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Edexcel
Success through qualifications

Key skills application of number Level 4

Monday 15 November 2004

Test Paper

YOU NEED

- This test paper
- An answer booklet
- A pen with black or blue ink
- Pencils
- An eraser
- A ruler marked in mm and cm
- 2mm squared paper
- A scientific calculator

You may use a bilingual dictionary

Do NOT open this paper until you are told to do so by the supervisor

THERE ARE 5 TASKS IN THIS TEST

Task 1: total 11 marks

Task 2: total 9 marks

Task 3: total 9 marks

Task 4: total 10 marks

Task 5: total 11 marks

Total marks available: 50

Try to complete ALL the tasks

YOU HAVE 2 HOURS 30 MINUTES TO FINISH THE TEST

INSTRUCTIONS

- Make sure your personal details are entered correctly in the answer booklet
 - Read each question carefully
 - Write in black or blue ink
 - Make sure that your writing is clear, and show all your working
 - If you need extra paper, use a second answer booklet. Make sure you put your personal details on the front of the second answer booklet
 - At the end of the test, hand the test paper, your answer booklets and all notes to the supervisor
-

REMEMBER: YOU HAVE 2 HOURS 30 MINUTES TO FINISH THE TEST

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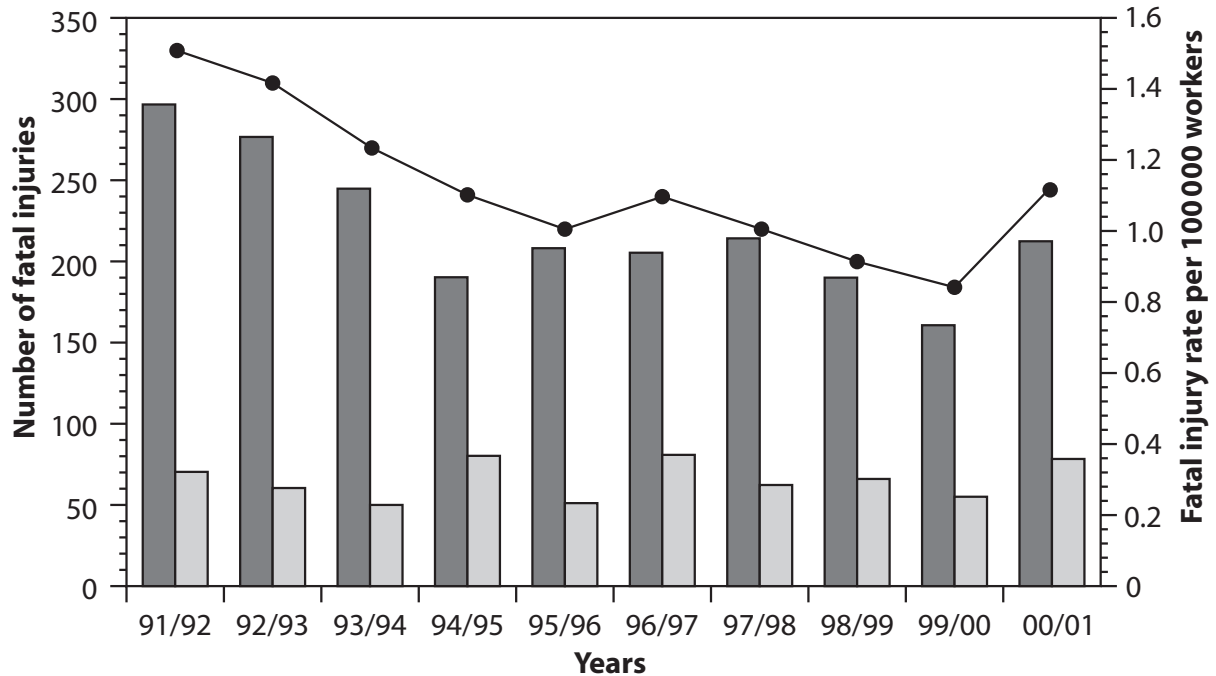
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Ref: AoN/L4/3.1/P31

- 1 The Health and Safety Commission plays an important part in monitoring safety and enforcing legislation to ensure standards are maintained. The following information shows how the number and rate of fatal injuries to workers has changed over a period of ten years.

