowing 1 square on graph paper to represent 3 units for example will cause unnecessary difficulties when reading off values.

Activities

Prepare cards showing a range of graphs and charts with features missing or mistakes, and make another set of 'category' cards showing types of missing features or mistakes, for example, *There's no title*, *The vertical axis does not have a label*, *The vertical scale is incorrect*, *There is no key*. Ask learners, in pairs or groups, to match each graph or chart card to the matching explanation card.

Ask learners to collect some data that has a purpose, for example, journey times to or from school or furthest distance travelled for a holiday. Ask them to design a table to organise the data.

Give learners some general graph information, for example, *The y-axis has a minimum value of 0 and a maximum value of 200*. Allow them to choose their own scale, including the numbered and unnumbered divisions, and to draw this axis. As a group, discuss the benefits and disadvantages of chosen scales.

Misconceptions

Learners make mistakes in data handling by not having a mental checklist to check off when examining example graphs. They can easily overlook a missing title, key or axis label because they are not sure what they are looking for. For example, in practice question 2 on page 110 of the Skills Book, learners need to be clear that bar charts require a title, labelled axes and a vertical scale. Encourage them to be systematic when checking for these and then they are more likely to identify the missing feature.

Learners are often inconsistent when using scales because they have mapped the data directly to the scale instead of counting up systematically: for example, if the numbers in the table are 5, 7 and 10, they will mark off evenly spaced divisions on the axis 0, 5, 7 and 10, instead of 0, 2, 4, 6, 8 and 10.

12 Interpreting data from tables and tally charts, J3 Interpreting bar charts and pie charts and J4 Interpreting pictograms and line graphs

The main idea is that data given in any table or tally chart can be interpreted in order to solve problems. Start by presenting learners with simple tables involving, for example, prices, catalogue items, insurance details, mobile phone tariffs, and give them practice in selecting particular items. Remind learners how to use and interpret tally marks and demonstrate how to use tally charts to answer questions of the type: *How many more does x have?* Advise learners that they can use bar charts to find the number of *individual* items of data and to find the *total number* of items of data. Demonstrate how to read scales accurately. Encourage learners to use rulers to ensure they read values on axes accurately. Explain that some bar charts (dual bar charts) represent two types of data and that a key will explain how each type is represented. Stress that pie charts are mainly used to show relative proportions of categories and that questions often ask learners to identify the most or least popular item, or to establish the categories that occupy simple fractions of the total (e.g. $\frac{1}{2}$ or $\frac{1}{4}$). Explain how to use the key in pictograms to establish the number of data items represented by pictogram symbols, in particular, half symbols. Use a straight-line graph to demonstrate how to convert between related quantities (e.g. miles and kilometres) by using values on both horizontal and vertical scales and reading across and down or up then across.

Activities

Prepare cards showing straight-line conversion graphs and corresponding conversion question cards, for example, 5 miles = ?km, £2.00 = €? Ask learners, in pairs or groups, to match the question cards and the graphs and then to use the graph to answer the question.

Misconceptions

Many learners make mistakes when using bar charts because they have not read the question carefully. For example, in practice question 1 on page 109 of the Skills Book, learners need to realise they are required

to read two values (9:00 to 10:00 and 10:00 to 11:00) and add these together. Many learners will only read the value for 9:00 to 10:00 and select answer A. Stress to learners the importance of reading questions carefully and making sure they are clear about what is being asked, to avoid making this sort of careless error. Make them aware that they could be asked to read the value(s) of any number of bars.

With pictograms, learners sometimes make errors because they ignore the key. For example, in practice question 3 on page 108, each calculator symbol represents two calculators. If learners ignore this, they are likely to assume one symbol equals one calculator. Stress the importance of using the key in pictograms and advise learners how to interpret fractions of symbols. Remind them of the importance of choosing appropriate symbols if they need to be able to depict amounts using fractions of symbols.

Difficulties arise in pie chart questions when learners have to interpret fractions of quantities. For example, in question 2 on page 105, learners need to understand that $\frac{1}{2}$ is twice $\frac{1}{4}$ in order to identify statement B as true. Encourage learners first to identify the fraction or approximate fraction for each sector and then systematically to try out each answer option; this may overcome the difficulty.

