

Teaching and Learning
Move On with your learners – numeracy

Module 8

Averages and test preparation

Session plan

Module 8: Averages and test preparation

Group: _____

Teacher: _____

Location: _____

Aims

- To develop an understanding of averages and range within practical contexts and be able to use them appropriately.
- To further develop the skills required for test success.

Outcomes

Participants will be able to:

- find the mean, median and mode and use them as appropriate to compare two sets of data
- find the range and use it to describe the spread within sets of data
- 'unpack' numeracy test questions and explore strategies for test success.

Activity and time	Teacher activity	Learner activity
Introduction 15 mins	<ul style="list-style-type: none"> ● Recap on last module, and explore any issues arising from individual and group tasks. ● Ask for feedback on the Inter-session task: try it out on your learners. ● Distribute drawings for Mental maths – 2D visualisation. Explain task and link to visualisation activity from the previous module – vocabulary of shapes. ● Show module 8 presentation slides 1–3 and outline the aims and objectives of the session. 	<ul style="list-style-type: none"> ● Listen and respond. ● Provide examples of problems or issues resulting from tasks. ● Provide feedback on adapting activity for their learners. ● Complete Mental maths task in pairs; feed back. ● Listen and respond.

Activity and time	Teacher activity	Learner activity
Introduction to averages 30 mins	<ul style="list-style-type: none"> ● Use Q and A to explore prior understanding of averages. Elicit everyday occurrences. ● Ask for a definition of 'mean', and find the mean height of the participants. Introduce 'range' and calculate the range of height amongst the participants. ● Go through a worked example showing 'grouped data'. ● Distribute Mean activity sheet and support individual/paired activity; give out Averages handout for reference. 	<ul style="list-style-type: none"> ● Listen and respond. ● Contribute examples. ● Participate in task. ● Contribute to discussion. ● Complete worksheet, working individually but with peer support.
Median and mode 30 mins	<ul style="list-style-type: none"> ● Explore median and mode, using worked examples. ● Discuss examples of when using the mean would be misleading and when it would be better to use median or mode. ● Review range. Use Q and A to explore what it could be an indicator of, and use. ● Distribute Mean, median and mode activity sheet and support individual/paired activity. 	<ul style="list-style-type: none"> ● Listen, read and respond. ● Paired activity. ● Contribute to discussion. ● Begin to work on problems – complete for homework if necessary.
Average speed 15 mins	<ul style="list-style-type: none"> ● Use Q and A (scaffolded if necessary) to elicit a formula for working out average speed. ● Ask participants to provide examples and work through on flipchart or whiteboard. 	<ul style="list-style-type: none"> ● Listen and respond. ● Provide examples and contribute to discussion.
Break 15 mins		
Average speed 15 mins	<ul style="list-style-type: none"> ● Distribute Average speed activity sheet and support individual/paired work. 	<ul style="list-style-type: none"> ● Complete activity sheet in pairs, with peer support.

Activity and time	Teacher activity	Learner activity
Pointers to test success 15 mins	<ul style="list-style-type: none"> Using the Move On learner route from the web site, explore 'Unpacking numeracy questions' and 'explore what YOU need to succeed'. Distribute hard copies of Checklist of test tips. 	<ul style="list-style-type: none"> Contribute to discussion. Reflect on personal test technique and test readiness. Complete checklist.
Test practice 25 mins	<ul style="list-style-type: none"> Demonstrate how www.itembank.org.uk can be navigated and used to select skill-specific timed test practice. Set ten timed questions from www.itembank.org.uk on averages at L2. 	<ul style="list-style-type: none"> Listen and respond. Individual timed test practice.
Summary 20 mins	<ul style="list-style-type: none"> Revisit session aims and objectives. Take feedback and questions. Set independent group tasks: Hot Topics and Sample test questions (averages), and individual tasks from supplementary material. Give out Journal sheet for module 8. 	<ul style="list-style-type: none"> Listen and respond. Agree independent tasks.

Resources/aids

- Module 8 PowerPoint presentation/OHP slides
- Handouts: Averages; Checklist of test tips (from www.move-on.org.uk/ilr/numeracy/welcome.asp); Journal
- Activity sheets: Mental maths – 2D visualisation; Mean; Mean, median and mode; Average speed; Sample test questions (averages)
- Teacher resources: laptop and data projector with Internet connection; PCs or laptops with Internet connection
- Hot Topics CD-ROM
- Personal whiteboards and markers
- Flipchart or whiteboard and markers.