Fatal injuries to workers 1991/92 – 2000/01



Key	
	Number of fatal injuries (employees)
	Number of fatal injuries (self-employed)
	Fatal injury rate (all workers)

Fatal injuries to workers 1991/92 – 2000/01

	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01
Employees	297	276	245	191	209	207	212	188	162	213
Self-employed	71	63	51	81	49	80	62	65	58	79
Total workers	368	339	296	272	258	287	274	253	220	292

Rates of fatal injuries to workers 1991/92 – 2000/01 (per 100000 workers)

	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01
Employees	1.4	1.3	1.2	0.9	1.0	0.9	0.9	0.8	0.7	0.9
Self-employed	2.1	2.0	1.6	2.5	1.5	2.3	1.8	1.9	1.7	2.4
Total workers	1.5	1.4	1.2	1.1	1.0	1.1	1.0	0.9	0.8	1.1

Source: Health and Safety Commission – www.hse.gov.uk

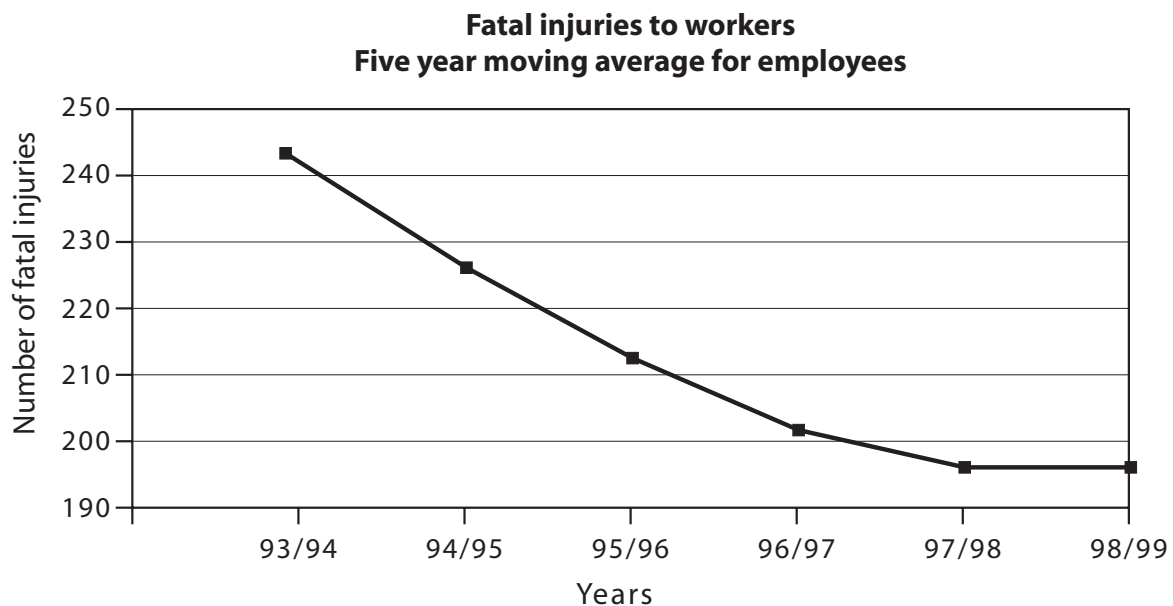
a Make quantified comparisons between fatal injuries to employees and the self-employed during this period of time.

3 marks

b Assess the effectiveness of the presentation of the data in the chart. Make two positive comments and two criticisms.

2 marks

Further analysis has been carried out on the number of fatal injuries to employees using a moving average. The graph and results produced are shown below.



Five year moving average for fatal injuries to employees

93/94	94/95	95/96	96/97	97/98	98/99
244	226	213	201	196	196

c Calculate the equivalent five year moving averages for the number of fatal injuries among the self-employed over the period. Describe what information about fatal injuries to workers the moving average data for both groups of workers provides, and comment on any similarities with, and/or differences from, the findings in part a.

3 marks

The provisional figures for fatal injuries to workers for 2001/02 are shown below.

**Fatal injuries to workers 2001/02
(provisional figures)**

	01/02
Employees	204
Self-employed	45

**Rates of fatal injuries to workers 2001/02
(per 100 000 workers) (provisional figures)**

	01/02
Employees	0.8
Self-employed	1.3

Source: Health and Safety Commission – www.hse.gov.uk

- d Comment, with justification, on whether or not these figures reflect the pattern of the data over the period 1991–2001.

3 marks

Total 11 marks

- 2 The population of a town may determine the range and variety of stock offered by its supermarkets. Planners use a tool called the Attractiveness Index to quantify how attractive a shopping centre or supermarket is to an individual shopper. The Attractiveness Index is related to the size of the local population and the distance a shopper can be expected to travel.

