



Unit Number

U3051246/KA3T

Key Skills

Application of Number

Level 3

Monday 12 November 2007

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 busiest period of the day for a major internet search engine during September 2005 was between 6:00am and 12:00 noon. On average, the internet search engine answered 2 000 queries **per second** between 6:00am and 12:00 noon each day.

- a On average, how many queries did the internet search engine answer between 6:00am and 12:00 noon each day in September 2005?

1 mark

During its first day of operation in June 1998 the internet search engine answered 2 million queries. On the corresponding day in June 2005 the internet search engine answered 100 million queries.

- b What was the percentage increase in the number of queries answered per day from June 1998 to June 2005?

1 mark

In June 2005 the average daily number of queries answered by the internet search engine was 100 million. The average percentage increase **per year** in the daily number of queries answered in the previous three years was 75%.

- c If this rate of increase continues, in which year will the average daily number of queries answered by the internet search engine exceed 500 million?

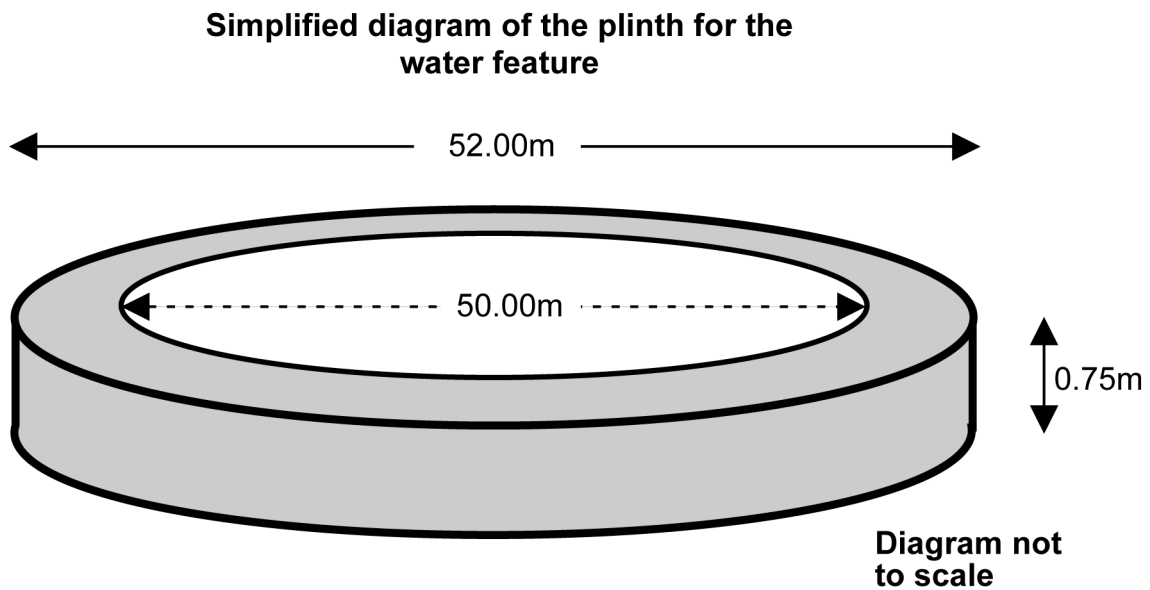
2 marks

Total 4 marks

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- 2 A local council is redeveloping an extensive public park. It commissions a design for a large water feature. This feature will consist of eight fountains set into a circular concrete plinth.



The outer diameter of the plinth is 52.00 metres and the inner diameter is 50.00 metres. The depth of the plinth is 0.75 metres. The designer uses the formula below to calculate the approximate volume of concrete needed to make the plinth.

$$V = 0.79 (D^2 - d^2) t$$

where

- V** is the volume of concrete needed to make the plinth in cubic metres
- D** is the outer diameter of the plinth in metres
- d** is the inner diameter of the plinth in metres
- t** is the depth of the plinth in metres

- a Use the formula to calculate the approximate volume of concrete needed to make the plinth for the water feature.

2 marks

The 8 identical fountains will operate at the same time for a period of 5 minutes and then switch off. The water will drain back into a reservoir in the centre of the plinth to be re-used. Each fountain will spray water at a rate of 5.5 litres per second.