Assessment evaluation

Individual learning planning

Learner	Skills	Activity/ Resources	Evaluation (where next?)

Teacher's notes

Module 8: Averages and test preparation

Introduction

Recap on the last session and review any difficulties experienced by the group with the independent tasks that were set. Ask for feedback on the Inter-session activity: Try it out with your learners. The **Mental maths** activity is a 2D visualisation: participants work in pairs, one partner trying to describe the drawing and the other drawing according to the instructions given. They then swap roles for the second drawing. Link to the last module and review vocabulary of shapes, if required.

Introduction to averages

Use Q and A to explore what people understand by 'average'. Elicit 'typical'. When do we use average, and how is it useful? Use the examples provided; if prompts are needed: we can compare wages, prices, weight of a baby at two months and mobile phone tariffs. It can help us plan, budget, or reassure us that the situation is within the 'normal' range of what could be expected. Ask for a definition of 'mean' and carry out a practical task to find the mean characteristic of the individuals in the group. Mean height is 'safe', but you might want to work out mean working hours, or mean number of learners they see in a week. Record the data on the flipchart or whiteboard and keep the data available for later in the session. Ask what people understand by 'range'. What's the range of the data set produced by the task?

Go through a worked example of finding the mean from grouped data. There is an example supplied in the **Averages** handout.

Distribute the **Averages** handout, the **Mean** activity sheet and the **answer sheet** for the module and suggest that participants work individually or in pairs. If participants prefer to work individually, encourage peer support to share methods of working and to check understanding. Support one-to-one and group work.

Median and mode

Use Q and A to explore examples of where using the mean as the average could be misleading. Elicit examples where an unrepresentatively large (director's salary) or small (the weight of a Chihuahua when finding the weight of an 'average' dog) item could skew the mean value. Was mean the right average to use with the data provided from the practical task? Revisit the concept of range, and discuss the implications of a small or large range value. What does it tell you? Is a large range value due to data spread

with equal frequency throughout the range, or one unrepresentatively large or small value in the data? What are the different implications? You may also wish to refer to the examples given in the **Averages** handout to support the concept of range.

Explore median and mode using worked examples from either those provided by the participants or the **Averages** handout. Revisit the data given by the practical activity on mean. What's the median value? What's the mean? What is the most appropriate average to use in this instance? Distribute **Mean, median and mode** activity sheet and support where necessary. Go over any common difficulties presented by the problems with the whole group.

Average speed

Use Q and A to elicit a formula for working out average speed, working through examples on the whiteboard. It might be useful to use the example given at the end of the **Average speed** activity sheet, which is from a Level 2 numeracy test, to highlight the potential pitfalls of Level 2 two-stage questions on averages. Give the 'learner's answer' as 55 mph, and ask them to work out where the learner has gone wrong. Support individual or paired work on the **Average speed** activity, and resolve common difficulties presented by the problems to the whole group, as before.

Pointers to test success

This activity will require a laptop and data projector with internet connectivity, so that you can project the Move On web site onto the screen. Click on the Learner Route for numeracy, and follow the links to 'Pointers to test success'. You will need to register as a user and enter the site by clicking on 'Prepare at Level 2'. Scroll down the right-hand side menu to 'Unpacking numeracy questions'. Use the material provided to prompt discussion on the language of test questions, identifying extraneous information, identifying where the question requires estimation and approximation skills, rounding and so on. Use 'Understanding what you need to succeed' to encourage the participants to reflect on their 'readiness', on whether they have identified remaining skills gaps resulting from the one-to-one progress reviews from module 6, and on whether they have an insight into their test technique and potential pitfalls. Supply hard copies of the **Checklist of test tips** to encourage participants to plan their preparation for the numeracy test.

Test practice

Using the same equipment as in the previous activity, demonstrate how the ItemBank web site (www.itembank.org.uk) can be used to select groups of questions that are skills-specific and timed, for test practice and preparation, for themselves and for their learners. Explain how passing the test is a skill in itself, requiring both technique and


practice, skills that should be explicitly taught. On individual PCs or laptops with an Internet connection, set timed questions on averages at Level 2. Reconvene as a group and take feedback. What was the experience like? Did they get the questions right, or make mistakes under pressure? Suggest that they complete a full practice test under exam conditions before the next session.

