



Unit Number

**U3051246/KA3T**

**Key Skills**

**Application of Number**

**Level 3**

**Monday 10 March 2008**

**Total Marks: 50**

**No. of Questions: 6**

**Time: 1 hour 30 minutes**

**Materials required for examination**

This test paper

An answer booklet

A pen with black or blue ink

A pencil and eraser

A ruler marked in mm and cm

2mm squared paper

A scientific calculator

**You may use a bilingual dictionary**

**Instructions to Candidates**

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

In the boxes on the answer book, write your centre number, registration number, surname and initials. The paper reference is shown above.

Write in black or blue ink only.

You have 15 minutes to read through the paper prior to starting the test.

Use this time to read through all the questions carefully, consider how you will attempt them and make rough notes if you wish.

Do not start writing in the answer book until you are told you can.

You will then have 1 hour 30 minutes to finish the test.

At the end of the test, hand the test paper, the Answer Booklet(s) and all notes to the supervisor.

**Information for Candidates**

There are two parts to this test.

Part A (total 34 marks) consists of 5 short-answer questions.

Part B (total 16 marks) consists of 1 extended-answer question.

Try to answer ALL the questions.

**Advice to Candidates**

Make sure that your writing is clear, and show all your working.

Read each question carefully.

If you need extra paper, use a second answer booklet. Make sure you put your personal details on the front of this booklet too.

**Instructions to Centres**

This paper must not be photocopied

***Turn over***

## Part A - Short-answer questions

- 1 The disposal of worn rubber tyres from vehicles is a serious problem because it is harmful to the environment.

490 000 tonnes of worn tyres were discarded in the United Kingdom (UK) in 2004. 12% of this total weight was buried in landfill sites.

- a What was the weight of worn tyres that was buried in landfill sites in the UK in 2004?

**1 mark**

In 2006, a company built a road by laying rubber tiles made from recycled tyres along railway tracks. This road was 400 metres long, and used the rubber from 88 500 tyres. The company intend to use the same method to build a road on a stretch of railway track that is 7 miles long.

1 mile is equivalent to 1 609 metres
--------------------------------------

- b How many tyres will the company need to provide the rubber for the road along the 7 mile railway track? Give your answer to **the nearest thousand** tyres.

**2 marks**

- c Show how to check your answer to part b by reverse calculation.

**1 mark**

The rubber road will cost £1.4 million per mile to build. A report states that the cost of building the 7 mile road could be repaid over a period of four years by charging vehicles £1 each time they use the road.

- d According to the report, what is the least number of vehicles that must use the road per day, on average, in order to repay the cost of building the road over a period of four years?

**2 marks**

**Total 6 marks**

**Please go on to the next page**

2 In the UK an increasing number of people are buying bottled water.

One company sold a total of 256 million litres of bottled water in 2005. This was an increase of 12.3% on its sales in 2004.

a How many litres of bottled water did the company sell in 2004?

**2 marks**

b If sales continue to increase at 12.3% per year from 256 million litres in 2005, in which year will the company's annual sales of bottled water first exceed 500 million litres?

**2 marks**

Out of the company's total sales of 256 million litres of bottled water in 2005, sales of sparkling water were 66.3 million litres. The remainder were of still water.

c Approximately, what was the ratio of the company's sales of sparkling water in 2005 to its sales of still water in 2005? Give your answer in a simple form.

**1 mark**

In a marketing campaign in 2005 the company suggested that schools should provide one 500ml bottle of water per school day for each child enrolled.

There were 9.96 million children enrolled in schools in the UK in 2005  
The average school year has 190 days

The company sold 500ml bottles of water to schools at 22p per bottle in 2005.

d If all schools in the UK had followed the suggestion in the 2005 marketing campaign, what would have been the total value of sales of the bottled water to schools?

**1 mark**

The company report gives information about the consumption of bottled water in the UK and other countries in 2005.

**Consumption of bottled water in selected countries in 2005**

Country	Population (millions)	Total consumption of bottled water (millions of litres)
Belgium	10.4	1 504.2
Spain	40.8	5 141.9
Italy	58.1	11 793.3
UK	59.4	2 197.7
France	61.5	9 169.5
Germany	82.5	10 645.1
Russia	144.6	1 445.7

- e Calculate the average consumption of bottled water **per person** in the UK in 2005 and the average consumption of bottled water **per person** in Germany in 2005.  
Comment on your findings.

