

Mathematical Studies

Summer Work

What you need to know about Mathematical Studies

Mathematical Studies has been designed to maintain and develop real-life maths skills. What you will study is not purely theoretical or abstract; it can be applied on a day-to-day basis in work, study or life and will include a financial maths element. It will also help with other A-level subjects – in particular with science, geography, business studies, psychology and economics.

Mathematical Studies is a new course but already several universities have come out in strong support of it. Even subjects like history now recognise the importance of statistics and so a Mathematical Studies qualification will help you hit the ground running at university.

Employers from all different sectors are also firmly behind the Mathematical Studies qualification. Many roles in today's workplace require high levels of budget management and problem-solving skills; Mathematical Studies will be a useful tool in equipping you with these skills.

You will be following AQA specification, which is formally known as Level 3 Mathematical Studies (code 1350). It is equivalent to an AS course in terms of UCAS points.

How you will be assessed:

- Two formal examinations at the end of year 12.
- Each exam accounts for 50% of the final grade and is 1.5 hours long.
- End of unit internal assessments and mocks throughout the course.

Some exam questions will involve analysing data that will be made available one month before formal examinations. This will allow you to become familiar with the data before the exam.

What you will need in lessons:

- A scientific calculator.
- A folder containing all notes and materials in an organised fashion.
- You will need to purchase a textbook.

Foreign exchange rates

Answer these multiple choice questions about exchange rates.

Tick the correct answer.

1. A record costs \$5.50 in the USA. What is the price in British money when £1 = \$1.40?
 - £3.92
 - £3.93
 - £7.70

2. Change £1000 into euros if £1 buys €1.04.
 - £961.53
 - £961.54
 - £1040

3. How many pounds are 500 rand worth if 12.5 rand = £1?
 - £40
 - £45
 - £6250

4. On holiday from the USA Janice spends her money on: Golf £30, Plane ticket £200 and Hotel £32. How much does it cost her in dollars if £1 = \$1.60?
 - \$157.20
 - \$163.75
 - \$419.20

5. Mrs Grant returns from Europe with €87. How much does she get back in pounds to the nearest 10p if £1 = €1.06?
 - £82
 - £82.10
 - £92.20

6. When on holiday in Spain, Sandy sees a pair of jeans priced at €65. Sandy knows that he gets €13 for £10. What is the price of the jeans in pounds?
 - £6.50
 - £50
 - £845

7. Convert \$50 into British pounds, to the nearest penny, if £1 = \$1.55
 - £32.25
 - £32.26
 - £77.50

Using percentages for comparison

Use the next page for workings out and your final answers.

1. Sian buys 50 pens for £8.50 and sells them for 25p each. Michael buys 100 postcards for £10.50 and sells them for 15p each. Who makes the bigger percentage profit; Sian or Michael?
2. The two sale stickers below show reductions on two items.



Which item has the bigger percentage reduction?

3. Smallville has 47 523 registered electors. Bigtown has 68 382 registered electors. In an election, 32 463 people vote in Smallville and 45 369 people vote in Bigtown. Calculate the percentage voter turnout for each town.

Percentage change

4. The 2012 population of Uganda was 36.3 million. The population of Uganda has been growing by 3.4% a year for the past few years. Use this information to predict the 2013 population of Uganda.
5. A small business buys a computer for £850. For accounting purposes, the business assumes that the computer depreciates at 25% a year. This means that each year it is worth 25% less than it was the previous year. How much is it worth at the end of the first year?
6. A credit union lends money at an annual interest rate of 26.8%. Angela borrows £350. Suppose she makes no repayments for a year, she will owe 26.8% more than she borrowed. How much will she owe?
7. Michael earns £28 000 a year. He has a tax allowance of £9440 and has to pay 20% income tax on the rest of his earnings. How much of his annual earnings are left after tax?

SECTION B:

Answer all questions in this section.

Write your answers in the spaces provided.

1 Pete is a farmer.
He wants to use a field for a campsite.

The field has an area of 6 acres.
He is going to use $\frac{2}{3}$ of the field for tents.

He uses this method to work out how many tents he could have.

- Find $\frac{2}{3}$ of the area of the field (in acres)
- Then multiply by 45

Pete thinks he has enough space for 200 tents.

(a) Is Pete correct?

(3)

Use the box below to show clearly how you get your answer.



