



**MATHEMATICS KEY STAGE 4** 

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### Introduction

### **SUMMARY:**

Use statistics and statistical analysis to investigate the costs of going to university.

### STRUCTURE:

The content is divided into two (approximately) 60 minute lessons.

### **PRESENTATION:**

*Italicised* text are suggested scripts for the teacher to say. There are explanatory notes to aid quick understanding of some of the finance material.

### **GCSE ASSESSMENT OBJECTIVES ADDRESSED IN THE LESSON<sup>1</sup>**

The mathematical content specifications in this presentation are those used in the Mathematics GCSE Subject content and assessment objectives and are identified in red.

- **S2:** interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data and know their appropriate use
- **S4:** interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:
  - appropriate graphical representation involving discrete, continuous and grouped data
  - appropriate measures of central tendency (... mode and modal class) and spread (range, including consideration of outliers)
- **S6:** use and interpret scatter graphs of bivariate data; recognise correlation <u>and know</u> <u>that it does not indicate causation; draw estimated lines of best fit; make predictions;</u> <u>interpolate and extrapolate apparent trends whilst knowing the dangers of so doing</u>

<sup>1</sup> The expectation is that:

• Only the more highly attaining pupils will be assessed on the content identified by **bold** type. The highest attaining pupils.

<sup>•</sup> All pupils will develop confidence and competence with the content identified by standard type

<sup>•</sup> All pupils will be assessed on the content identified by the standard and the <u>underlined</u> type; more highly attaining pupils will develop confidence and competence with all of this content

### **Before lesson 1**

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### HOMEWORK FOR THE PUPILS

The following work to be set before the lesson:

Choose a city in the UK that has a university and try to identify five key factors that influence rentals in the city.

Tip: it might be worthwhile finding out first what general factors determine rent and then see, for the city of your choice, what specific factors determine rent.

### FOR THE TEACHER

- 1. It might be worthwhile providing some guidance to pupils on key phrases to use in a search engine such as: 'What determines rent prices in the UK?'. In Google Chrome, this phrase calls up some interesting sites including a BBC site.
- 2. Review the submitted homework before the lesson and select one or two to discuss in class (detailed in an activity below).



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### **GENERAL NOTES**

The associated powerpoint presentation has supporting script notes to help you. These can best be viewed by clicking 'View/Notes Page' in powerpoint. Items in *italics* are a proposed script for you to say. The content of the lesson plan follows closely the notes contained in the powerpoint.

# Teaching and activities

### CLASS DISCUSSION: INTRODUCE DISCUSSION ON THE HOMEWORK

Ask for volunteers to present or introduce their homework results to the class. (How this is tackled by the teacher will vary depending on how willing the class is to present their ideas). It may be preferable to have group ideas presented or to choose one or two pieces of homework for the teacher to present.



### EXPLANATORY NOTES

A key skill is being resourceful in research. There are websites that are available which detail general factors affecting rents. There are also specific, locational factors that can be found and it is these that should be praised and encouraged.

Asking the pupils to look at general factors first should enable them to place into context the detail they observe when looking at the specific factors for a city.

### **REFERENCE SLIDES**

Chaosing to go to university	2	Homework A You were asked to do the following: Choose a city in the UK that has a university and try to identify five key factors that influence rentals in the city.
<b>part 1</b> INTERPRETING AND REPRESENTING DATA - KEY STAGE 4		<b>Tip:</b> It might be worthwhile finding out first what general factors determine rent and then see, for the city of your choice, what specific factors determine rent.
		Slide 5
omework A et's have a look at some of the answers:		Homework A Here are some factors specific to Leeds:
		<ol> <li>High number of visitors increasing short-term lets and reducing availability of long-term lets</li> </ol>
		<ol> <li>Large number of jobs in sectors that recruit young people (high tech)</li> </ol>
		3. Three universities creating huge student demand
		<ol> <li>Continued development of business and housing creating tenant interest</li> </ol>
		<ol><li>Good commuting networks that, in turn, increase business and employment within the city</li></ol>
	6	



