MARLBOROUGH COLLEGE

ENTRANCE & FOUNDATION SCHOLARSHIPS EXAMINATIONS 2008

Mathematics I

Compulsory Paper

TUESDAY 4th MARCH 2008

Time: 1 hour 20 minutes

Attempt all questions. You are advised to show enough working.
If an answer is not exact, you should give it to 2 decimal places unless otherwise stated.

There is an insert for use with question 5.

1. **Do not use a calculator in this question.**

(a) Find the cost of 35 items costing £7.95 each.

(b) Giving your answer as a fraction, work out

$$3\frac{4}{5}+4\frac{3}{8}\times 2\frac{2}{7}$$

2. In 1998 about 4 000 000 000 aluminium cans were used in the UK. 36% of these were recycled and the average height of a can is 14.5 centimetres. If all the recycled cans were laid end to end, they would stretch from Land's End to John O'Groats 160 times.
How far is it from Land's End to John O'Groats in kilometres?
Mount Everest is 8872m high. If **all** the cans were recycled and put on top of each other, how many Mount Everests would this be?

Please Turn Over

3. Solve:

(a) $3x+5=\frac{2(x-7)}{5}$

(b) $4x-3y=17$
$3x+2y=0$

4. Valencia and Alicante are two places on the East Coast of Spain. Alicante is 180km due South of Valencia.

A yacht is on a bearing of 140° from Valencia and on a bearing of 058° from Alicante.

Using a scale of 1 cm:20 km, draw a scale diagram of the yacht's position in relation to the two places and determine which place is nearer to the yacht and by how much.

5. **On the insert is a timetable for safe crossing times to Holy Island along a causeway for the first two weeks of July 2007. Please use the insert to answer the following questions, making your answers clear.**

(a) If I want to visit Holy Island from 10am to 3pm, which days are possible?

(b) Why is there only one entry for Sunday 8th July?

(c) On the 4th July, how long is the causeway unsafe to cross between noon and midnight?

(d) On the 4th July, how long altogether is the causeway safe to cross?

(e) On which days is it unsafe to cross at midnight?

6(a) Write down the next two terms in each sequence:

2, 6, 12, 20, 30, _, _

2, 2, 3, 4, 6, 9, 14, _, _

1, 3, 6, 11, 18, 29, 42, _, _

(b) "When you multiply a number by a second one the answer will always be bigger than the original number."
"When you divide a number by a second one the answer will always be smaller than the original number."
Are these statements always true? Give examples to support your answers.

7. (a) (i) Find the area and perimeter of a circle of radius 6cm.

(ii) Find the radius of a circle whose area is sixteen times the area of the first circle.

(b) What is the area of the largest circle which can fit inside a regular hexagon with side length 8cm?

End of examination, please go back and check your answers.

MARLBOROUGH COLLEGE

ENTRANCE & FOUNDATION SCHOLARSHIPS EXAMINATIONS 2004

Mathematics II

Optional Paper

TUESDAY 2nd MARCH 2004

Time: 1 hour 30 minutes

Attempt all questions.

1. The currency at Harry's boarding school consists of Galleons (G), Sickles (S) and Knuts (K).

   23 Knuts make a Sickle, and 17 Sickles make a Galleon.

   Harry goes shopping with 10 Galleons in his pocket.
   He buys 1 new broomstick costing 4 Galleons, 12 Sickles and 20 Knuts,
   I magic wand at 2 Galleons, 10 Sickles and 14 Knuts,
   2 potion books costing 9 Sickles and 15 Knuts each,
   and a dozen chocolate frogs at 11 Knuts each.

   Calculate his total bill and his change in Galleons, Sickles and Knuts.

2. (a) $x + y = 24$,
   $y + z = 14$,
   $z + w = 7$
   and $x - w = 13$.