A large empty rectangular box for writing the solution to the problem.

Pete needs to grow grass on this field.

He uses this information.

- The area of the field is 6 acres
- 1 acre is 4047 m^2
- One 20 kg bag of grass seed covers 800 m^2
- Each bag of grass seed costs £95

Pete has £3500 to buy grass seed for the field.

(b) Does Pete have enough money to buy the grass seed?

(4)

Use the box below to show clearly how you get your answer.



A large empty rectangular box for writing the answer.

(Total for Question 1 is 7 marks)

2 Pete wants to borrow some money from the bank.

He needs to show the bank manager how his farming business is doing.

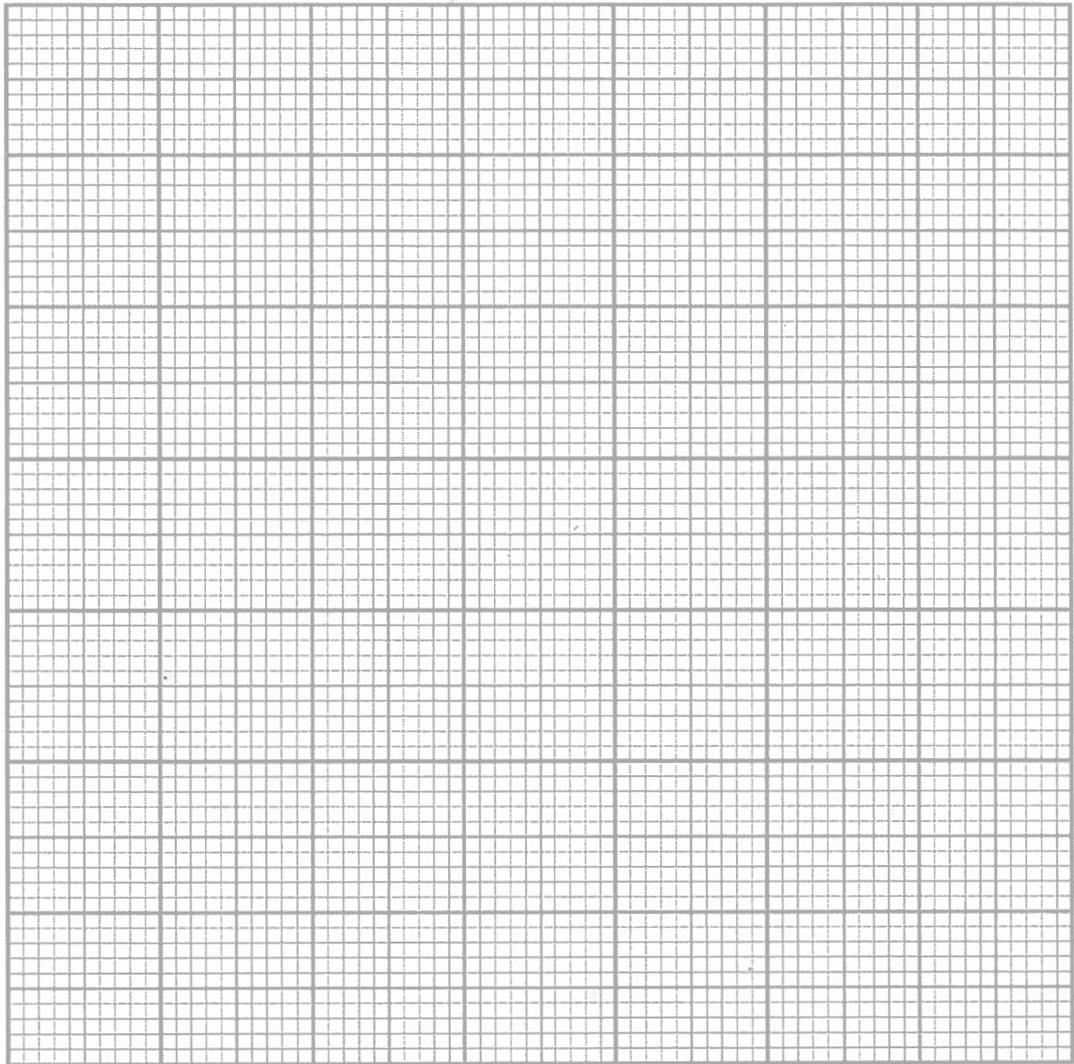
Pete shows the bank manager this information about his profits from dairy and live stock.