### POINTS FOR THE TEACHER

- Identify and comment on the points raised and raise the question about what level of impact each or some of the factors has. This will act as a good prelude to the material to follow where we try to address some of these 'impact' factors statistically to decide if they are important.
- 2. The Leeds rental market slide indicates what can be done for one city as an illustration to the class. It is indicative only as the factors are likely to vary between cities.
- 3. Go through the slides provided reporting the factors impacting on the Leeds rental market. It might be worthwhile mentioning the additional observations provided in the notes to the slide that detail some further factors:
  - a. Good quality of life, particularly for students
  - b. Excellent external impression that Leeds is a good place to live
  - c. The standing of the University of Leeds is high as one of the leading Russell Group universities
  - d. The demographics of the area are important if there is a high proportion of young people who cannot afford mortgages but can afford rentals

### INTRODUCE THE CLASS TOPIC

Meet Rohan and his family. Rohan is studying for his GCSEs at the local school. Rohan lives with his parents and his sister, Maya, and is discussing which university he should consider applying to so that he can choose his A-level subjects accordingly.

He lives in a part of the country without a university nearby and knows he will have to leave home and move if he gets a place at the list of universities he wishes to apply for.

There is a lot to think about and your mathematical skills can help us be clearer about what information we might use to make some important decisions. Mathematics doesn't provide all the answers to financial problems but it can provide a useful perspective on what can be a complex set of issues.

What we can do together today is to see how realistic financial problems can be thought about in terms of how we interpret and represent data. Let's see how we can apply some of the ideas you have been taught.

### **REFERENCE SLIDE**



Slide 8

Task 1

### **CLASS PROBLEM: INTRODUCE TASK 1**

Present task 1 for the pupils to answer

### **EXPLANATORY NOTES**

The key here is to begin thinking about reasons to go to university that are not financial. Discussion of the financial factors will begin shortly. Be sure to encourage pupils to think about the non-financial factors. The aim here is simply to place financial factors relating to going to university in a broader context and not to over-emphasise the importance of any one factor.

### **REFERENCE SLIDE**

Task 1: why go to university	5
Rohan lives in a part of the country without a university nearby and knows he will have to leave home and move if he gets a place at the universities he wants to apply for.	
Working in pairs, list all the reasons that you can think of that would make you choose to go to university. Think about the reasons such as making new friends. Use the sheet provided.	

**PUPILS ARE ANSWERING TASK 1** 

### **EXPLANATORY NOTES**

Following the pupils' work on task 1, ask the class what they thought the reasons for attending universities were. Then, ask them to prioritise (rank) which are the most important.

This will be an important task to gauge the level and quality of information pupils have about university and what their opinions are. It should naturally then lead to a focus on costs, where mathematical skills can be applied.







### **REFERENCE SLIDE**

Class discussion	
What might be good reasons for attending university?	
• Which reasons might be the most important?	
	10
Slide 10	

## Task 2

### **CLASS PROBLEM: INTRODUCE TASK 2**

The link from the previous slides should show pupils that there is a natural progression to thinking about the detailed, financial factors that may be important. The key here is to begin thinking about the costs of attending university, to set the context for the subsequent mathematics work. Pupil answers should identify the 'big ticket' items.

### **REFERENCE SLIDE**

Task 2: costs of university	
Let's think about the cost aspects for Rohan of attending a university in a town that is different from where he is already living.	
Using the sheet provided, identify what costs Rohan is likely to face when he starts university. Be sure to think of everything that Rohan is going to pay for. Write your answer onto the worksheets provided. Identify at least three or four items under each heading.	
	11



### **EXPLANATORY NOTES**



Emphasise that they may have different answers which are acceptable. Explore in a class discussion which are likely to be the most important items. It might be worthwhile exploring what is meant by 'important': it might be defined as the largest item, or an item that cannot be avoided, or an item that has to be paid first because it is due earliest. Ideally, you should get to a point where you are able to emphasise that there are quite a few factors to take into account. What is important in this session is that the pupils are able to see the range of issues and can offer perspective about which are important, helping to define priorities.