- b What is the minimum amount of water required for all the 8 fountains to operate for 5 minutes?

1 mark

At an entrance to the public park a plan of the park, drawn to a scale of 1 : 1 250, is displayed on a notice board. A rowing club wants to hold a 1 000-metre race on a boating lake in the park. The club secretary measures the length of this lake on the plan as 784 millimetres.

- c Based on this measurement, is the lake long enough to allow the rowing club to hold a 1 000-metre race? Show calculations to justify your answer.

2 marks

Total 5 marks

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3 A large hotel chain has hotels in the United Kingdom (UK) and the rest of Europe. They have 90 hotels in the UK and another 55 in the rest of Europe.

- a Approximately, what fraction of the chain's hotels are in the UK? Give your answer as a simple fraction.

1 mark

A couple from London plan a 2-night autumn break in Paris. They compare offers on the internet.

Hotel chain

£299 per couple for 2 nights bed and breakfast with dinner on the first night
Travel not included

Travel company

£169 per person for 2 nights bed and breakfast including travel
(return flights)

Eurostar travel by rail costs £59 per person for the return journey to Paris and the couple estimate that they will spend 35 euros(€) each on dinner when it is not included in the offer.

$1 \text{ pound } (\pounds) = 1.65 \text{ euros } (\text{€})$

- b Which offer is cheaper, the hotel chain's offer with return travel by Eurostar or the travel company's offer, assuming that the couple eat dinner on both evenings? Ignore any additional expenses, such as travel to the airport or railway station. Show calculations to support your answer.

2 marks

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The hotel chain offers short weekend and long weekend spring breaks in the United Kingdom. The cost per person for bed and breakfast and the cost per person for dinner are the same on both weekend spring breaks.

Short Weekend Spring Break £144 per couple

Includes 2 nights bed and breakfast with dinner at your hotel's restaurant on the first night for each person

Long Weekend Spring Break £230 per couple

Includes 3 nights bed and breakfast with dinner at your hotel's restaurant on the first and second nights for each person

- c Use this information to form two equations about the cost per person for one night's bed and breakfast and the cost per person for one dinner on a weekend spring break.

1 mark

- d Use your equations to find the cost per person for one night's bed and breakfast and the cost per person for one dinner on a weekend spring break.

2 marks

- e Show how to check your answers to part d.

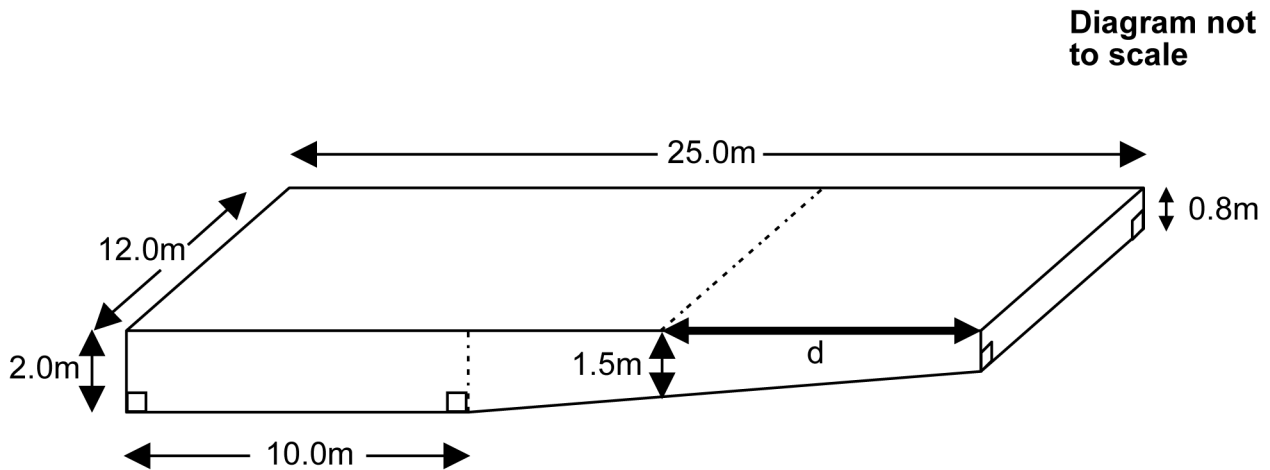
1 mark

Total 7 marks

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- 4 The swimming pool at a leisure centre is 25 metres long and 12 metres wide. The deep end is 10 metres long with a depth of 2.0 metres. The floor of the rest of the pool slopes uniformly from a depth of 2.0 metres at the deep end to a depth of 0.8 metres at the shallow end.