J1 Understanding mean

The main idea is that learners can find the average (mean) value for any list of data by adding all the data values and dividing the total by the number of items of data. Review examples involving lists of whole numbers and decimals. Advise learners that many questions require them to extract relevant data from a table first. Encourage learners to read questions carefully, to take care when adding items of data and to divide by the correct number. Remind them also that zero counts as an item of data.

Activities

Prepare sets of cards that show related stages of solving problems involving the mean of a set of data, for example, *What is the average (mean) temperature for the week in Madrid?*, a table of data showing temperatures over one week in Madrid, the temperatures added together, the total divided by 7, *The mean is x*. Ask learners to group the cards into their sets, and then to put them in order, ending with the answer card.

Misconceptions

Many learners are unsure which numbers to *divide by*. Such confusion is likely to occur with, for example, practice question 6 on page 118 of the Skills Book.

Learners may add up the times successfully but then divide the result by 5 instead of 7 (or the converse, in a question asking for the average over the week days). Encourage learners to read questions very carefully and to make sure they have answered them properly.

J2 Understanding range

The main idea is that learners can find the range for any set of data by subtracting the smallest value from the largest. Review examples involving sets of whole numbers and decimals. Remind learners to include zero when considering which item of data is the largest and which is the smallest. Advise them that questions often provide data in a table, and they will need to interpret the data in order to find the range.

Activities

Prepare sets of cards of at least three items of data, with one item missing and replaced by ?, and information about range and mean (e.g. 9, ?, 8, 1; mean = 7, range = 9). Ask learners, in pairs, to work out the missing numbers.

Misconceptions

Learners sometimes forget to include zero when working out mean and range. For example, in question 1b on page 116 of the Skills Book, the range for the temperature values is found as $14 - 0$, not $14 - 1$. Another common error is to subtract the first number in a table from the last, instead of identifying the largest and smallest.

Apply the skills

The learners need to develop their Process Skills, which are:

Representing	Analysing	Interpreting
Making sense of situations and representing them	Processing and using the mathematics	Interpreting and communicating the results of the analysis

At level 1 the learners may receive some guidance on how to first approach a problem but then must decide on the methods used and identify the information they need for themselves. A suitable activity to practice their skills in data handling would be to investigate relationships between heart rate and lifestyles. The practice task below involves collecting data on learners' heart rates, exercise levels and diet, and organising and representing this data to make valid conclusions.

A practice level 1 task is given below:

An investigation into the effects of exercise and healthy eating on heart rate

SAMPLE TASKS

- Ask up to 10 learners to count the number of heart beats over 15 seconds.
- Inform them that heart rate is the number of heart beats per minute. Ask them which number they should multiply the number of heart beats they have counted in 15 seconds by, to work out their individual heart rates.
- Collect student information on average hours of exercise per week and the preferred type of exercise.
- Collect student information on the number of portions of fruit or vegetables learners eat per day.
- Ask learners to organise individual student information on exercise, diet and heart rate into a table.
- Calculate the mean and range heart rate of the group.
- Calculate the mean and range for the number of hours of exercise per week.
- Discuss where the mean fits into adult's normal heart rate range (60–80 bpm)
- Draw a bar chart showing learners' preferred type of exercise.
- Draw a pictogram showing the numbers of portions of fruit and vegetables learners eat daily.
- Use the charts and the mean calculations to draw any conclusions on the effects of exercise and diet on heart rate.

Answers: Section I

I Working with data

1 Collecting, recording and representing information – page 95

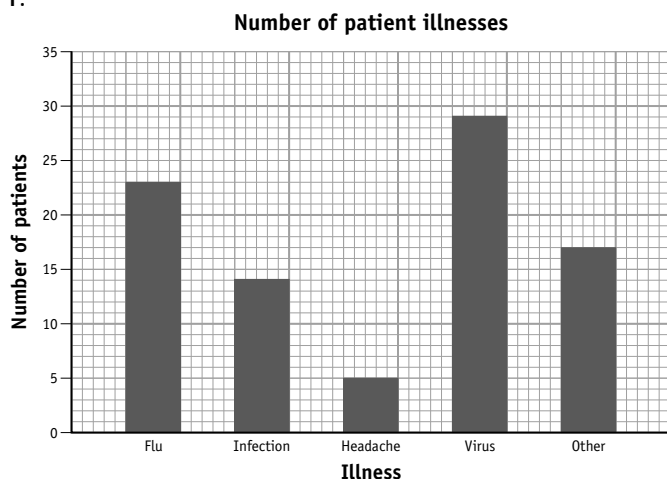
- 1. a 19 fiction books
- b $8 + 3 = 11$
- c $12 - 5 = 7$

2.