You should then focus on the 'big ticket' items of university fees and rent. Then turn to the rent cost and suggest that this is likely to be the biggest week-by-week cost (university fees are likely to be the largest item but these will be directly financed and don't need budgeting for while at university because they are only repayable once students are in employment).

### **REFERENCE SLIDE**

	Day-to-day costs	University/studying costs
Electricity	Groceries	University fees
Gas	Eating out and socialising	Computer/laptop
Water	Hobbies, sports	Books, pens and writing pads
Council tax	Transport and travel	
Home entertainment	Mobile phone	
Rent and rent/security deposits	Clothes, shoes, accessories	

Slide 12

### **TEACHING: A FOCUS ON RENTING A HOUSE**

Now that we have identified rental costs as a big item, let's have a look at this in a bit more detail.

### EXPLANATORY NOTES

Explain that most new students will probably stay in university accommodation in the first year but that subsequently they will go into the private rental sector. It is probably worth explaining that renting a private sector house involves getting together with friends who each pay a share of the rent and other costs.



The teacher will need to explain why the factors identified influence rental costs:

- If the cost to buy houses is high then rentals will be high. It would be a strange situation if you were able to live in a mansion for £20 per week.
- Houses available for rent are in limited supply and if rental demand is high, as it will be in towns with a high student population, then rents are likely to increase to a high level.

We can also have a look at some data. The data has been adapted and amended from a number of sources but it basically represents a realistic picture.

Note that:

- Housing costs are derived but amended from median purchase costs of terraced houses in 2015 from the Office for National Statistics Cities Data
- 2. Weekly mean rents are data derived but amended from the Royal Bank of Scotland student living index for 2016
- 3. Student population is the proportion of full-time students aged 16-74 from the 2011 census (amended).

The data has been amended in parts for presentational purposes to tell a stronger story from a correlation perspective.

### **REFERENCE SLIDES**

Renting a house	Student rental	costs
Rohan has read an article on a website that says that renting a room in a house is likely to	University	Н
e one of the biggest costs that students face when they attend university for the first	University College London	
	University of Bristol	
Control control upper control. Mileu 2	University of Cardiff	
tental costs vary across the country. Why?	University of Exeter	
	University of Leicester	
A newspaper recently conducted an analysis of student rental costs across key university	University of Newcastle	
owns in England and Wales.	University of Norwich	
	University of Oxford	
The report concluded that two of the key factors that influence student rental costs are:	University of Portsmouth	
<ul> <li>The mean cost to buy houses in the town being rented; and</li> </ul>	University of Reading	
<ul> <li>The number of students in the town as a proportion of the population as a whole.</li> </ul>		
	Mean all data	
13		



Slide 14

### Task 3

Slide 13

### **CLASS PROBLEM: INTRODUCE TASK 3**

Tell the students that the line of best fit for their combination of data should pass through the coordinate for the means. So, for house costs on the horizontal axis, the line of best fit should include the coordinate specified by the mean house cost (£273,888) and the mean rental cost (£107.39). For student proportions on the horizontal axis, the line of best fit should include the coordinate specified by the mean of student proportions (14.58%) and the mean rental cost (£107.39).

### **REFERENCE SLIDE**

Task 3: renting a house	۲Ŀ
IS THE NEWSPAPER ARTICLE CORRECT?	
Split into two groups (A and B) and pair up with a friend.	
Group A pairs • Produce a scatter diagram with house costs on the horizontal axis and rental costs on the vertical axis. • Draw a line of best fit to the data.	Mean data (from the previous table) • House costs: £273,888 • Rental: £107.33
Group B pairs	Student
<ul> <li>Produce a scatter diagram with student population on the horizontal axis and rental costs on the vertical axis.</li> </ul>	proportion of population
<ul> <li>Draw a line of best fit to the data.</li> </ul>	14.58%

Slide 15

### **PUPILS ARE ANSWERING TASK 3**

<b>~</b> —	
✓—	
✓—	

### CLASS PROBLEM SOLUTION: TASK 3: COMMENTS ON THE RESULTING SCATTER PLOTS AND LINES OF BEST FIT

### **Comments for both diagrams**

The first thing to notice is that it appears that both mean house purchase costs and student populations are positively related to rental costs. This is because they have positive correlations. I didn't ask you to calculate these but, if you've drawn your lines of best fit reasonably accurately, then you should be able to see that a positive correlation is reflected in the diagram. This should be apparent because the line of best fit is sloping upward.