Profit (£)	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Dairy	3200	3250	3600	3850
Live stock	1650	1900	2100	2200

He wants to display the information on a graph or chart.

Draw a graph or chart for Pete.

(3)



(Total for Question 2 is 3 marks)

- 3 Meena also needs new radiators in her living room. She finds this information about radiators.

Heat output from a radiator is measured in BTU (British Thermal Units)

$$\text{Number of BTU needed} = \text{Volume of room in cubic feet} \times 3$$

She finds these prices.

Radiator	Maximum output (BTU)	Price (£)
Small convector	1148	25
Medium convector	1837	29
Large convector	2297	36
X Large convector	3216	51
Super convector	4594	89

Meena works out that the volume of her living room is 1530 cubic feet.

Meena wants to spend as little as possible on radiators for her living room. She needs to be sure that the total output is enough for the living room.

(a) Which radiators should Meena buy for her living room?

(3)

Use the box below to show clearly how you get your answer.



Meena buys new radiators for all of her house.

The total cost is £370

The store gives her a discount of $17\frac{1}{2}\%$

(b) How much does Meena pay for the radiators?

(2)

Use the box below to show clearly how you get your answer.



A large empty rectangular box for writing the solution to the problem.

(Total for Question 3 is 5 marks)

4 Dave is a milk tanker driver.
He collects milk from farms.



At 9:35 am he arrives at Pete's farm.

Dave has to wait until the temperature of the milk is 5°C or below.
The temperature of Pete's milk is 9°C at 9:35 am.
The milk cools at a rate of 1°C every 10 minutes.

Then Dave pumps the milk into the tanker at 20 000 litres per hour.
Dave has to collect 2500 litres of milk from Pete's farm.

Dave usually takes an extra 5 to 10 minutes to pack up at the end.

He wants to leave Pete's farm by 10:45 am.

Will Dave be ready to leave Pete's farm at 10:45 am?
Show how you have checked your answer.

(6)

Use the box below to show clearly how you get your answer.



(Total for Question 4 is 6 marks)

5

The table shows petrol prices in ten European countries in summer 2010. All values are given in pence per litre.

2010	Price (before tax is added)			Pump price (after tax is added)		
	Jun	Jul	Aug	Jun	Jul	Aug
Austria	43.5	42.2	41.9	100.5	99.4	98.0
Denmark	50.6	48.5	47.4	124.8	123.4	120.9
Finland	49.6	47.0	46.4	122.4	119.7	118.8
France	43.5	42.5	42.0	112.2	111.5	109.7
Germany	45.5	42.7	40.4	118.9	115.9	112.0
Ireland	45.2	45.0	44.3	111.3	111.5	109.5
Luxembourg	45.9	45.1	44.3	97.0	96.3	94.6
Netherlands	45.5	44.4	43.4	124.4	122.5	121.9
Sweden	42.9	41.2	39.0	113.5	112.5	108.4
UK	43.0	42.6	41.7	117.7	117.2	116.2

Source: Adapted from the Office for National Statistics

(a) (i) Which country had the lowest **pump price** per litre in July?

Answer (1 mark)

(a) (ii) Which country had the highest **pump price** per litre in August?

Answer (1 mark)

(b) Calculate the amount of tax paid per litre in the UK in June.

.....
 Answer p (2 marks)