Type of programme	Tally marks	Frequency
Comedy	### ////	9
Soap opera	//	2
Sport	### ### /	11
Drama	### /	6
Light entertainment	/	1
Documentary	/	1

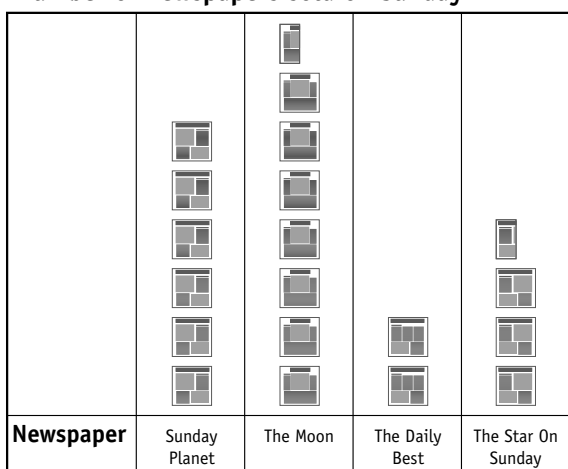
2 Pictograms, bar charts and line graphs – page 100

1.



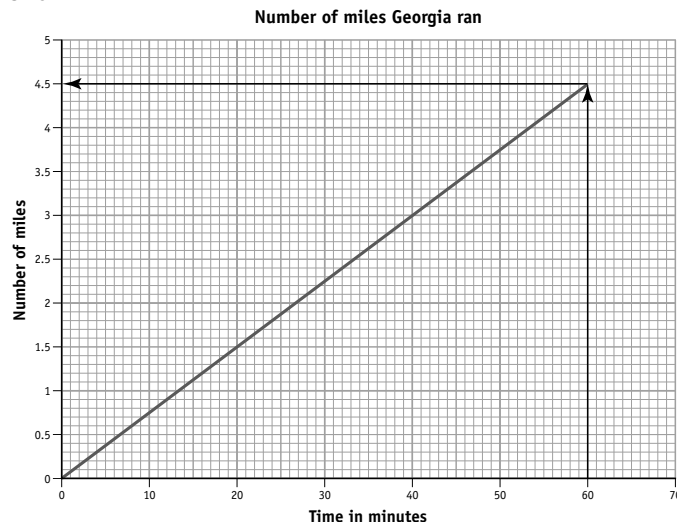
2.

Number of newspapers sold on Sunday



Key:
 = 4 newspapers

3. a



b 4.5 miles (follow arrow on graph)

2 Interpreting data from tables and tally charts – page 101

- 1. a £99.99
- b 680/454
- 2. a $19 - 4 = 15$
- b $8 + 15 = 23$
- 3. a £55
- b $£75 - £55 = £20$

3 Interpreting bar charts and pie charts – page 103

- 1. a $3\frac{1}{2}$ hours
- b Rugby and Motor racing
- 2. a B
- b cloud
- 3. The title is missing.

4 Interpreting pictograms and line graphs – page 106

- 1. a 9
- b 5 more homes
- 2. a 125°C
- b 4 minutes
- c 100 degrees
- 3. There is no key.
- 4. The vertical axis is not labelled.

5 Remember what you have learned – page 109

- 1. B
- 2. B
- 3. B
- 4. D
- 5. B
- 6. B

J Working with mean and range

1 Understanding mean – page 112

- 8
 - 3.7 cm
 - £1.64
- £37.50
- 9 hours
- 60p
 - 63p to the nearest penny
 - Fizzy drink
- Team B, £1776.40 as against team A, with £1 699.60

The effect on the mean when a few numbers are different to the majority – page 114

- $20 \div 10 = 2$
 - $27 \div 10 = 2.7$
 - $31 \div 10 = 3.1$
 - No, most houses have 1 or 2 people living there
 - $6 \times 3 = 18$ people
- $15 \div 30 = \frac{1}{2}$ a minute per call
- $400 \div 40 = 10$ miles per delivery
- $50 \div 20 = 2.5$ goals per team
- $£450 \div 20 = £22.50$

2 Understanding range – page 116

- 12
 - 14 degrees
 - £7.90

2. 6

5 Remember what you have learned – page 117

- C
- C
- B
- A
- D
- C
- B
- B
- A