2 marks

Total 8 marks

**Please go on to the next page**

- 3 A heating engineer advises a customer about a fire for her living room. To help her decide between a gas fire and an electric fire, the engineer obtains the following information.

**Cost of gas and electric fires**

Type of fire	Purchase cost (£)	Running cost (£ per hour)
Gas fire	599	0.056
Electric fire	469	0.181

- a Write two formulae, one for the total cost of purchasing and running the gas fire for a number of hours ( $h$ ), and one for total cost of purchasing and running the electric fire for a number of hours ( $h$ ).

**1 mark**

- b Use your two formulae to find the number of hours for which the total cost of purchasing and running the gas fire is the same as the total cost of purchasing and running the electric fire.

**2 marks**

The engineer claims that the lower running costs for the gas fire will pay back the extra purchase price in less than one year, if it is used for an average of three hours per day.

- c Is the engineer's claim correct? Show a calculation to support your answer.

**1 mark**

For the customer's gas fire, a circular ventilation hole with a cross-sectional area of at least 100 square centimetres must be cut in the wall of her living room. The engineer has a selection of hole cutters of different diameters. These diameters are given in the list below.

Hole cutter diameter (millimetres)
17mm
19mm
32mm
35mm
38mm
57mm
67mm
83mm
89mm
112mm
114mm
121mm

- d Which of these is the diameter of the smallest hole cutter that the engineer can use to cut a suitable circular ventilation hole in the customer's living room? Show calculations to support your answer.

3 marks

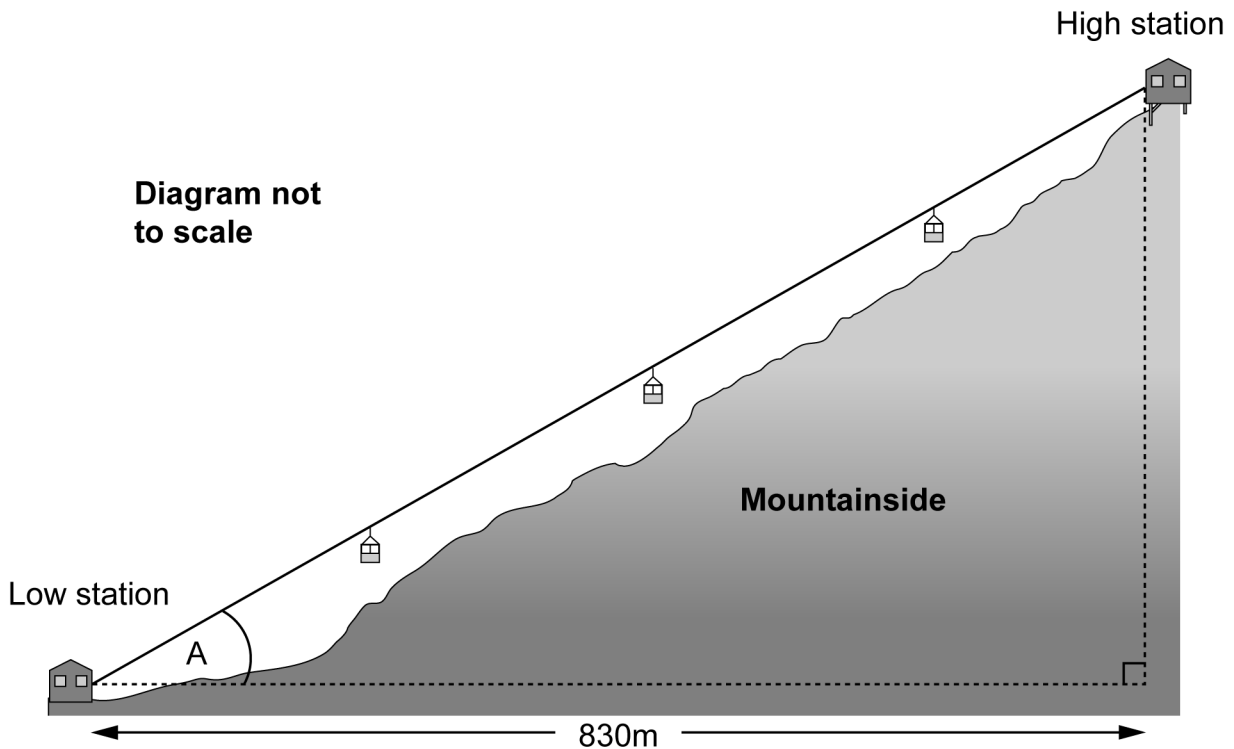
Total 7 marks

**Please go on to the next page**

- 4 A ski resort manager plans to build a cable car up a mountainside to take people to the ski slopes.