Simplified diagram of the swimming pool



- a How much water will the pool hold when it is full to the brim?

3 marks

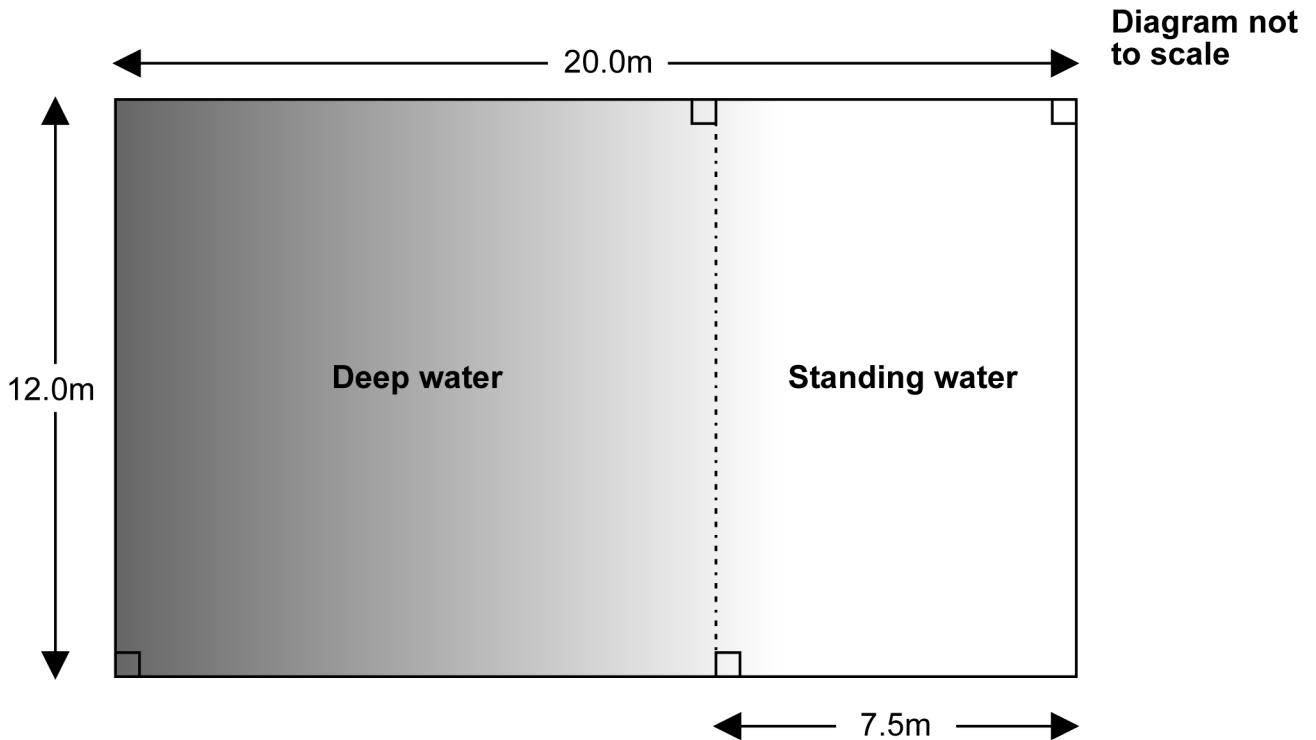
'*Standing water*' is defined as a depth of less than 1.5 metres of water. A marker shows this depth on the side of the pool.

- b What is the distance (d) from the shallow end to the standing water marker?

3 marks

A nearby town has an open-air swimming pool. This pool also has an area of standing water and a deep-water area.

Aerial view of the open-air swimming pool



Health and Safety regulations limit the number of bathers allowed to use a swimming pool. The table below summarises these regulations.