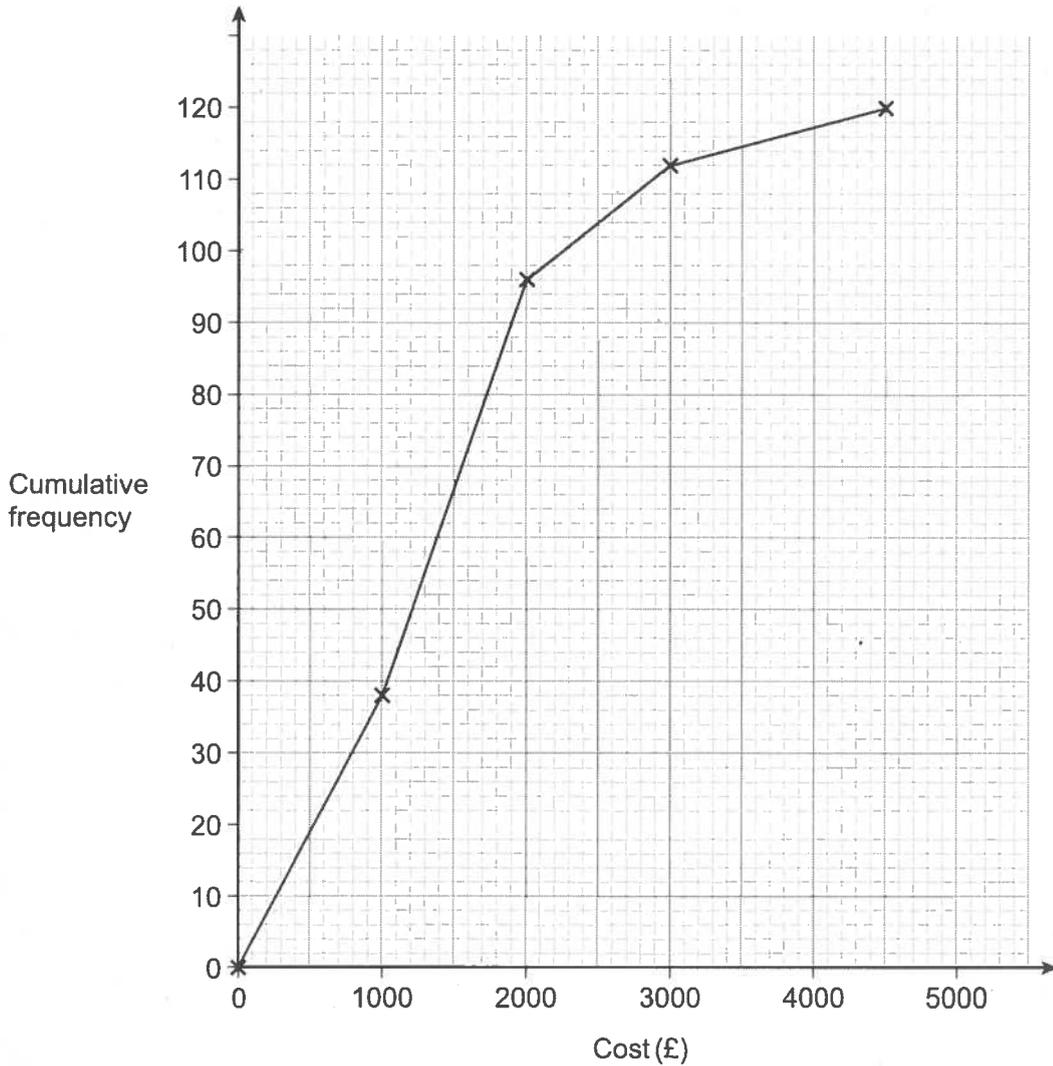
(c) Briefly describe the pattern in petrol prices during this 3 month period.

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 (1 mark)

6

The graph shows the cost (£) of 120 holidays advertised by a travel agent.



(a) Estimate the median cost of one of these 120 holidays.

.....

Answer £ (2 marks)

(b) Write down the number of holidays costing £2000 or less.

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Answer (1 mark)

(c) Write down the probability that a holiday chosen at random costs £2000 or less.

.....

Answer (1 mark)