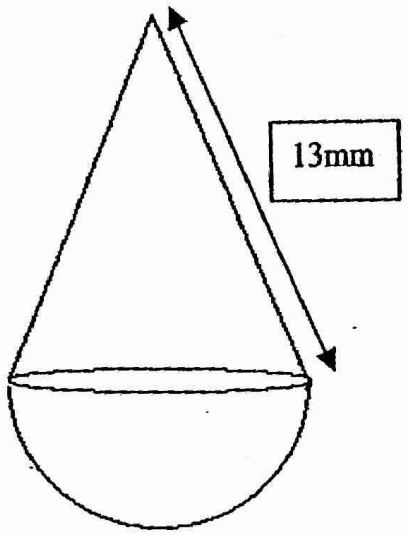
   Find x, y, z, and w.

   (b) $ab = 4$
   $bc = 9$
   and $ca = 16$

   Find a, b and c, given that the values are all positive and should be expressed as whole numbers or fractions.

Please Turn Over

3. To celebrate the 800th anniversary of Marlborough's town charter, a local Jeweller decides to make 800 pendant type necklaces. He chooses a design based on a cone sitting on a half sphere as shown in the diagram. (The top of the cone then has a ring attached and it slides freely on a chain of the same material.) The joint diameter of the base of the cone and the top of the hemisphere is 10mm. The length of the slanting edge of the cone is 13mm as shown



You are given that the volume of a hemisphere is $\frac{2}{3}\pi r^3$ and the volume of a cone is $\frac{1}{3}\pi r^2 h$, where r is the base radius and h is the height of the top above the centre of the circular base (which is common to the cone and the hemisphere).

Calculate the volume of the design in cm^3 and the mass of all 800, in kg to the nearest gram, if they are made in silver where the mass of one cm^3 is 10.5grams.

4. To add the first n square numbers we can use the formula:

$1^2 + 2^2 + 3^2 + 4^2 + \ldots\ldots\ldots + n^2 = \frac{1}{6}n(n+1)(2n+1)$

For example: $1^2 + 2^2 + 3^2 + 4^2 = \frac{1}{6} \times 4 \times 5 \times 9 = 30$

Use this formula, showing your method, to find the following sums:

(a) $1^2 + 2^2 + 3^2 + 4^2 + \ldots\ldots\ldots\ldots + 111^2$

(b) $59^2 + 60^2 + 61^2 + \ldots\ldots\ldots\ldots + 150^2$

(c) $2^2 + 4^2 + 6^2 + \ldots\ldots\ldots + 150^2$. (Hint: $10^2 = 4 \times 5^2$ and $52^2 = 4 \times 26^2$ etc.)

(d) $1^2 + 3^2 + 5^2 + \ldots\ldots\ldots + 149^2$

5. A man returns home from the pub along the road. The distance is 4 km. At the same time as he leaves the pub, his dog leaves his home and travels on the same road to meet him. The man walks at 5 km per hour and the dog travels at 7 km per hour. Once the dog has met its owner it returns home, turns round and goes to meet its owner, returns home again, and so on until its owner gets home.

(a) How long after leaving the pub does the man meet his dog for the first time? Give your answer in minutes.

(b) How far has the dog travelled by the time he meets his owner for the second time? Give your answer in metres to the nearest metre.

(c) How far has the dog travelled by the time his owner has returned home?

6.. Find the next **two** terms in the sequences below, making your reasoning clear:

(a) 2, 9, 16, 23, 30, ...
(b) 12, 5½, 3⅓, 2¼, ...
(c) 1.1, 1.21, 1.331, ...
(d) 12.1, 13.6, 15.7, 18.4, ...
For the sequence in (a), find the 151st term.

The next two sequences are more unusual; give the next term in each case.

(e) 1, 2, 4, 4, 9, 8, 16, 16, 25, ...
(f) 60°, 90°, 108°, 120°, ...
For the sequence in (e), find the 79th term.

7. In a country in Central America, travellers can contract a serious disease either by insect bite or by contaminated water. The following information is known about the disease.

30% of travellers are bitten by an insect which carries the disease.
20% of those who are bitten by the insect catch the disease.
40% of those who catch the disease from insects die.
60% of those who contract the disease have drunk contaminated water.
Anyone contracting the disease from water is half as likely to die as anyone who catches it from insects.

(a) What percentage of travellers contract the disease by insect bites?
(b) What percentage of travellers contracts the disease?
(c) What percentage of those dying of the disease contracted it from insects?

End of examination, please check your answers.