### **REFERENCE SLIDES**



### CLASS DISCUSSION: RAISE THE ISSUES IN THE SLIDE





### **EXPLANATORY NOTES**

Note that the discussion should centre around the distinction between causation and association. Data may be associated (eq, have a positive correlation) but not have a relationship that's causal. In this case, it looks to be a causal relationship since we might expect high housing costs and high student populations to put pressure on rental prices and because the correlations are relatively high. But generally, causation should not be confused with correlation. Causation has to be tested using hypotheses, an appropriate methodology, statistical tests and evaluation.

Oxford has concentrations of students in a relatively small town combined with very high housing costs. This may not be representative of the rest of the country and so it might be best to separate out this university and analyse it separately.

It might be right to exclude outliers because a more representative picture of the large body of data is obtained. This seems to be the case because the correlation direction changes from a positive slope to a negative slope when the outlier is excluded, as can be seen from the next slide.

Let's have a look at the weekly rental diagram by student population to see the effect of removing Oxford, a potential outlier.

### Discussion What do you think of the following: 1. Do higher housing costs cause high rentals in this data? 2. Do higher student populations cause high rentals in this data? 3. Are there any outliers in the data that might distort our results? Slide 18

**REFERENCE SLIDE** 



**CLASS DISCUSSION: OUTLIER REMOVED** 

#### **EXPLANATORY NOTE**



By excluding the data point relating to the University of Oxford we see that the correlation has changed dramatically from a positive (upward sloping) figure to one close to zero (implying – but not proving – no relationship between the data).

The outcome is that there is likely to be no relationship between student proportion and rental costs.

The conclusions for Rohan are:

- 1. He should avoid cities with high housing costs
- 2. Student proportions don't appear to matter, except in places like Oxford.

### **REFERENCE SLIDE**





### Task 4

### **CLASS PROBLEM: INTRODUCE TASK 4**

This is an exercise in interpolation and extrapolation. Interpolation is a method of predicting data values within the range of the data provided. Extrapolation is a method of predicting data value outside the range of the data provided. Interpolation is generally more accurate than extrapolation because extrapolation is beyond our current data and hence there may be circumstances which drastically alter the relationships on which the line of best fit is drawn when extending a line beyond a data range. That is to say, extrapolation assumes that the correlation relationship continues beyond the range of the existing data so that the line of best fit can be extended in a reliable manner. This may not be so.



### FOR THE TEACHER TO WORK THROUGH:

#### CLASS PROBLEM SOLUTION: TASK 4: COMMENTS ON BOTH DIAGRAMS

- 1. The interpolated rent appears to be at about £110 per week for a house purchase price of £300,000.
- 2. Note that the line of best fit has to be extended beyond the data: this is extrapolation. Extrapolation assumes the line of best fit, as drawn for the existing data, also applies to the proportion of students beyond the existing maximum data point. The extrapolated rent appears to be at about £130 per week for a proportion of just under 28%.

### **REFERENCE SLIDES**

Rohan is considering two options for university towns that his parents have mentioned:	WEEKLY RENTAL BY HOUSE PRICE – INTERPOLATION
Town X where mean house prices are £300,000. Group A: Using the line of best fit that you have drawn, find out how much rental Rohan might pay in Town X. Town Y where student populations are very high at 28%. Group B: Using the line of best fit that you have drawn, find out how much rental Rohan might pay in Town Y.	Weekly rental by house price
se the scatter diagrams you have drawn, including Oxford.	0 100000 200000 300000 400000 500000 Mean house purchase price (£)
20	Slide 21
Task 4: rental costs	
WEEKLY RENTAL BY STUDENT POPULATION - EXTRAPOLATION	
We add a second day and a second add as	

Slide 22

12 14 16 18 20 22 24 26 28 3

## Homework for lesson 2

We've now got a fairly good understanding of the costs that Rohan is going to have to pay. Let's now see how mathematics can help us understand how Rohan can make some decisions about university.