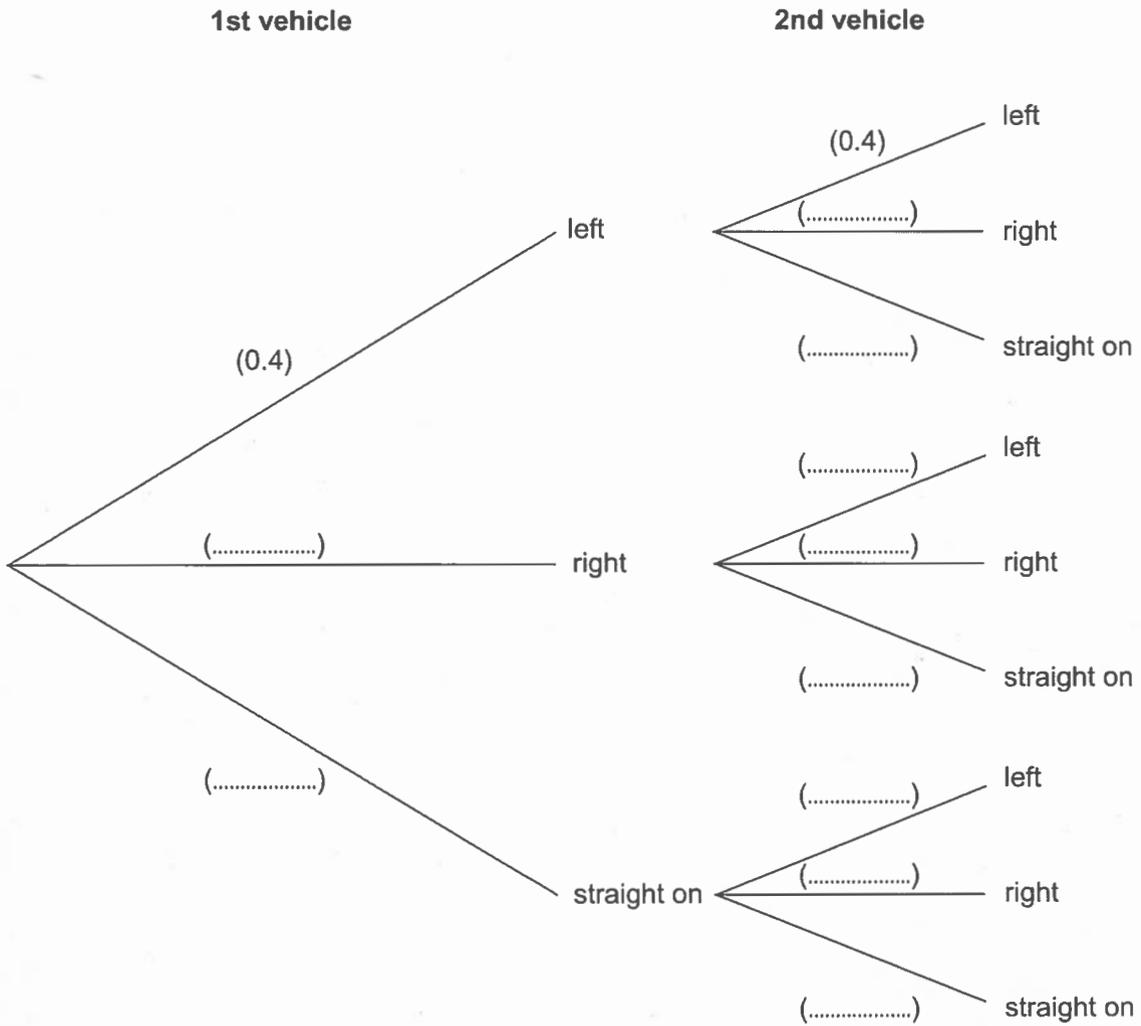
7

Vehicles coming to a crossroads must go in one of three directions: left, right or straight on.

Traffic officers conducted a survey of vehicles coming from the south. It showed that 40% turn left, 25% turn right and the rest go straight on.

- (a) Assume the drivers of the vehicles choose direction independently of each other.

Complete the tree diagram to show the possible outcomes for the next two vehicles coming from the south.



(3 marks)

(b) Use the tree diagram to find the probability that

(b) (i) both vehicles turn left

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Answer (2 marks)

(b) (ii) one vehicle turns right and the other goes straight on

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Answer (3 marks)

(b) (iii) both vehicles go in different directions.

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Answer (4 marks)

(c) One day, 2800 vehicles come to the crossroads from the south.

How many of these would you expect to turn right?

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.....
.....

Answer (2 marks)