Note: At present, the minimum number of questions you can select from the site for skills-specific timed practice is 20. Depending on the time available, you may need to set up the timed practice for 20 questions, but ask them to answer at least 11 in 20 minutes. Remind the participants that in the test itself, they have 1.8 minutes to answer each question.

Summary

Revisit aims and objectives of session using **slides 2 and 3**. Set **Sample test questions (averages)** and individual tasks according to need. Explain that the topic for module 9 will be Handling data: tables, charts and graphs. Ask participants to use the Hot Topics CD-ROMs they have been provided with (or the Hot Topics section of the Move On web site) to review tables, charts and graphs for next session, by working through the 'basics' and 'intro' sections. Demonstrate the Hot Topics material and signpost participants to the relevant section. Finally, ask that participants bring in examples of tables, charts and graphs for next session, from newspapers, web sites or work-related material.


Module 8 PowerPoint presentation



The National Certificate in Adult Numeracy

Level 2 Skills for Life Support Strategies

**Module 8:
Averages and test preparation**




department for
education and skills
creating opportunity, releasing potential, achieving excellence

Aims

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- ➔ To further develop skills required for test success.

2




Outcomes

Participants will be able to:

- ➔ find the mean, median and mode and use them as appropriate to compare two sets of data
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- ➔ 'unpack' numeracy test questions and explore strategies for test success.

3



Activity: Mental maths – 2D visualisation

Diagram 1

Sit back-to-back with your partner.

Look at the diagram. Don't show the diagram to your partner.

Tell your partner how to draw the diagram.

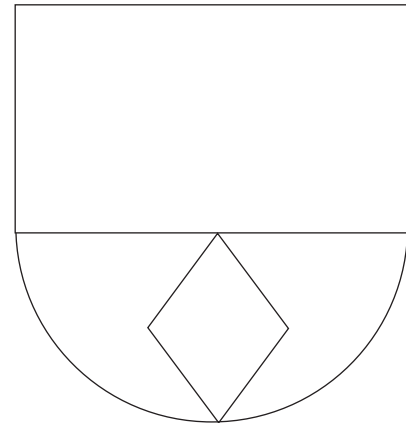
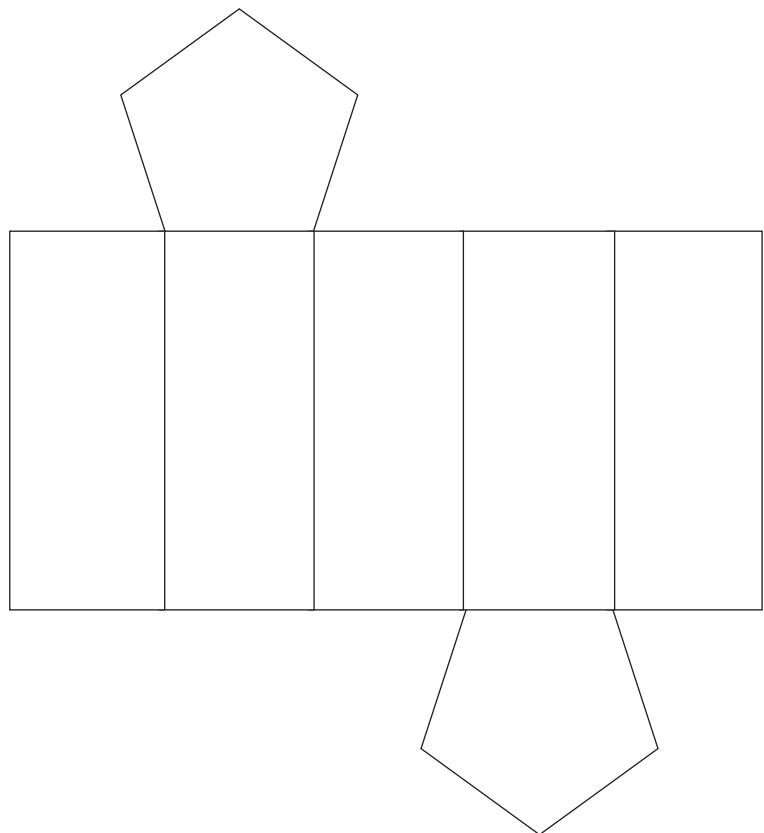


Diagram 2

Sit back-to-back with your partner.

Look at the diagram.
Don't show the diagram to your partner.

Tell your partner how to draw the diagram.



Taken from the Adult Numeracy Core Curriculum training materials.