One model for the Attractiveness Index (A) of a supermarket is:

$$A = \frac{cp}{d^2}$$

where:

p = population of the town

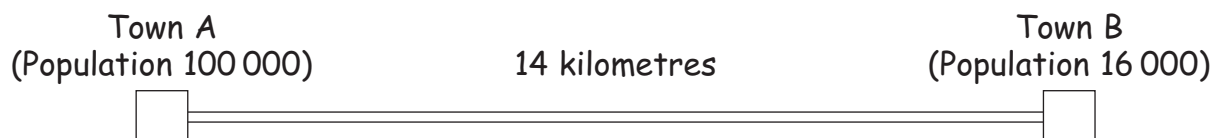
d = distance a shopper has to travel to the supermarket

c is a constant.

- a Comment on the effect of both the population and the distance on the value of the Attractiveness Index using this model.

1 mark

Two towns, both with one main supermarket, have populations of 100 000 and 16 000 and are 14 kilometres apart.



- b Identify the position between the two towns where, according to the model, an individual shopper would be equally attracted to both supermarkets.

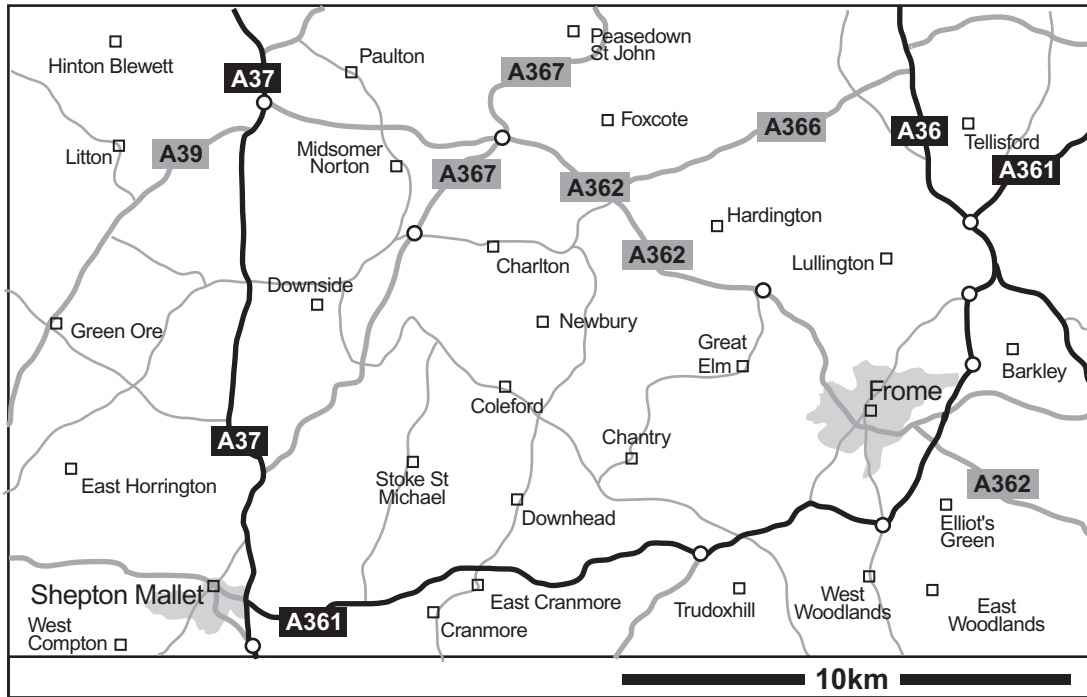
2 marks

Points where two supermarkets are equally attractive to a shopper are called neutral points. The path traced out by these neutral points helps to define the boundary of the area of influence for a supermarket, which may in turn determine aspects of marketing and transport strategies.

- c With the aid of a suitably labelled diagram, indicate the approximate position and shape of the boundary between the areas of influence of the two supermarkets, justifying your solution. Suggest reasons why their actual areas of influence may differ from those in your diagram.

4 marks

The map below shows the area around Frome and Shepton Mallet.



The population of Frome is 25 500. A property developer is planning a large new housing development at Shepton Mallet and a subsequent expansion of the current supermarket in the town. The existing population at Shepton Mallet is 7 500

Shoppers who live at East Cranmore, which is approximately 11 kilometres from Frome on the road to Shepton Mallet, currently tend to shop at Frome.

- d According to the model, what is the minimum increase in the population of Shepton Mallet needed to make it likely that individual shoppers of East Cranmore will be attracted equally to the supermarkets in Frome and Shepton Mallet?

