

Linear Graphs

MATHEMATICS KEY STAGE 4

Introduction

SUMMARY:

Use linear graphs to help understand the relationships between working and wages.

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 LESSON¹

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

- A8:** work with coordinates in all four quadrants
- A9:** plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form $y = mx + c$ to identify parallel and perpendicular lines; find the equation of the line through two given points, or through one point with a given gradient
- A10:** identify and interpret gradients and intercepts of linear functions graphically and algebraically
- A12:** recognise, sketch and interpret graphs of linear functions, quadratic functions ...
- A14:** plot and interpret graphs (including reciprocal graphs and exponential graphs) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration
- A15:** calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts

¹ From government specification content where:

- All pupils will develop confidence and competence with the content identified by standard type
- All pupils will be assessed on the content identified by the standard and the underlined type; more highly attaining pupils will develop confidence and competence with all of this content
- Only the more highly attaining pupils will be assessed on the content identified by **bold** type. The highest attaining students will develop confidence and competence with the **bold** content.

Before lesson 1

HOMework FOR THE PUPILS



Have a look at the following website which is from the Office for National Statistics:

<https://visual.ons.gov.uk/the-gender-pay-gap-what-is-it-and-what-affects-it/>

From the graphs on the page, answer the following questions:

1. What is the gender pay gap for full-time workers in 2016? Who is it in favour of, men or women?
2. What is the gender pay gap for part-time workers in 2016? Who is it in favour of, men or women?

Have a look at the graph on the website search for the section entitled 'Percentage of male and female employees in different occupational groups, UK, April to June 2016'

3. Which occupation has the largest difference, with more females being employed in it compared to males?
4. Does the occupation you identified have any explanation to offer for the gender pay gap?

FOR THE TEACHER

The two sets of homework - this is the first - will draw attention to websites from the Office for National Statistics (ONS) and, specifically, to their diagrammatic presentation of various investigations relating to pay in the UK. The essential idea is to get pupils used to reading and interpreting diagrams along with using and developing them in the following lessons. The first homework should be set a few days before the lesson begins. Clearly, it is assumed that the pupils have access to the internet either at home or at school.

The questions may look challenging but the answers are obvious once the diagrams are studied.

Lesson time



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 being developed is in using financial websites confidently and in discovering that there is useful information and web content available.



HOMEWORK FOR THE PUPILS

the following work to be set before the lesson:

Have a look at the following website which is from the Office for National Statistics:

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1. What is the gender pay gap for full-time workers in 2016? Who is it in favour of, men or women?
2. What is the gender pay gap for part-time workers in 2016? Who is it in favour of, men or women?

Have a look at the graph on the website and search for the section titled 'Percentage of male and female employees in different occupational groups, UK, April to June 2016'

3. Which occupation has the largest difference of more females being employed in it compared to males?
4. Does the occupation you identified have any explanation to offer for the gender pay gap?

POINTS FOR THE TEACHER TO WATCH OUT FOR

If possible, it would be helpful if the teacher shows the website during class to point out the answers to the homework. The last question is a discussion question: the website does not really offer clear links and that will be a teaching point about how far we can stretch the interpretation of diagrams presented to us.

Read through the slides and make sure that pupils understand how the different presentations reveal information i) over time and ii) between groups. Be sure to point out that the presentation should be chosen carefully to be informative.

REFERENCE SLIDES

Homework A, part 1

Have a look at the following website which is from the Office for National Statistics:
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From the graphs on the page, answer the following questions:

1. What is the gender pay gap for full-time workers in 2016? Who is it in favour of, men or women?
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Slide 4

Homework A, part 2

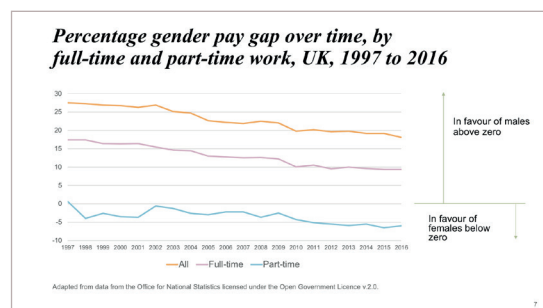
Have a look at the graph on the website and search for the section entitled 'Percentage of male and female employees in different occupational groups, UK, April to June 2016'

3. Which occupation has the largest difference, with more females being employed in it compared to males?
4. Does the occupation you identified have any explanation to offer for the gender pay gap?