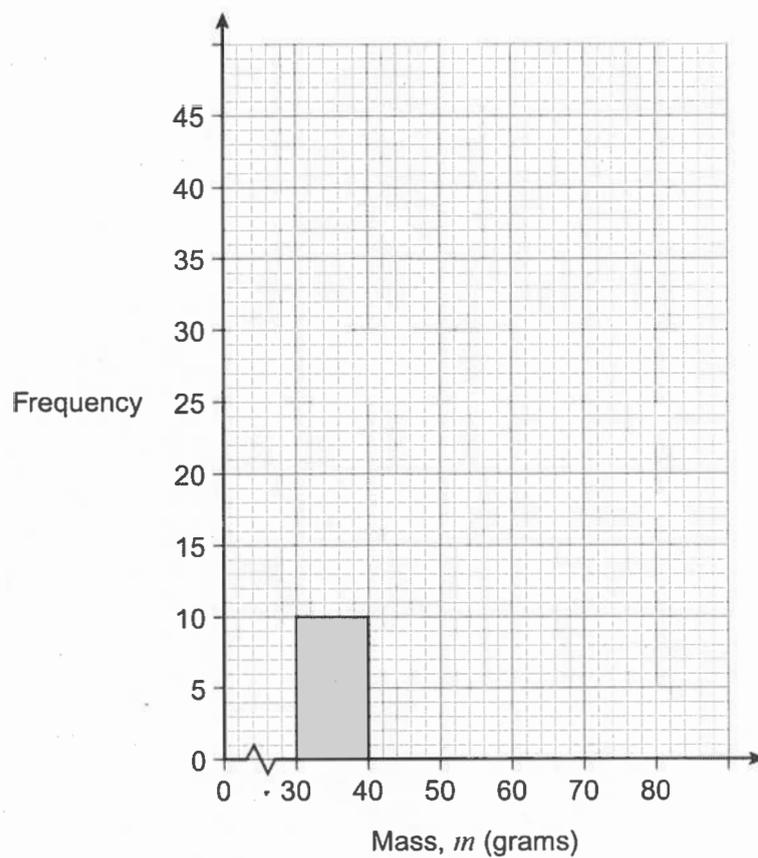
8

The table shows the mass of 100 hamsters.

Mass, m (grams)	Frequency
$30 \leq m < 40$	10
$40 \leq m < 50$	35
$50 \leq m < 60$	42
$60 \leq m < 70$	10
$70 \leq m < 80$	3

(a) Complete the frequency diagram.

[3 marks]



(b) The modal group for the mass of the hamsters is between 50 and 60 grams.

(b) (i) How can you tell this by looking at the table?

[1 mark]

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.....

(b) (ii) How can you tell this by looking at the graph?

[1 mark]

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(c) What is the probability that one of these hamsters, chosen at random, has a mass of 60g or more?

[2 marks]

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.....

Answer

9

The table is a summary of key statistics relating to Housing, Traffic, Recycling and Crime in the UK in 2009.

	Number of houses built (thousands)	Median house price (£ thousands)	Percentage increase in traffic between 1999 and 2009	Percentage of household waste recycled	Number of recorded crimes per 100,000 population
English Regions					
North East	3.9	120	9.1	34.7	6 900
North West	12.9	130	9.2	38.5	8 101
Yorkshire and the Humber	10.8	130	8.4	36.8	8 304
East Midlands	9.0	135	7.3	45.6	7 894
West Midlands	9.1	142	7.8	40.0	7 260
East	13.5	175	6.8	46.1	6 437
London	12.3	250	-6.3	31.8	10 893
South East	22.0	203	4.2	40.0	7 172
South West	13.8	175	11.6	43.5	6 598
England	107.3	170	6.5	37.8	7 883
Wales	6.4	133	12.7	40.4	7 404
Scotland	16.1	-	10.6	37.7	6 508
Northern Ireland	8.7	-	20.3	35.6	6 097

Source: Adapted from Social Trends (41)

(a) Which **English Region** had the lowest level of 'recorded crime' in 2009?

[1 mark]

Answer

- (b) Look at the values in the column headed 'Percentage increase in traffic between 1999 and 2009'.

Find the range of these percentages for the **English Regions**.

[2 marks]

.....
.....

Answer %

- (c) A statistician plans to draw a pie chart to compare the 'number of houses built' in 2009 for the four countries of the UK.

Calculate the angle for **Scotland**.
Give your angle to the nearest degree.

[4 marks]

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Answer degrees

Research task

Carry out a research task about 'Standard Deviation'.

Don't be put off by technical details and formulae, just try to get to grips with what it means.

Write down five things you found out about Standard Deviation (σ):

-
-
-
-
-

Check these sources if stuck for ideas:

<http://www.mathsisfun.com/data/standard-deviation.html>

<http://www.robertniles.com/stats/stdev.shtml>

<http://app.mymaths.co.uk/821-resource/standard-deviation-introduction>

(mymaths login: sandringham, password: square, A-level, S1)