Depth of water	Safe bather load
Standing water - under 1.5m deep	1 bather per 2.7m^2 surface area
Deep water - over 1.5m deep	1 bather per 4.0m^2 surface area

- c What is the maximum number of bathers who can use the open-air pool if Health and Safety regulations are satisfied?

2 marks

To fill the open-air pool to the brim requires 300 cubic metres of water. To clean the water in this pool, a filter pump circulates the water in the pool so that the equivalent of the full volume of water in the pool is filtered every 2.5 hours.

1 gallon is equivalent to 4.55 litres

The pump is rated for water flow in gallons per hour.

- d What rate of water flow is required through the pump in order to circulate the full volume of water in this pool every 2.5 hours? Give your answer to the nearest 1 000 gallons per hour.

2 marks

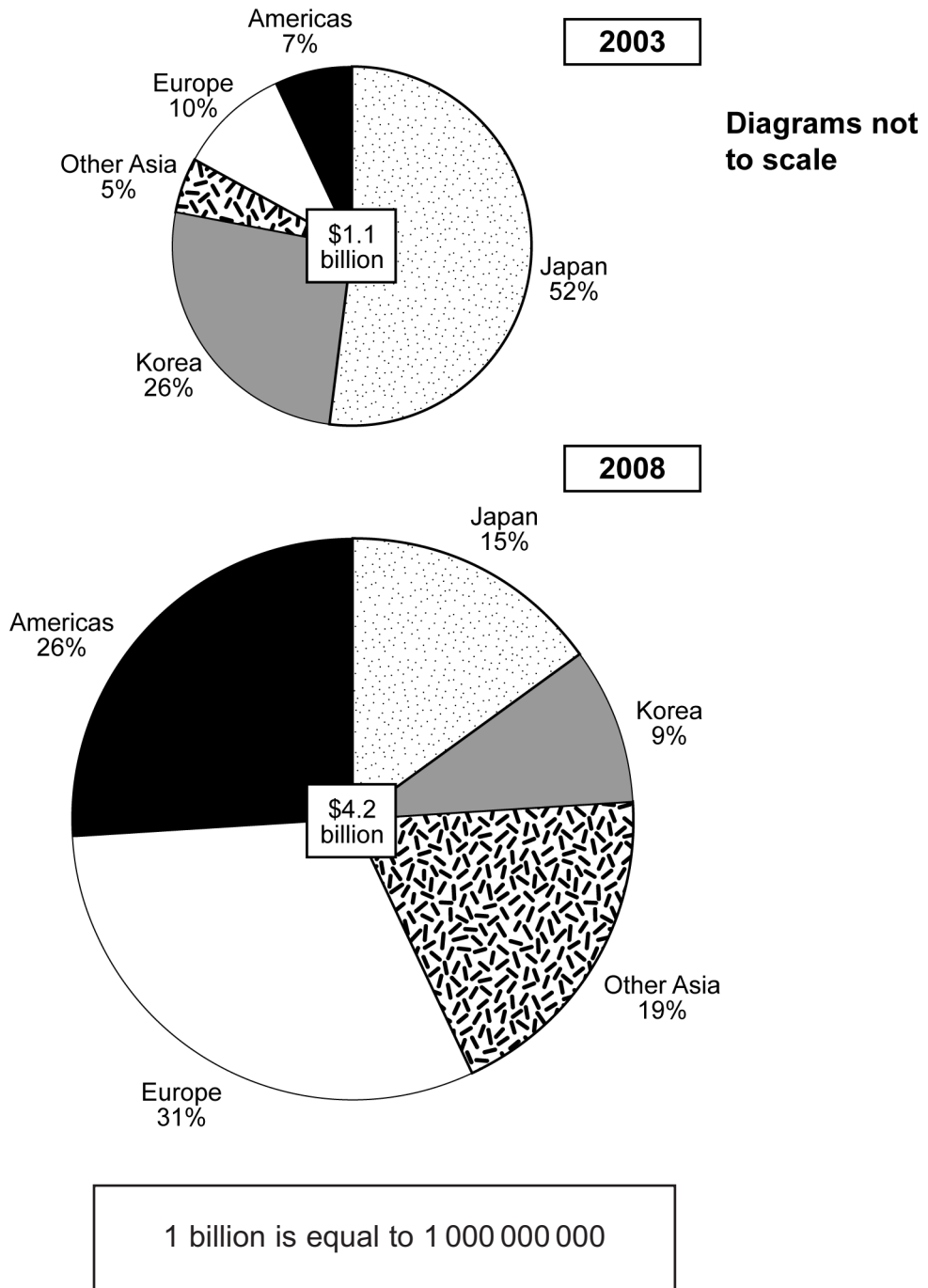
Total 10 marks

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- 5 Manufacturers of mobile phones predict that the revenue from games downloads will increase significantly between the years 2003 and 2008. The pie charts below show the revenue from games downloads on mobile phones recorded in 2003 and predicted for 2008 in different regions of the world.

Pie charts showing the share of revenue from games downloads on mobile phones by region in 2003 and predicted for 2008



- a Compare and interpret the pie charts for 2003 and 2008. Make two comments with numerical comparisons to describe the expected change in the pattern of revenue from games downloads between 2003 and 2008.

2 marks

- b Use the data in the charts to calculate how much greater the revenue from games downloads on mobile phones in the Americas is expected to be in 2008 than it was in 2003.

2 marks

The average increase in world revenue from games downloads on mobile phones is predicted to be 30.7% per year. The following formula can be used to predict the total world revenue from games downloads on mobile phones for 2010.

$$R_n = R_o \left(1 + \frac{p}{100} \right)^7$$

where R_n is the predicted total world revenue in dollars for 2010
 R_o is the total world revenue in dollars for 2003
 p is the average percentage increase in world revenue per year

- c Use the formula to predict the total world revenue from games downloads on mobile phones for 2010.

2 marks

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Market researchers compare the average revenue per individual in the population (ARPI) from games downloads on mobile phones for Japan with those for Europe and the Americas in 2003. The recorded annual revenue from games downloads on mobile phones for Japan in 2003 was \$0.572 billion.