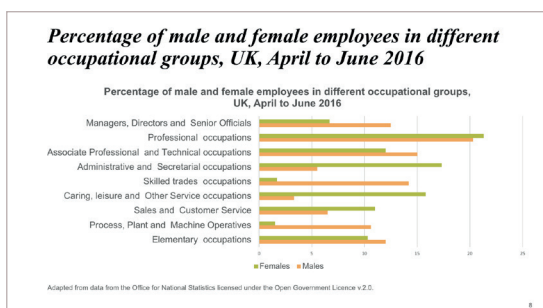
Slide 5

Homework A
Let's see the graphs

Slide 6



Slide 7



Slide 8

Homework A
Answers

1. Approximately 9% in favour of men.
2. Approximately 6% in favour of women.
3. The largest gap in favour of females appears to be 'Caring, leisure and Other Service occupations' at about 13%, although the other occupational group 'Administrative and Secretarial occupations' appears to be about 11%-12%.
4. Discussion: does the occupation you identified explain the gender pay gap?

Slide 9

INTRODUCE THE CLASS TOPIC: LINEAR GRAPHS (WAGES AND WORKING)

The growth of jobs which are temporary, not fixed, and paid in relation to achievement (eg, number of deliveries made) has grown dramatically in recent years. It has altered how we think about working.

The growth of 'alternative' work is impacting on young people most and it is important to understand how earnings can vary with the different types of payment for work. Not all earnings are from 'employed' wages, as we will see.

There is a lot to think about and your mathematical skills can help us understand better how earnings vary with payment methods. In this lesson, we are going to use some graphical analysis to help.

REFERENCE SLIDE

Working – wages, salaries, bonuses and more!

1. Jordan, Mollie and Niamh are looking for their first jobs. They have all left school and are searching for summer work to fill the time before they all depart to some work abroad in October.
2. We are going to use linear graphs to understand some of the relationships between work and payment. But first, let's see how working and payment might work.

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Slide 10

OPTIONAL SLIDES

Some of the following slides are optional depending on how deep you wish to go into the subject of different pay types. The shorter version focuses on pay types that young people are most likely to come across and which form the basis of this lesson.

Read through the slides

The basic graphical relationship between the payment base and earnings should slope upwards. That is, as more hours are worked, for example, we would expect earnings to increase.

The details of how the line looks will vary depending on the detail of the relationship between the payment base in the rate of pay. Let's look at some of that detail.

The first payment method is hours worked. This can be in relation to an agreed, set number of hours for each week or there can be no hours guaranteed.

Your courier delivery driver or pizza delivery person is almost certainly on a piecework rate. Often such schemes generate low earnings although they don't have to.

Salaries are probably widely used. They are often used where the output from a job is hard to measure. The example shown is teachers. Other hard-to-measure jobs would be nurses, police officers and doctors.

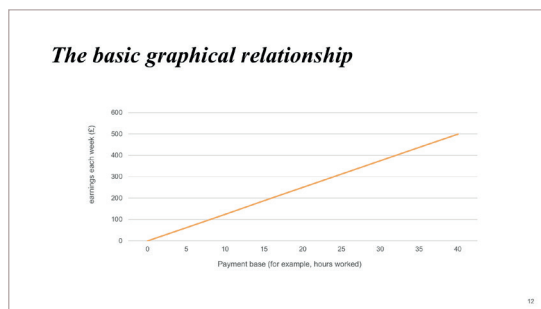
REFERENCE SLIDES

Payment bases and payments

1. There are different ways that 'wages' may be earned. The payment base will depend on the job you are in.
2. Examples of payment bases are time, the amount produced, and profits.
3. Examples of payments are wages, salaries, commission, bonuses, and profit shares.