Handout: Averages

The **average** – a number or item that is typical for a set. It is like the ‘middle’ of a set of numbers. Finding the average can help to compare and to plan (for example, if you know your average expenditure on a night out, you can plan how much money you need for a weekend).

Mean

The most common average used is the **mean**. When people say ‘average’ (average wage, average cost, goal average etc.), they usually mean the mean.

A sports report might say: ‘The team’s goal average is two goals per match.’ This doesn’t mean that the team scored two goals every match: it means that they scored about two goals each match, although sometimes they scored more, sometimes less. The goal average was calculated by adding up all the goals scored and dividing by the number of matches played.

$$\text{Mean} = \frac{\text{sum of the numbers}}{\text{how many there are}}$$

Note: Sometimes the mean turns out to be an ‘impossible’ number. For example: the average number of children per family is 2.1. Obviously you cannot have 0.1 of a child, but it is still the mean value and you could use it to make calculations and to compare values.

Grouped data

Sometimes data is grouped – in this case care must be taken to use the correct numbers.

Example

The weights of 10 bolts are given in this table:

Weight	Number of bolts with this weight
10 g	2
14 g	3
16 g	3
18 g	2

Find the average weight of the bolts.

First we need the total weight, which is:

$$\begin{aligned}(10 \times 2) + (14 \times 3) + (16 \times 3) + (18 \times 2) \text{ g} &= (20 + 42 + 48 + 36) \text{ g} \\ &= 146 \text{ g}\end{aligned}$$

$$\text{Average weight} = 146 \div 10 = 14.6 \text{ g}$$

Median

Sometimes the mean can be misleading, particularly if the data is distorted by a particularly large or small value. In this case, the mean does not give a typical result.

Examples are: average wage for a company when the managing director's wage is included, or average family expenditure per month when the Christmas period is included.

In these cases it would be better to use another type of average that ignores the excessively high or low value. If the numbers are arranged in order, the middle number (or the mean of the two middle numbers if there is not a single middle one) is called the **median**.

Example

A company employs four people whose wages are £11 000, £13 000, £14 000 and £16 000 per year, and the company director earns £200 000 per year. If the mean value was calculated, the average wage would be

$\pounds(11\,000 + 13\,000 + 14\,000 + 16\,000 + 200\,000) \div 5 = \pounds254\,000 \div 5 = \pounds50\,800$. This is clearly not a representative wage for the staff. The median wage is £14 000, which is a much more representative figure than the mean in this case.

Mode

The third type of average is called the **mode**. This means the most commonly occurring item in a set, and is particularly useful in certain cases, such as the most popular shoe sizes (for ordering purposes), the most popular film, the most commonly occurring number of days people took off sick. The mode is often handy for comparisons.

Example

A local pub asked its customers to name their favourite short drinks. Their answers were as follows:

rum, vodka, gin, whisky, whisky, brandy, vodka,

sherry, whisky, gin, martini, whisky, brandy, rum

The mode for this data is whisky (most people said whisky).

Note: You can have more than one modal value if two or more are equal in popularity.

Range

The **range** is a measure of how much spread there is in the values. It often gives an idea of the best type of average to use, or of how indicative the average value

is. A large range can indicate a data set where the mean could be distorted due to particularly high or low values.

Example

Find the range of these house prices:

£95 999 £114 250 £90 500
£109 750 £99 000 £103 900

Highest price = £114 250

Lowest price = £90 500

Highest – Lowest = £114 250

$$\begin{array}{r} \text{£90 500} \\ \hline \text{£23 750} \end{array} \quad -$$

There is a difference of £23 750 between the highest and lowest house prices. The range is £23 750.

The range of house prices in this example is not great, and the mean price is £102 233 – about in the middle of the range – so the mean would be an appropriate average to use. However, if the highest house price was considerably more than the other houses in the survey, £275 000 for example, then the range, the difference between the highest and the lowest price, would be bigger:

$$\text{£275 000} - \text{£90 500} = \text{£184 500}$$

Would the mean still be the most appropriate average to use?

Speed, distance, time

mph means miles per hour
kph or km/h means kilometres per hour



These units are measures of speed – that is, the distance travelled in an hour.

A car going from Paris to Marseille travels at 80 km/h. How far will it travel in 3 hours?

80 km/h means that the car travels 80 km in each hour travelled. So it will travel $3 \times 80 = 240$ kilometres in 3 hours.

Distance = speed \times time

How far will a lorry travelling at 50 mph go in 75 minutes?