**Homework:** Ask the pupils to complete the homework. This is included in the Tasks folder to print off if necessary.

The homework refers pupils to a government website which will be up to date. At the time of writing (April 2019), the answer to the homework is up to date. Do please check this when you set the homework.

The website will require the pupils to do some website navigation. This is deliberate since the skill being developed is to require pupils to be determined in finding answers to specific questions. This is more than browsing; pupils need to be targeted in their searches and to understand what they're reading in order to find answers to questions set for them. As it happens, the website is easy to navigate.

### **REFERENCE SLIDE**



Slide 23



### HOMEWORK FOR THE PUPILS: THE FOLLOWING WORK TO BE SET BEFORE THE LESSON:

**Homework:** Ask the pupils to complete the homework. This is included in the Tasks folder to print off if necessary.

The homework refers pupils to a government website which will be up to date. At the time of writing (April 2019), the answer to the homework is up to date. Do please check this when you set the homework.

The website will require the pupils to do some navigation. This is deliberate since the skill being developed is to require pupils to be determined in finding answers to specific questions. This is more than browsing; pupils need to be targeted in their searches and to understand what they're reading in order to find answers to questions set for them. As it happens, the website is easy to navigate.

Tuition fees to attend a university in England or Wales currently cost up to £9,250 in England and £9,000 in Wales. There are arrangements in place to pay back the loan a student takes out.

Have a look at the website below and answer the following questions.

- 1. Do I have to pay back all of the loan?
- 2. When do I have to start paying back the loan?
- 3. How much would my monthly repayments be if I earned £30,000 after graduation?

### **REFERENCE SLIDE**

B	orrowing to finance university education
Tui Eng stu	tion fees to attend a university in England or Wales currently cost up to $\pm 9,250$ in gland and $\pm 9,000$ in Wales. There are arrangements in place to pay back the loan dent takes out.
Ha	ve a look at the website below and answer the following questions.
1.	Do I have to pay back all of the loan?
2.	When do I have to start paying back the loan?
3.	How much would my monthly repayments be if I earned £30,000 after graduation
<u>htt</u>	os://www.gov.uk/repaying-your-student-loan

Lesson 2

**General notes:** The associated powerpoint presentation has supporting script notes to help you. These can best be viewed by clicking 'View/Notes Page' in powerpoint. Items in italics are a proposed script for you to say. The content of the lesson plan follows closely the notes contained in the powerpoint.

# Teaching activities



### CLASS DISCUSSION: INTRODUCE DISCUSSION ON THE HOMEWORK

Ask for volunteers to say or present their homework results to the class. (How this is tackled by the teacher will vary depending on how willing the class is to present their ideas). It may be preferable to have group ideas presented or to choose one or two pieces of homework for the teacher to present.



### **EXPLANATORY NOTE**

At the time of writing, the information from the website is correct. A good alternative website is the Money Advice Service website at:

https://www.moneyadviceservice.org.uk/en/articles/repaying-student-loans

### **REFERENCE SLIDE**



#### Slide 23

#### HOMEWORK

Tuition fees to attend a university in England or Wales currently cost up to £9,250 in England and £9,000 in Wales. There are arrangements in place to pay back the loan a student takes out.

Have a look at the website below and answer the following questions.

- 1. Do I have to pay back all of the loan?
- 2. When do I have to start paying back the loan?
- 3. How much would my monthly repayments be if I earned £30,000 after graduation?

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### EXPLANATORY NOTE

Student loans for tuition fees are known as 'income-contingent loans': the amount paid back is referenced to the income level of the former student. It is possible that the amount borrowed may never be paid back because the former student might not have earned enough before the 30-year deadline is reached, at which point the loan is written off. However, the website makes clear that the loan has to be repaid, which appears contradictory. Loans are written off if they are not paid back by 30 years after 1 April following graduation (which is the time the first repayments are due - see below).