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Slide 11



Slide 12

REFERENCE SLIDE (CONT)

Payment bases and payment in practice: time in the workplace (paid by the hour)

Time in the workplace. The payment base is 'time' and can be paid as different rates:

- Basic
- Overtime

Example: Jo has agreed to work 35 hours each week where she is paid a basic rate of pay of £7.50 per hour. Any hours over that are paid at an overtime rate at £10 per hour. Jo works 40 hours one week and will be paid:
 $35 \times £7.50 + 5 \times £10 = £312.50$.

However, if Jo only works eight hours she will only be paid:
 $8 \times £7.50 = £60$.

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Slide 13

Productivity or piecework

- Productivity is measured by job activity and can be measured by how much a person produces, delivers, etc. This is often referred to as a piece rate. Let's see how the payment base can affect earnings.
- Suppose that £0.50 is paid by the pizza company for each delivery made. Assume, on average, that a tip of £1 is received for each delivery. On this basis, it might be expected that £1.50 is earned for each delivery. How much might be earned for a 40-hour week when five deliveries are made each hour? The answer is as follows:
 $£1.50 \times 40 \times 5 \text{ deliveries} = £300$.

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Slide 14

Salary

- Salary: This is, typically, a monthly amount. It might not be related to a specific base but there will be an expectation that work-based tasks are fulfilled. Salaries are often used when the outcome of tasks is hard to measure.
- Example: salaries vary a great deal depending on the job you do. The starting salary for a newly qualified teacher will be at least £22,467, or £28,098 in inner London.
<https://getintoeducation.gov.uk/funding-and-salary/teacher-salaries>

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Slide 15

THE FOLLOWING ARE OPTIONAL SLIDES THAT SHOW FURTHER, ALTERNATIVE WAYS OF EARNING MONEY IN WORK

Commission-based work is often an entry-level employment for those developing careers in sales and/or marketing. It is a way of incentivising individuals to meet sales targets. There are some jobs which are commission-only. Would you want a job like that?

The underlying principles in terms of how pay is calculated for bonuses and performance-related pay is essentially the same as commission. The difference is that under commission, the payment base is sales whereas under bonuses or performance-related pay it will be another base, almost certainly production related.

Profit shares are usually thought of in terms of executive power. However, the John Lewis stores group has famously had a profit share arrangement for many years where all employees take part.

REFERENCE SLIDES

Commission

- How much a person sells. This is called 'commission' and it is paid in relation to sales. Commission is often paid on top of a basic salary. The payment base is sales. This can be calculated in a number of ways; for example, as an amount per unit sold or as a proportion of sales.
- Example: a person selling confectionery to local shops may earn a basic salary of £15,000 a year. In addition, they may be paid an additional 2% of the value of the sales made. A person selling £25,000 of confectionery a year would then have earnings of:

$$£15,000 + (2/100) \times £25,000 = £15,500.$$

Slide 16

Bonuses and performance-related pay

- Here, wages vary directly with a defined work-based criterion. The payment base is a pre-set performance criterion and is paid on top of a basic salary. It can be used to motivate staff to work harder.
- Example: a production worker has a basic salary of £25,000 and is paid a performance-related bonus if she produces 8,000 metal castings a month. The bonus is £100 for each month she meets her target. If her production target is met in 8 months out of 12 then her annual earnings would be:

$$£25,000 + 8 \times £100 = £25,800.$$

Slide 17

Profit share

- This is like performance-related pay but it is not based on a specific criterion that can be specifically related to the individual. It reflects a general, team-based reward for working profitably. John Lewis department store has a well-known profit share scheme in which all staff take part.
- Example: a senior executive may have a salary of £50,000 and be paid an additional 0.5% of the profits earned by the business she works for. If the business makes a profit of £1.2m then her earnings for the year would be:

$$£50,000 + (0.5/100) \times £1,200,000 = £56,000.$$

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Task 1

CLASS PROBLEM: INTRODUCE TASK 1

Present task 1 for the pupils to answer

The purpose of this task is to get pupils to think about the implications of choosing one payment method over another. Of course, when the time comes they may not have a choice but the implications of the differences between them should be drawn out. There may be others in addition to those identified in the answers.