The populations of Europe, the Americas and Japan in 2003

Region	Population in millions
Europe	729
Japan	127
The Americas	876

d What was the ARPI for Japan in 2003?

1 mark

In 2003 the ARPI for Europe was approximately \$0.15.

e Approximately, what was the ratio of the ARPI value for Europe to the ARPI value for Japan in 2003? Give your answer in its simplest form.

1 mark

Total 8 marks

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Part B - Extended-answer question

- 6 The pupils in Year 6 classes in a primary school investigate the growth of plants.

Pupils in one of the Year 6 classes grow *Giant Yellow* sunflowers from seed. After 15 weeks, they measure the height of each sunflower to the nearest centimetre. Their measurements are summarised in the table below.

Height in centimetres	Number of Giant Yellow sunflowers	Cumulative frequency
150 - 169	11	11
170 - 189	15	26
190 - 209	23	49
210 - 229	22	71
230 - 249	15	86
250 - 299	3	89

- a Use the data in the table to draw a cumulative frequency graph for the distribution of the heights of the *Giant Yellow* sunflowers. **5 marks**
- b Use your graph to obtain estimates of the median height and the interquartile range of the heights of the *Giant Yellow* sunflowers. **3 marks**
- c Calculate an estimate of the mean height of the *Giant Yellow* sunflowers grown by the pupils. **3 marks**

Pupils in the other Year 6 class grow *Sunburst Orange* sunflowers and measure the heights of these sunflowers.

The results for the *Sunburst Orange* sunflowers are

- median height **154.9 centimetres**
- interquartile range of heights **32.1 centimetres**
- mean height **153.8 centimetres**

- d Compare your results for the Giant Yellow sunflowers with the results for the Sunburst Orange sunflowers. Interpret and comment on your findings.
2 marks

The Year 6 pupils decide to sell 60 pots of Giant Yellow sunflowers at the school's Summer Fair. They estimate their costs for the 60 potted sunflowers as

- 5 packets of seeds at £1.99 per packet
- 4 bags of compost at £2.95 per bag
- 60 large pots at £3.25 each

The pupils want to cover their costs and donate all the profits to the school fund. The target for their donation is £65.00.

- e What is the minimum price the Year 6 pupils must charge for each potted sunflower if they are to reach their target?
2 marks
- f Show, by estimation, how to check your answer to part e.
1 mark

Total 16 marks

End of test

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