It travels 50 miles in 1 hour (60 minutes). 15 minutes = $\frac{1}{4}$ hour. It travels $\frac{1}{4} \times 50 = 12.5$ miles in 15 minutes

So it travels $(50 + 12.5) = 62.5$ miles in 75 minutes.

Average speed

$$\text{Average Speed} = \frac{\text{Total distance}}{\text{Total time taken}}$$

Example

A motorist travels 80 miles at an average speed of 40 miles per hour and spends two hours travelling the remaining 60 miles. What is the total distance? What is the total time? What is the overall average speed?

- a) Total distance = $80 + 60 = 140$ miles
- b) Total time = $\frac{80}{40} + 2$ hours = 4 hours
- c) Overall average speed = $\frac{140 \text{ miles}}{4 \text{ hours}} = 35$ miles per hour

Note: Level 2 questions on averages (and many other aspects of the curriculum) tend to involve a two-stage calculation. If you find yourself answering the question in one stage in the test, you may have jumped to a wrong conclusion about what the question is asking, and it may well be worth taking a closer look to ensure that you are not over-simplifying things.

For example, this is an original question from a Level 2 question:

The average speed for a journey of 300 miles was 50 mph. The average speed for the first 150 miles was 60 mph. What was the average speed for the second 150 miles of the journey?

The answer is 43 mph (to the nearest mile). People often come up with the answer of 55 mph. Where have they gone wrong?

Activity: Mean

- 1 The hourly wages of seven employees are: £5.50, £6.35, £5.10, £7.30, £8.21, £6.40 and £7.20. What is the average hourly wage?
- 2 Five workers earn £130, £145, £145, £150 and £170 a week. What is their mean wage? What must a sixth worker earn if the average wage for the six is to be £5 more?
- 3 A student gains 10, 15, 20, 30 and 40 marks in five different tests.
 - a What is her average mark?
 - b What mark must she get in her next test to improve her average by two marks?
- 4 Two litres of petrol at 75p a litre are mixed with three litres at 80p a litre. Find the price of one litre of the mixture.
- 5 A brass consists of copper and zinc in the ratio 3 : 1. Find the cost of 1 kg of brass if copper costs 92p per kg and zinc costs 80p per kg.
- 6 Three types of wine are mixed in the ratio 5 : 3 : 2. Their prices per litre are £2.00, £4.00 and £6.00 respectively. Find the cost per litre of the mixture.
- 7 The lengths of five bars of steel are given in this table:

Length	Number of bars of steel with this length
250 cm	3
300 cm	1
400 cm	1

Find the mean length of the bars of steel.

- 8 The number of goals scored by a football team in December was 2, 3, 4, 4, 5, and 6. What was the average number of goals scored?

Activity: Mean, median and mode

- 1** The hourly wages of five people are £4.40, £4.20, £4.50, £4.70 and £4.60. What is their average (mean) hourly wage? What is the range of their wages? What is the median wage?
- 2** Eight mechanics earn £180, £196, £196, £196, £202, £205, £221, and £204. What is their mean wage?

What is the range of their wage? What is the modal wage? What is the median wage?
- 3** Five bars of steel have the following lengths: 260 cm, 320 cm, 400 cm, 260 cm, and 310 cm. What is their mean length? What is the modal value?
- 4** The average weight of five packages is 9.6 kg. The average weight of four of them is 10.6 kg. What does the fifth weigh?
- 5** The weights in kg of nine students are: 56, 62, 62, 75, 49, 57, 52, 65, 71. What is their mean weight? What is their median weight? What is the range of their weights? What is the modal weight?
- 6** A shop sells three pairs of boots at size 6, five pairs at size 7, eight pairs at size 8, four pairs at size 9 and one pair at size 11. What is the median shoe size? What is the modal size?
- 7** A shoe shop notes which brand of trainers is being sold one morning:

Lacoste, Puma, Nike, Nike, Reebok, Adidas, Puma, Asics, Nike, Puma, Adidas, Asics, Adidas, Reebok, Adidas, Adidas, Adidas, Reebok, Reebok, Adidas

What is the modal brand of trainers?