Have a go at this task. Think about what work entails which payment method and try to think about the benefits of payment methods and also some of the risks. For example, it is often risky to choose a job where earnings are not guaranteed because that means it is possible you may not get the earnings you need in order to pay the bills you have to.

REFERENCE SLIDE

Task 1: payment methods

If you had a choice when starting a job, which payment method would you prefer and why? Identify the benefits and risks of your chosen method.

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Slide 19



PUPILS ARE ANSWERING TASK 1



EXPLANATORY NOTES

The slide is self explanatory and it may be useful to add further illustrations of the example payment methods and their benefits and risks.

REFERENCE SLIDE

Task 1: payment methods:

SOME ANSWERS

Payment method	Benefit	Risks
Time in the workplace	It is certain how much you will earn per hour	Not certain how many hours will be worked
Piece rate	You decide how much you earn by how hard you work	The pay may be small and it may not be possible to earn a living wage however hard you work
Salary	Certain level of earnings each month	Not related to how hard you work and so you may not be paid for your contribution to the organisation

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Slide 21



EXPLANATORY NOTES

(THIS IS AN ALTERNATE TO THE PREVIOUS SLIDE WHICH OFFERS A WIDER RANGE OF PAYMENT METHODS TO CONSIDER) The slide is self explanatory and it may be useful to add further illustrations of the example payment methods and their benefits and risks

REFERENCE SLIDES

Task 1: payment methods, part a:

SOME ANSWERS

Payment method	Benefit	Risks
Time in the workplace	It is certain how much you will earn per hour	Not certain how many hours will be worked
Piece rate	You decide how much you earn by how hard you work	The pay may be small and it may not be possible to earn a living wage however hard you work
Commission	You decide how much you earn by how successful you are against a sales target	Earnings can vary widely if success is not consistent

Slide 22

Task 1: payment methods, part b:

SOME ANSWERS

Payment method	Benefit	Risks
Performance-related pay	You decide how much you earn by how successful you are against a target set by your boss	Earnings can vary widely if the target is not met
Salary	Certain level of earnings each month	Not related to how hard you work and so you may not be paid for your contribution to the organisation
Profit share	Employees can benefit from profits of the business they helped to achieve	Profits may not be consistent and earnings may be variable

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INTRODUCTORY TEACHING

The scene involves analysing the payment methods of two jobs. The difference between them is that Job 1 offers a basic salary. Both jobs provide hourly rates of pay. The hourly rate is provided to indicate that there would be a variable level of earnings depending on how many hours are worked. However, while Job 1 has a minimum earnings level of £57.50, Job 2 has a minimum of £zero. There is no safety net with Job 2.

REFERENCE SLIDE

Looking for work

Jordan, Mollie and Niamh are looking for their first jobs. They have all left school and are searching for summer work to fill some time before they all leave to work abroad in October.

Jordan, Mollie and Niamh are trying to understand how the payment methods work for the jobs they are looking at. They have found two jobs available in local restaurants:

- **Job 1** Job 1 pays a basic weekly wage of £200.00 for staff working up to 25 hrs per week. For any hours staff work over the 25 contracted, it will pay overtime at a rate of £8.50 per hour.
- **Job 2** does not guarantee any hours of work and has no basic wage. It will pay an hourly rate of £12.50 depending on how many hours are needed by the restaurant.

Both jobs set the maximum hours at 40.

Slide 24

Task 2

CLASS PROBLEM: INTRODUCE TASK 2

There are quite a few tasks in task 2 although, in reality, the steps have been broken down so that there should be a clear sense of direction for pupils.