All of your tuition fee loans will be under the rules for Plan 2 (for those starting university after 1 September 2012). The first repayment will either be:

- April after the course finishes for full-time students; or
- April four years after the course started, for part-time students.

The website gives a specific example for Plan 2 repayments if  $\pm 30,000$  is earned after graduation. The rule for Plan 2 is that 9% of income over  $\pm 25,000$  is repaid. This would amount to, for an income of  $\pm 30,000$ :

 $[(30,000 - 25,000) \times 0.09]/12 = £37.53$  or £37 as described on the website.

### **REFERENCE SLIDES**

Homework B Answers 1. Do I have to pay back all of the Ioan? The short answer is 'yes' but the amount of repayment depends on what you earn after graduation. That means the actual repayment is based on the outstanding Ioan but will not be more than a certain percentage of your income. These are known as 'income contingent Ioans'.	Homework B         Answers         2. When do I have to start paying back the loan?         All of your tuition fee loans will be under the rules for Plan 2 (for those starting university after 1 September 2012). The first repayment will either be:         • April after the course finishes for full-time students; or         • April four years after the course started, for part-time students.
26	27
Slide 26	Slide 27
Homework B         Answers         Image: Construction of the state of the sta	
Slide 28	

### **RECAP ON WHAT HAS ALREADY BEEN DONE**

IF NEEDED, RECAP THIS FROM THE PREVIOUS SESSION: Meet Rohan and his family. Rohan is studying for his GCSEs at the local school. Rohan lives with his parents and his sister, Maya, and is discussing which university he should consider applying to.

He lives in a part of the country without a university nearby and knows he will have to leave home and move if he gets a place at the list of universities he wishes to apply for.

We've now got a fairly good understanding of the costs that Rohan is going to have to pay. Let's now have a look to see how mathematics can help us with understanding how Rohan can make some decisions about university.

### **REFERENCE SLIDES**



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#### What we've already done

We've looked at how we can help Rohan understand what costs he is likely to face when attending university. In particular, we made sure that Rohan understood how rents varied across the country at the universities he was likely to apply to.

In mathematics, we have learned:

- how to apply scatter diagrams to the rental cost data we had;
  what lines of best fit were appropriate to the data;
- to deal with outliers and what impact they had on our understanding of rent costs; and to interpolate and extrapolate with additional data.

Slide 30

### INTRODUCE AND MOTIVATE THE NEXT TASK

The press frequently draw attention to the importance of carefully choosing your degree subject. There are many factors that will influence subject choice and one key factor will be the career you are hoping to develop.

Students looking at jobs after university will also look at what they may be expected to earn. The following table shows some indicative salaries for various jobs and what the student loan repayment would be for the salary indicated.

**Note: monthly repayment calculation.** The earnings threshold is currently (2018) £25,000 per year (or £2,083 per month) and 9% is paid on the excess over the threshold. For example, if you are paid monthly and earn £2,500 before tax per month you would repay 9% of the difference between what you earn and what the threshold is: £2,500 - £2,083 = £417, 9% of £417 = £37.53. So your student loan repayment would be £37.53 a month (in fact, the amounts are rounded down so the actual payment would be £37).

### **REFERENCE SLIDES**



Slide 31



### **CLASS PROBLEM: INTRODUCE TASK 5**

Look at the questions and work through the tasks in the Task 5 worksheet. What we're trying to do is to see what mathematics can say about the data in the worksheet to help Rohan. Work in your pairs and come up with some answers. We'll discuss what you've found in a minute.

#### **REFERENCE SLIDES**





### **PUPILS ARE ANSWERING TASK 5**

The answer to the problem is ... (go through the slide)

First, here are the answers to the calculations. We'll next see how to interpret them to help answer the questions.