Activity: Average speed

- 1 A vehicle travels at 45 mph for four hours. How far does it travel?
- 2 A truck travels from Liverpool to Norwich (220 miles). If it goes at 50 mph for $3\frac{1}{2}$ hours, how much further does it need to travel?
- 3 How far would you travel doing:
 - a) 55 mph for 3 hours?
 - b) 40 mph for 2 hours 15 minutes?
 - c) 60 mph for 1 hour 40 minutes?
 - d) 30 mph for 2 hours 10 minutes?
- 4 A motorist does the first 50 miles of a 90-mile journey at an average speed of 25 mph. In what time must he do the other 40 miles for his average speed to be 30 mph for the whole journey?
- 5 A motorist drives for $3\frac{1}{2}$ hours at an average speed of 50 mph. How far has she travelled? She then travels for $2\frac{1}{2}$ hours at an average speed of 60 mph. What is the total distance she has travelled? What is the total time? What is her average speed?
- 6 A car travels 45 km at an average speed of 30 km/hr and then travels 175 km at 70 km/hr. What is the overall average speed for the journey?
- 7 A truck travels for two hours at 60 mph and then for one hour at 45 mph. What is the average speed for the whole journey?
- 8 A main road through a village has a speed limit of 40 mph. A motorist covers the $2\frac{1}{2}$ miles through the village in three minutes. Did she break the speed limit?

Activity: Sample test questions (averages)

- 1 The table shows the temperatures for various cities for one day in January.

City	Max °C	Min °C
Athens	12	5
London	7	0
Moscow	−10	−16
New York	1	−6
Oslo	−18	−23
Paris	6	−2
Sydney	29	25

Which city had the greatest range of temperatures?

- A Athens
 - B Moscow
 - C Oslo
 - D Paris
- 2 There are 500 runners in a marathon race. Their running times vary. The mean running time is four hours exactly. Which of the following **must** be true?
- A Half of the runners take more than four hours.
 - B The total time taken is 2 000 hours.
 - C Most people take four hours.
 - D Everyone takes four hours.

Questions 3 and 4 are about wages.

A company wants to compare the wages of its male and female employees. A new manager gathers the following data.

Male wages (£ per week)	Female wages (£ per week)
170, 180, 190, 190, 200, 210, 230, 230, 240, 260, 460, 500	160, 180, 190, 210, 210, 220, 230, 240, 310, 340

3 What is the range of female wages?

- A** £180
- B** £210
- C** £229
- D** £230

4 The manager works out that the mean wage for males is £255. How much less than this is the mean wage for females?

- A** £26
- B** £36
- C** £40
- D** £45

Questions 5 and 6 are about the work of a travel agent.

A travel agent produces a summary of sales of holiday types for the first six months of a year.

	Beach holidays	City breaks	Coach tours	Flight only	Total
January	65	47	62	29	203
February	82	48	85	43	258
March	79	37	53	55	224
April	87	59	65	78	289
May	104	30	47	97	278
June	123	19	36	88	266
Total for six months	540	240	348	390	1 518

5 What is the mean monthly sales of city breaks?

- A** 40
- B** 58
- C** 65
- D** 90

6 What is the range of all sales in February?

- A** 39
- B** 42
- C** 58
- D** 125

Questions 7 to 9 are about travelling times to college.

A survey is made of travelling times to college. The results from one group of 20 students are (in minutes):

25 25 30 30 30 50 20 15 10 20
 25 10 30 40 20 30 20 15 20 25

- 7** What percentage of the journeys are **longer** than 30 minutes?
- A** 10
B 20
C 35
D 70
- 8** What is the mean length of time for a journey?
- A** 22.5 minutes
B 23.5 minutes
C 24.5 minutes
D 25.5 minutes
- 9** What is the range of the journey times?
- A** 5 minutes
B 10 minutes
C 20 minutes
D 40 minutes
- 10** A car manufacturer produces an owner's handbook for one of its models. The section on lubricating oil recommends the thickness (viscosity) of oil to use for different temperature ranges.

Viscosity class	Temperature range in °C
SAE 20W-50	-10 to 45
SAE 15W-40	-15 to 40
SAE 15W-50	-15 to 45
SAE 10W-30	-20 to 30

What is the biggest range of temperatures of an oil in the table?

- A** 50 °C
B 55 °C
C 60 °C
D 65 °C

- 11** The weather forecaster on local television is showing viewers this record of air temperatures in the past week.

Day	Temperature (°C)	
	Daytime high	Night time low
Monday	6	4
Tuesday	7	3
Wednesday	6	1
Thursday	9	-2
Friday	4	-2
Saturday	5	-4
Sunday	4	0

How did the range of daytime temperatures compare with the range of night time temperatures?