It is left up to the teacher to indicate if the pupils should pause after completing a set number of tasks before proceeding with the final set. The following dialogue reflects this:

Option 1

Have a go at these tasks. Work in your pairs. Use the graph paper provided.

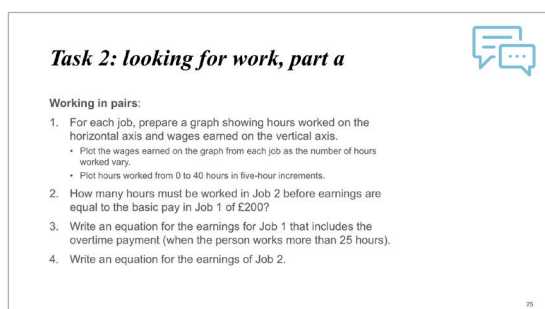
Option 2

Have a go at questions 1 and 2 and we will then look at the answers. Work in your pairs. Use the graph paper provided.

Now have a go at questions 3 to 8 and then we will look at the answers.

Now have a go at question 9. In question 9 think broadly about the non-financial factors that might influence which job you would prefer.

REFERENCE SLIDES

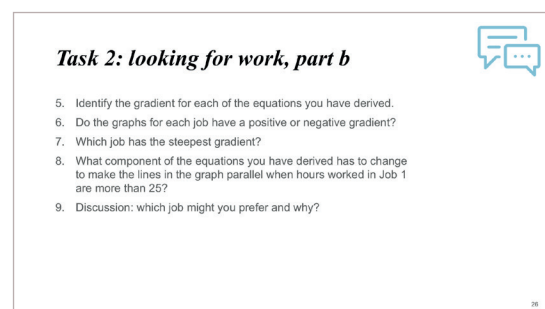


Task 2: looking for work, part a

Working in pairs:

- For each job, prepare a graph showing hours worked on the horizontal axis and wages earned on the vertical axis.
 - Plot the wages earned on the graph from each job as the number of hours worked vary.
 - Plot hours worked from 0 to 40 hours in five-hour increments.
- How many hours must be worked in Job 2 before earnings are equal to the basic pay in Job 1 of £200?
- Write an equation for the earnings for Job 1 that includes the overtime payment (when the person works more than 25 hours).
- Write an equation for the earnings of Job 2.

Slide 25



Task 2: looking for work, part b

- Identify the gradient for each of the equations you have derived.
- Do the graphs for each job have a positive or negative gradient?
- Which job has the steepest gradient?
- What component of the equations you have derived has to change to make the lines in the graph parallel when hours worked in Job 1 are more than 25?
- Discussion: which job might you prefer and why?

Slide 26



PUPILS ARE ANSWERING TASK 2



EXPLANATORY NOTES

This should be straightforward for pupils to complete. Note that they may have different scales on the axes.

Note also that the line for Job 1 in the range 0-25 hours should not be interpreted that a person could work less than 25 hours and still be paid the same amount. It simply records the fact that wages are the same over the 0-25 hour range and that the related line is flat over that range. It starts increasing after 25 hours have been worked.

The diagrams are fully explanatory. Please teach from them.

REFERENCE SLIDES



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Task 2: looking for work

ANSWERS TO QUESTIONS 2 TO 4

2. Reading from the graph, 16 hours would need to be worked before Job 2 has earnings equal to Job 1. This could be worked out exactly as $£200/12.5 = 16$ hours.

3. Equation for Job 1, including the overtime payment will be:
 $y = 200 + 8.5(x - 25)$ for $x > 25$.

4. Equation for Job 2: $y = 12.5x$

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Task 2: looking for work

ANSWERS TO QUESTIONS 5 TO 8

5. The gradient for the equation for Job 1 is 8.5. The gradient for the equation for Job 2 is 12.5.

6. Both graphs have a positive gradient.

7. Job 2 has the steepest gradient because the value is bigger ($12.5 > 8.5$).

8. The gradients have to have the same value in order for them to be parallel.

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Task 2: looking for work

ANSWERS

9. Discussion: which job might you prefer and why?

The following issues might be raised:

- Job 1 allows a level of certainty in earnings.
- Job 2 allows more money to be earned as long as you are prepared to work long hours.
- There is a risk with Job 2 that not enough hours may be worked. It is unclear how many hours of work would be available.