2 marks

Total 9 marks

- 3 A group of 10 work colleagues decide to set up a scheme to invest in National Savings Premium Bonds for one year and give a proportion of any winnings to a local charity. It is agreed that 50% of any winnings will go to the charity and that the remainder will be shared between the participants. Each of the 10 participants purchases 200 National Savings Premium Bonds, costing £1 each. The bond numbers are included in the draw two months after purchase.

Premium Bonds have a 1 in 30 000 chance of winning a prize in each monthly draw.

The table below details the prizes given out in the July 2003 Premium Bond Draw.

Prizes

As well as the £1 million jackpot, you can win anything from £50 to £100,000 for each Bond you hold. The table below gives an example of the number of prizes of each value for a prize fund of £36.5 million.

Prize band	Prize value	No. of prizes
Higher value: £1.8 million	£ 1,000,000	1
(5% of prize fund)	£ 100,000	2
	£ 50,000	3
	£ 25,000	6
	£ 10,000	16
	£ 5,000	33
Medium value: £1.8 million	£ 1,000	730
(5% of prize fund)	£ 500	2,190
Lower value: £32.9 million	£ 100	11,129
(90% of prize fund)	£ 50	635,071
Total: £36.5 million		

Source: www.nsandi.com

- a At the planning meeting for the scheme, a colleague states that the probability of one of the participants winning at least one prize after holding the Bonds for one year, can be calculated as:

$$(200 \times 10 \times 10) / 30\,000 = 0.6667$$

Another participant challenges these figures. Review the calculation stated, clarify any possible confusion and prepare a correct and clear explanation of what the probability of one of the participants winning at least one prize is after one year.

4 marks

- b After one year, instead of closing the scheme altogether they decide to cash in half of the Premium Bonds and leave the remaining Bonds invested. Calculate an estimate of how long this number of Bonds need to be invested to have at least a 90% probability of one of the participants winning a prize.

3 marks

- c At a time of low inflation and minimal returns on investments, a person with a large lump sum might consider investing £30 000 in Premium Bonds in the hope of winning at least one higher value prize, as it appears that 5% of the prize fund is allocated to this type of prize. Discuss, with supporting calculations, whether or not this is a reasonable strategy.

2 marks

Total 9 marks

- 4 The table below shows the number of sight tests conducted in the UK between 1994 and 2002, together with some details of the optometric workforce and the hours worked by them.

Year	No. of sight tests (millions)	Optometric workforce			Average weekly time (hrs:mins) worked per full-time optometrist
		Full-time	Part-time	Total FTE* optometrists	
1994–95	13.869	4 454	1 650	5 198	39:25
1995–96	14.558	4 427	1 962	5 318	39:46
1996–97	14.596	4 652	2 013	5 631	39:34
1997–98	15.239	4 937	1 882	5 865	38:22
1998–99	15.644	4 877	2 179	5 905	38:26
1999–00	16.177	5 268	2 129	6 275	38:16
2000–01	16.564	5 154	2 394	6 325	38:22
2001–02	17.0 (estimate)	5 459	2 397	6 636	38:09

* FTE = Full-time equivalent

Source: Department of Health Statistics, December 2002

- a Use the data in the table to identify, and quantify, general trends in the optometric workforce during this time.

2 marks

The number of average weekly hours worked by a part-time optometrist from 1994 to 1997 is shown below.

Average weekly hours worked by part-time optometrists

Year	94/5	95/6	96/7
Average weekly hours	17.8	18.1	19.2

- b Identify how the average weekly hours worked by a part-time optometrist, as shown in the table above, can be calculated from the data given in part a, and investigate whether the trend shown by the data continues after 1997.

2 marks

- c Investigate how the average number of sight tests per FTE optometrist has varied over the time period and identify if there has been any significant change in the average duration of a sight test (assume that each FTE optometrist works 46 weeks per year).

4 marks

- d In April 1999, patients aged 60 and over became eligible for free NHS sight tests and extra optometrists were recruited to allow for the expected increased demand. Reflect, using supporting evidence that includes two specific facts, on whether the number of optometrists is now sufficient to meet demand.

2 marks

Total 10 marks

- 5 The British Dental Health Foundation (BDHF) promotes good dental hygiene by recommending that people visit their dentist at least once a year.

The BDHF wishes to carry out a dental health survey to obtain data that could be used to support the above recommendation. The results of the survey will then be presented to both dental health professionals and the general public. Outline how the survey should be designed and the results presented.

Include comments on:

- The data to be obtained 3 marks

- The sources of data 1 mark

- Selection of methods for obtaining the data 3 marks

- Techniques that should be used to analyse the data 2 marks

- How the outcomes could be presented effectively to clearly illustrate the findings for the two different audiences. 2 marks

Total 11 marks

End of test