- A** The range of daytime temperatures was 1 degree greater than the range of night time temperatures.
- B** The ranges of daytime and night time temperatures were the same.
- C** The range of daytime temperatures was 2 degrees less than the range of night time temperatures.
- D** The range of daytime temperatures was 3 degrees less than the range of night time temperatures.
- 12** Here are the lengths of 20 fish in centimetres.

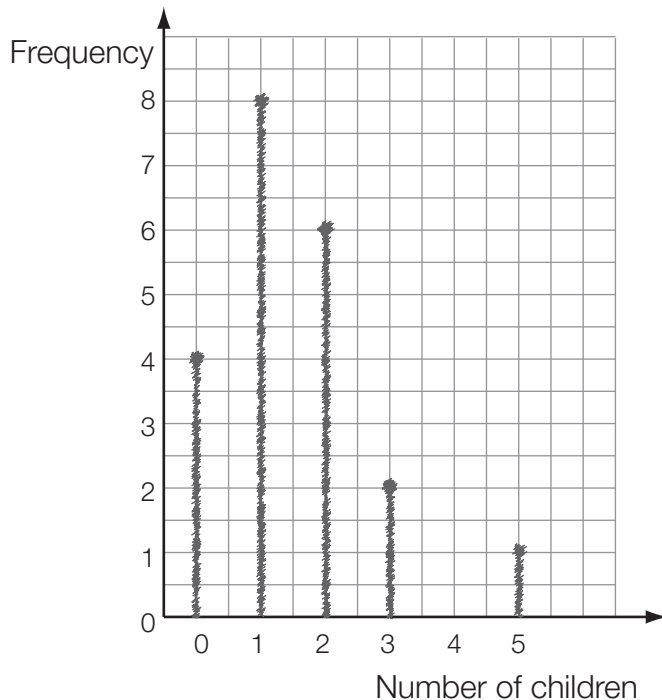
20 15 17 13 19 26 30 14 18 21 10 14 17
13 15 19 28 8 27 4

What is the median length of the fish?

- A** 14 cm
- B** 15.5 cm
- C** 17 cm
- D** 17.5 cm

Questions 13 and 14 are about a market research survey.

A researcher asks a question about the number of children families have. The chart shows her results for one day.

Numbers of children in families

13 How many families had more than 1 but fewer than 5 children?

- A** 8
- B** 16
- C** 17
- D** 21

14 What is the median number of children in the families?

- A** 1
- B** 2
- C** 2.5
- D** 3

Use the information below for questions 15, 16 and 17.

Penny asked a group of 40 people to keep a record of the times they each spent using the Internet in one week. Her results showed that:

- The mean of the times was 2 hrs 15 min.
- The range of the times was 9 hrs 30 min.
- 15% of people asked did not use the Internet in the week.

15 What was the total of the times spent using the Internet during the week?

- A** 40 hours
- B** 49 hours 30 minutes
- C** 76 hours 30minutes
- D** 90 hours

- 16** What was the greatest amount of time spent by one of the 40 people using the Internet during the week?
- A** 2 hours 15 minutes
- B** 7 hours 15 minutes
- C** 9 hours 30 minutes
- D** 11 hours 45 minutes
- 17** The mean time of the people who did use the Internet during the week was approximately
- A** 2 hours 15 minutes
- B** 2 hours 25 minutes
- C** 2 hours 40 minutes
- D** 2 hours 55 minutes

Questions 18 and 19 are about the results of a typing test.

Four typists who are applying for a job are being assessed. Each has to type 10 items and the number of mistakes are counted.

Results of assessment										
Number of mistakes on each item of typing										
Item	1	2	3	4	5	6	7	8	9	10
Alena	2	6	5	2	5	1	6	3	6	5
James	3	1	7	5	1	5	7	2	6	0
Mark	3	7	2	3	9	3	3	2	9	5
Stella	6	6	1	8	3	2	4	6	5	3

- 18** The number of mistakes for James' tenth item was incorrectly recorded as zero. His mean score is 4. What was the correct result for his tenth assessment?
- A** 2
- B** 3
- C** 4
- D** 5

- 19** The assessor wants to know which applicant is the most inconsistent. Which measure would be the most appropriate to use?
- A** mode
 - B** median
 - C** range
 - D** maximum value