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Slide 30

Task 2: looking for work

ANSWERS

9. Discussion: which job might you prefer and why?

The terms and conditions of the jobs need to be compared. The comparison is not only about earnings as other factors should be taken into account such as:

- What are the working conditions like?
- Are the work colleagues friendly?
- What time of the day is the work scheduled for? Does the working day end very late, for example?

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Slide 31

TEACHING: MINIMUM WAGES

This slide is for information only. It would be interesting to see if it causes any discussion about the level of pay that some people earn.

REFERENCE SLIDE

Minimum wages

The minimum wage depends on how old you are. The following are the rates per hour from April 2016:

Under 18	18-20	21-24	25 and over
£4.20	£5.90	£7.38	£7.83

For a 35-hour week, a 22 year old would expect to earn no less than £258.30.

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Homework for lesson 2

We've now got a fairly good understanding of how earnings are related to what we do in our job and the base - payment base - on which wages are calculated. Let's have a look at some homework using graphs on some real data.

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

Have a look at the website:

<https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/lowpay/apr2016#low-pay-by-occupation>

The website is from the Office for National Statistics and you should have found item 6 'Low pay by occupation'. Answer the following questions:

1. Which occupation has the highest proportion of people earning below the minimum wage?
2. Why do you think this occupation pays such a large proportion of individuals below the minimum wage?

REFERENCE SLIDES

Homework B

Have a look at the website:
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1. Which occupation has the highest proportion of people earning below the minimum wage?
2. Why do you think this occupation pays such a large proportion of individuals below the minimum wage?

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Wages and working, part 2

LINEAR GRAPHS – KEY STAGE 4

Slide 34

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.



HOMEWORK

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1. Which occupation has the highest proportion of people earning below the minimum wage?
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EXPLANATORY NOTE

The slides contain basic information. Some explanation might be needed on 'Elementary occupations'.

An 'Elementary' occupation is:

One which 'will usually require a minimum general level of education (ie, that which is acquired by the end of the period of compulsory education). Some occupations at this level will also have short periods of work-related training in areas such as health and safety, food hygiene, and customer service requirements.'

ONS Standard Occupational Classification 2010 volume 1 Structure and description of unit groups.

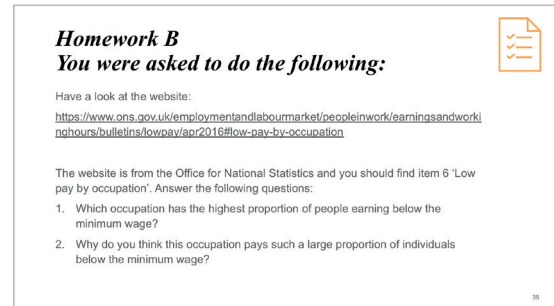
The answer to Question 2 might act as discussion point. The key point is for pupils to undertake comparisons, using the graph of other groups paying below the minimum wage. For example, there are few below-minimum wage earners in professional occupations.

The answer provided is likely to be true but there will also certainly be other factors. It might be worthwhile asking the class to identify what might be other factors that perhaps force people into very low jobs. There is no hard and fast answer, here; it is only to raise awareness of the issue and to let the pupils themselves present some ideas.