The detailed answers are as follows:

- 1. The loan repayments are higher in actuarial work and information technology because expected salaries are higher. It is not because these courses cost more. Remember that loan repayments are based on earnings not on the amount loaned.
- 2. Whichever subject Rohan chooses should not be based on the loan repayment level. The fact that retail management looks 'low cost' is because salary expectations are low.
- 3. The mode is different because it only considers the highest frequency amount appearing in the data. It does not consider what value the data is. In this instance, the mode just happens to be at a relatively low value of starting salary and loan repayments. The mean and the median take account of the value of the data (effectively, how 'big' or 'small' the number is) and hence will be calculated at approximately the 'centre' of the values.
- 4. The range of the monthly repayments is £31.88. It is large in relation to the mean and the median, and is certainly large in relation to the mode. It tells Rohan that the loan repayments vary a great deal. Since the loan repayments are based on salaries this also means that salaries vary a great deal.
- 5. Rohan should bring into consideration many other important factors when choosing a degree subject. Expected salary is one but others would be choosing a subject which interests him or for which he has the right aptitude.

### **REFERENCE SLIDES**

N	, MODE AN	D RANGE		<ol> <li>Why are the loan repayments higher for subjects like actuarial work and information tasksalars?</li> </ol>
		Starting salary (£)	Monthly repayment (£)	technology / 2. Would it be better if Rohan chose a low loan repayment course such as retail management?
	Mean	26,650	12.38	3. The mean and the median of the salaries should be close together in your calculations, but the mode is lower. Why is the mode different?
	Median	26,500	11.25	
P	Node	25,250	1.88	4. What message is your value of the range of monthly loan repayments giving to Rohan?
	Range	4,000	30	5. What course would you advise Rohan to do? Why?
ī: n	hich deg	ree		Slide 36
5: W ers	P <b>hich deg</b> ayments are high aries are higher ents are based o	<b>FEE</b> her in actuarial worl It is not because th n earnings not on th	k and information tech	at Slide 36 Task 5: which degree Answers 3. The mode is different because it only considers the highest frequency amount appearing in the data. It does not consider what value the data is. In this instance, the mode just happens to be at a relatively low
n repaids all n repaids all observed sall observed sall d sall sall sall sall sall sall sall sall	which deg ayments are high aries are higher. ents are based o ubject Rohan chc il management lo	FEE her in actuarial worf It is not because th n earnings not on th poses should not bu poses should not bu	k and information tech ese courses cost mor e amount loanse based on the loan rr cause salary expecta	Intel     Slide 36       Intel     Task 5: which degree Answers       Intel     . The mode is different because it only considers the highest frequency amount appearing in the data. It does not consider what value the data is. In this instance, the mode just happens to be at a relatively jow value of starting astary and io an resymmetry. The mean and the media nue account of the value of the data (effectively, how 'big' or 'small' the number is) and hence will be calculated at approximately the 'centre' of the values.
n repa d sala bayme ver su ver su	Phich deg ayments are high aries are higher, ents are based o ubject Rohan chc il management lo	FEE It is not because th n earnings not on th poses should not be poses should not be	k and information tech ese courses cost mon he amount loaned. s based on the loan re cause salary expecta	state       Slide 36         Interpretation of the state

### Task 6

### **CLASS PROBLEM: INTRODUCE TASK 6**

The task involves filling in the table in the task with the frequencies of salaries over a number of class intervals. A frequency polygon is chosen but there are other ways of representing the data graphically.

Go through the detail of the tasks required.

### **REFERENCE SLIDES**

Task 6: presentation		Task 6: presentation		
Rohan has been asked by his maths teacher to present some of his work to the whole class so		CLASS INTERVALS TO USE		
that his friends could also understand what it co	ists to go to university.	Salary range	Frequency	
Specifically, in your pairs:				
4. From the station entropy data associate the	for more stable union the following stars	£25,000 ≤ x <£2	16,000	
<ol> <li>From the starting salaries data, complete tr intervals (next slide)</li> </ol>	le frequency table using the following class	£26,000 ≤ x <£2	27,000	
		£27,000 ≤ x <£2	8,000	
<ol><li>Draw a frequency polygon of your results</li></ol>		£28,000 ≤ x <£2	9,000	
3. What do the frequency intervals tell us about	ut starting salaries between degree subjects?	£29,000 ≤ x <£3	0,000	
	39			40
Slide 39		Slide 40		