Answers

Mean

- 1 £6.58. Add them all up and the total is £46.06. To find the average (mean) divide by seven.
- 2 £148 per week. The total of the five wages is £740, so the mean is this divided by five. If a sixth person pulls the average wage up by £5, then the new mean is £153 and the new total is $£153 \times 6 = £918$. Therefore, we know that the total of the other five workers plus the wage of the sixth worker = £918, so $£740 + £? = £918$. The wage of the sixth worker is $£918 - £740 = £178$
- 3 a) 23 marks
b) To improve her average by 2 marks, i.e. to 25 marks, her total over six tests must be $6 \times 25 = 150$. Her total score over five tests is 115 marks, so she needs to score 35 marks ($150 - 115$) in her next test to increase her average to 25 marks.
- 4 78p per litre. Hint: The total price of the mixture is $2 \text{ litres} \times 75\text{p} + 3 \text{ litres} \times 80\text{p} = £3.90$, so 1 litre must cost £3.90 divided by 5.
- 5 89p per kilo. Hint if you work out $92\text{p} \times 3$ plus $80\text{p} \times 1$, this will give you the total price for four kilos of brass.
- 6 £3.40 per litre. Hint: To find the total price, you need to find 5 litres at £2 per litre, plus 3 litres at £4 per litre plus 2 litres at £6 per litres, and then divide by the total number of litres to find the average price per litre.
- 7 290 cm. Find the total length of all the steel bars $(3 \times 250 \text{ cm}) + 300 \text{ cm} + 400 \text{ cm} = 1450 \text{ cm}$ and then divide this by the numbers of bars (5).
- 8 4 goals.

Mean, median and mode

- 1 Mean: £4.48; Range: 50p; Median: £4.50
- 2 Mean: £200; Range: £41; Mode: £196; Median: £199
- 3 Mean length: 310 cm; Mode: 260 cm
- 4 5.6 kilos
- 5 Mean: 61 kg; Median: 62 kg; Range: 26 kg; Mode: 62 kg
- 6 Median: size 8; Mode: size 8
- 7 Adidas

Average speed

- 1 $45 \times 4 = 180$ miles
- 2 $50 \times 3.5 \text{ hrs} = 175$ miles. $220 \text{ miles} - 175 \text{ miles} = 45$ miles
- 3
 - a) 165 miles
 - b) 90 miles
 - c) $60 \text{ miles} + 40 \text{ miles} = 100$ miles
 - d) $30 + 30 + 5 = 65$ miles
- 4 If the average speed over 90 miles is 30 mph, we know that the journey takes three hours. We know that the first 50 miles was at 25 mph, so it must have taken 2 hours, so the remaining 40 miles must be done within 1 hour.
- 5 She travels at 50 mph, so in $3\frac{1}{2}$ hours, she travels $50 + 50 + 50 + 25$ miles = 175 miles. She then travels at 60 mph for another $2\frac{1}{2}$ hours = $60 + 60 + 30$ miles = 150 miles, so the total distance she has now travelled is 325 miles, in a total time of 6 hours, so her average speed over the whole journey is 325 divided by 6 hours = 54.2 mph.
- 6 Time taken to travel 45 km at 30 km/hr is $1\frac{1}{2}$ hours.
Time taken to travel 175 km at 70 km/hr is $2\frac{1}{2}$ hours.
Total time taken for journey is therefore 4 hours.
Total distance travelled is 220 km, so average speed is therefore 220 km divided by 4 hours = 55 km/hr.
- 7 Total distance travelled is $120 + 45$ miles = 165 miles.
Total time taken is 3 hours, therefore average speed is 165 divided by 3 = 55 mph.
- 8 There are several ways of approaching this problem, as usual. One line of thought may go: 'If she travels 2.5 miles in 3 minutes, this is $\frac{3}{60}$ th of an hour, or $\frac{1}{20}$ th, so in an hour she would travel 20 times as far, or 50 miles, therefore she is travelling at 50 mph and she did break the speed limit.' Alternatively, another approach would be: 'If she has travelled 2.5 miles in 3 minutes then in 6 minutes she would travel 5 miles, and in 60 minutes she would travel 50 miles, therefore her average speed is 50 mph and she has broken the speed limit.' However you solved the problem, her average speed is 50 mph and she has broken the speed limit!

Sample test questions (averages)

1 D

2 B

3 A

4 A

5 A

6 B

7 A

8 C

9 D

10 C

11 D

12 C

13 A

14 A

15 D

16 C

17 C

18 B

19 C

Journal

Module 8: Averages and test preparation

What have you learnt from this module?

How will you apply skills/strategies learnt with learners within your organisation?