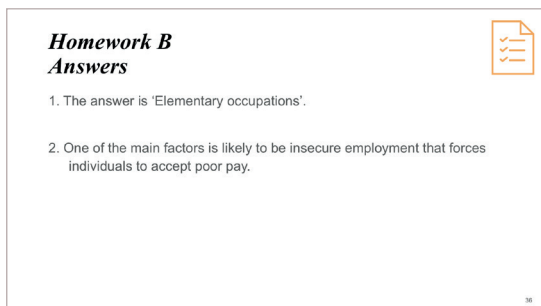
REFERENCE SLIDES



Slide 34



Slide 35



Slide 36

INTRODUCE AND MOTIVATE THE NEXT TASK

On the farm, three grades of strawberries are grown and they are sold at different prices to the supermarkets depending on their quality. Which strawberries are grown depends on the condition of the soil in the field and what methods of fertilisation are used.

Go through the slides to ensure that pupils are clear about what to do.

EXPLANATORY NOTES



Question 1: The tables are completed by setting one of the variables in turn to zero and then solving for the remaining unknowns. For example, in the table for field 1, when B is set to zero then the value of P can be found from the following sequence:

Field 1: $0.35B + 0.5P = \text{£}12.00$ per hour.

Set B to zero gives $0.35 \times 0 + 0.5P = \text{£}12.00$ per hour.

P is then clearly equal to $12/0.5 = 24$.

It might be worth completing this example to the class to get them started on the problem.

REFERENCE SLIDES

Task 3: the fruit farm

Jordan, Mollie and Niamh have decided to consider working on a fruit farm for the summer where wages are set by how many kilograms of strawberries are picked. This is known as piecework. The farmer has two fields growing three types of strawberry in total which are graded according to their quality. The three types are graded 'Basic', 'Premium' and 'Finest'.

The fields where the strawberries are grown are adjacent to one another as shown below and produce mixed crops.

Premium	Finest
Basic	Basic
Field 1	Field 2

Slide 37

Task 3: the fruit farm

The farmer has offered to pay the following rates:

	Basic (£)	Premium (£)	Finest (£)
Pay for each kg of strawberries picked	0.35	0.50	0.65

Workers can only work in one field during the same day. In field 1, a mixture of Basic and Premium grade strawberries is grown. In field 2, a mixture of Basic and Finest grade strawberries is grown.

Workers in the fields can choose to pick either crop within each field. So, for example, in field 1, workers can pick either Basic or Premium or a mixture of both. Jordan and his friends would like to know which field to choose to work in.

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Task 3: the fruit farm

The farmer says that his workers are able to earn the following wages per hour based on the equations:

Field 1: $0.35B + 0.5P = \text{£}12.00$ per hour

Field 2: $0.35B + 0.65F = \text{£}11.10$ per hour

Where B, P and F are the number of kilograms picked per hour for Basic, Premium and Finest grade strawberries, respectively. The work is typically easier in field 2 which is why earnings are less. The farmer's view is based on years of observing workers picking strawberries.

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Task 3: the fruit farm

- Find the intercepts of the equations for both fields 1 and 2 by completing the following tables of value:

	Field 1	Field 2
B	0	0
P		
F		0
- From your results, plot the graphs of the two fields with a separate graph for each.
- Mollie says that it should be possible to earn more money in field 1 by picking 20kgs of Basic strawberries and 12kgs of Premium strawberries per hour. If the coordinates for field 1 are labelled (B, P), find out if (20, 12) lies on the line $0.35B + 0.5P = 12.00$.
- If the coordinates for field 1 are labelled (B, P), find the gradient of the equation for field 1 using the pair of coordinates (10, 17) and (30, 3).
- What does the gradient mean in your answer to 4?

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Task 3



PUPILS ARE ANSWERING TASK 2

The answer to the problems are ... (go through the slides)

Task 3: problem 1

The answers are derived as follows:

Field 1: $0.35B + 0.5P = \text{£}12.00$ per hour. Set B to zero gives $0.35 \times 0 + 0.5P = \text{£}12.00$ per hour.

P is then clearly equal to $12/0.5 = 24$.

Field 1: $0.35B + 0.5P = \text{£}12.00$ per hour. Set P to zero gives $0.35B + 0.5 \times 0 = \text{£}12.00$ per hour.

B is then clearly equal to $12/0.35 = 34.28$.