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<b>~</b> -	- 1
<ul> <li>—</li> </ul>	- 1
<ul> <li>—</li> </ul>	- 1
	_

### **PUPILS ARE ANSWERING TASK 6**

The answer to the problem for the frequency results is ... (go through the slide)

The frequency table tells us that the most popular salary ranges are £25,000 to £26,000 and £27,000 to £28,000.

### **REFERENCE SLIDE**

Task 6: presentation				
FREQUENCY RESULTS				
Salary ra	inge	Frequency		
£25,000 :	≤ x <£26,000	3		
£26,000 :	≤ x <£27,000	2		
£27,000 :	≤ x <£28,000	3		
£28,000 :	≤ x <£29,000	1		
£29,000 :	≤ x <£30,000	1		
		10		

Slide 41

The frequency polygon has the following shape.

The diagram presents a visual version of the data in the previous slide and should show the same information as the data but in a manner that allows comparison between salary ranges to be made more quickly. This would depend if you prefer the information to be displayed visually!

### **REFERENCE SLIDE**



Slide 42

### **CLASS DISCUSSION**

What do the frequency intervals tell us about the difference in starting salaries between degree subjects?

This is essentially an interpretation of the results. The obvious points to make, from the available data, is that new graduates starting in the jobs indicated in the data are most likely to start on salaries in the range £25,000 - £27,000. Few start higher than that.

The following slides are really discussion points about aspects of debt (loans) that pupils might like to think about.

So, we've had a detailed look at the data to help Rohan. Let's now look at some of the background factors that might add some further information for Rohan.

Explain that debt is just another term for a loan.

Position this section and the subsequent slide as final considerations that might help Rohan to decide to go to university.

The final slide raises the issue of attitude towards money. This is important and forms part of much of the education about handling money.

### **REFERENCE SLIDES**

There is a difference between debts that help and debts that hinder	Debts that help
<ul> <li>Helpful debt</li> <li>1 There should be a specific reason for taking out a loan.</li> <li>3 Brould make you more affluent in the long term.</li> <li>3 Us should have a sensible plan for repayment.</li> <li>Texple of helpful debt which shows how taking on debt could make you wealthier in the long term.</li> <li>S Used to the statistic s</li></ul>	<ul> <li>Mortgage</li> <li>Enables you to buy a house to live in.</li> <li>When the mortgage is paid off, the house will be owned by you.</li> <li>Monthly mortgage payments could be cheaper than rent.</li> <li>Investing in your own business</li> <li>You will need to have a carefully thought through business plan.</li> <li>If your business is successful it could end up being worth much more than the original loan.</li> </ul>
le 43	Slide 44
Debts that hinder	Final messages
Risky long-term outlay for short-term gain  Oranin your wealth.  Offer on our crossent of the lan 'rassing for itself' in the future.	<ul> <li>Understanding finance and understanding mathematics go well together because mathematics can help with making financial decisions.</li> </ul>
end ne roa prospect of ale team paying to hear in the tate of	
Examples of bad debt which demonstrate risk for a quick-fix gain A car you don't need I a car isn't essential then don't buy one.	<ul> <li>Not all financial decisions depend on understanding mathematics because, for example, your attitude towards money will play an important role.</li> </ul>
Examples of bad debt which demonstrate risk for a quick-fix gain A car you don't need I a car inst essential then don't buy one. Borrowing money to pay bills • You are likely only to increase your debt because these bills should really only be paid out of ongoing income.	<ul> <li>Not all financial decisions depend on understanding mathematics because, for example, your attitude towards money will play an important role.</li> </ul>

Slide 46

Slide 45

### Resources

- 1. LESSON PLAN (THIS DOCUMENT)
- 2. POWERPOINT
- 3. TASK HANDOUTS
- 4. SPREADSHEET

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