The simplified diagram below shows the layout of the proposed cable car system.

**The proposed cable car system showing the direct route between the Low station and the High station**



The Low station is 1448 metres above sea level. The High station is 1612 metres above sea level. The horizontal distance between the two stations is 830 metres.

- a Calculate the angle of inclination (A) of the direct route between the Low station and the High station.

2 marks

- b Show how to check your answer to part a.

1 mark

A typical cable car travels at an average speed of 10.5 metres per second.

- c How long will a typical cable car take to travel along the direct route between the Low station and the High station?

**3 marks**

It will take an estimated 11 minutes for a cable car to complete one return trip from the Low station to the High station and back, including time for loading and unloading passengers.

One cable car can carry a maximum of 200 passengers

The resort manager expects that at peak times, 3 500 passengers per hour will want to take a cable car from the Low station to the High station.

- d What is the minimum number of cable cars needed to meet the expected demand at peak times?

**2 marks**

**Total 8 marks**

**Please go on to the next page**

- 5 Businesses can reduce their water bills by using rainwater-harvesting systems. This involves collecting rainwater that falls on the roofs of buildings for later use.

A manager of a factory has a plan of the rectangular flat roof of the factory drawn to a scale of 1 : 200. The length and width on the plan are 74 millimetres and 135 millimetres.

The factory is in a location where the average rainfall per year is 965 millimetres.

1 cubic metre is equal to 1000 litres
---------------------------------------

- a In a year of average rainfall, how many litres of rainwater fall on the roof?

**3 marks**

The manager plans to use rainwater collected from the roof of the factory for one of the factory processes. Her target is to use rainwater to supply three quarters of the water required for this process in the first year it operates.

The factory process

- uses 116 litres of water per hour
- continues for 16 hours every working day
- operates for 5 working days per week

The factory operates all year round except for a 2-week closure per year.

- b If the rainfall is average in the first year that the process operates, will the number of litres of rainwater harvested meet the manager's target? Show calculations to support your answer.

**2 marks**

**Total 5 marks**

**Please go on to the next page**

**Part B - Extended-answer question**

- 6 The age at which women have children has changed considerably since the 1970s.

The table below compares information on the age of mothers giving birth in the UK in 1974 and in 2004. The data has been rounded to the nearest thousand births.

**Births in the UK by age of mothers**

Age (A) of mothers giving birth (years)	Number of births (thousands)	
	1974	2004
$15 \leq A < 20$	68	45
$20 \leq A < 25$	208	121
$25 \leq A < 30$	236	160
$30 \leq A < 35$	89	191
$35 \leq A < 40$	30	102
$40 \leq A < 45$	8	20
$45 \leq A < 50$	1	1
Total	640	640

In 1974, approximately one sixteenth of births were to mothers aged 35 and over.

- a In 2004, approximately what fraction of births were to mothers aged 35 years or over? Give your answer in a simple form. 1 mark
- b Draw two frequency polygons on the same axes to show the age distribution of mothers giving birth in 1974 and the age distribution of mothers giving birth in 2004. 5 marks
- c Use your frequency polygons to compare the age **distributions** of mothers giving birth in 1974 and 2004. From your findings state two important points. 2 marks
- d Use the data in the table to calculate an estimate of the mean age of mothers giving birth in **2004**. 3 marks

The cumulative frequency graph below shows the ages of the 640 thousand mothers who gave birth in the UK in 2004.

**Cumulative frequency graph showing the age of mothers giving birth in the UK in 2004**



- e Use the cumulative frequency graph above to estimate the median age of mothers giving birth in 2004.

**1 mark**

In 1974, the mean age of mothers giving birth was 26.2 years and the median age of mothers giving birth was 25.2 years.

- f Which of the averages, the mean or the median, illustrates **better** the difference between the age of mothers giving birth in 1974 and the age of mothers giving birth in 2004? Give a reason for your answer.

**1 mark**

- g Use the cumulative frequency graph above to estimate the interquartile range for the ages of mothers giving birth in 2004.

**2 marks**

In 1974 the interquartile range for the ages of mothers giving birth was 7.1 years.

- h Explain what the change in the interquartile range of the ages of mothers giving birth between 1974 and 2004 tells us about the trend in ages at which women are giving birth.

**1 mark**

**Total 16 marks**

**End of test**

**BLANK PAGE**

**BLANK PAGE**