Field 2: $0.35B + 0.65F = \text{£}11.10$ per hour. Set B to zero gives $0.35 \times 0 + 0.65F = \text{£}11.10$ per hour. F is then clearly equal to $11.1/0.65 = 17.08$.

Field 2: $0.35B + 0.65F = \text{£}11.10$ per hour. Set F to zero gives $0.35B + 0.65 \times 0 = \text{£}11.10$ per hour. B is then clearly equal to $11.1/0.35 = 31.72$.

Task 3: problem 2

The diagram uses the data from the previous table to find the coordinates on the axes and to plot a straight line between them.

Task 3: problem 3

This can be answered by plotting the coordinates on the graph or by seeing if the values that Mollie proposes, when inserted into the equation for field 1, actually add up to 12. As can be seen, they don't.

Task 3: problem 4

Teacher to go through this. The instruction will depend on how the pupils have been taught to find gradients.

Note that the gradient is negative which means it is sloping downwards. The diagram drawn for field 1 is sloping downwards and so our answer makes sense!

Task 3: problem 5

Teach from the slide

REFERENCE SLIDES

Task 3: the fruit farm: ANSWER

1. Find the intercepts of the equations for both fields 1 and 2 by completing the following tables:

Field 1	
B	0 34.28
P	24.00 0

Field 2	
B	0 31.72
F	17.08 0

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Task 3: the fruit farm ANSWER

2. From your results, plot the graphs of the two fields with a separate graph for each.

Field 1	
B	0 34.28
P	24.00 0

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Task 3: the fruit farm ANSWER

2. From your results, plot the graphs of the two fields with a separate graph for each.

Field 2	
B	0 31.72
F	17.08 0

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Task 3: the fruit farm ANSWER

3. Mollie says that it should be possible to earn more money in field 1 by picking 20kgs of Basic strawberries and 12kgs of Premium strawberries. If the coordinates for field 1 are labelled (B, P), find out if (20, 12) lies on the line $0.35B + 0.5P = 12.00$.

It can be seen from the diagram for field 1 that coordinates (20,12) lie above the line. This can be confirmed by substituting the values of B, P into the equation for field 1:

$$0.35 \times 20 + 0.5 \times 12 = \text{£}13.00 \text{ per hour.}$$

For the coordinates to be on the line $0.35B + 0.5P = 12.00$ it must be correct that the equation equals £12 per hour using the coordinates (20, 12). It clearly does not and therefore the coordinates do not sit on the line. And, so, Mollie is incorrect.

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Task 3: the fruit farm ANSWER

4. If the coordinates for field 1 are labelled (B, P), find the gradient of the equation for field 1 using the pair of coordinates (10, 17) and (30, 3).

The gradient may be found using the formula:

$$\left(\frac{P_2 - P_1}{B_2 - B_1} \right) = \left(\frac{17 - 3}{10 - 30} \right) = -0.7$$

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Task 3: the fruit farm ANSWER

5. What does the gradient mean in your answer to 4?

The gradient is calculated as the vertical distance/horizontal distance. The interpretation of the result is that for every one extra Basic strawberry picked, there are 0.7 fewer Premium strawberries picked; or, more realistically, for every 10 extra Basic strawberries picked there will be seven Premium strawberries fewer in the basket.

There is a trade off because the farm worker cannot pick two different types of strawberries at the same time!

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SOME FINAL THOUGHTS

This is about zero hours and tries to present some thoughts about them.

What happens in practice

Most employees under such contracts have fairly regular hours (but, remember, not guaranteed) and so can expect a regular income. But there will inevitably be some employees who will face a very irregular working life.

Why would an employer offer zero hours?

Generally, it allows the employer to reduce labour costs to a minimum level and avoid the situation where an employer is paying a worker - on a regular-hour contract - when they are idle (which can sometimes happen when business activity fluctuates). This reduction in paying for 'idle time', in effect, transfers the risk of being idle to the employee from the employer: this is because when there is no work to do the worker under zero-hour contract is not paid.

Resources

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

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