MARLBOROUGH COLLEGE

Junior Scholarship Examination

MATHEMATICS II

(Optional Paper)

Date: 2nd March 2010

Time: 1 hour 20 minutes

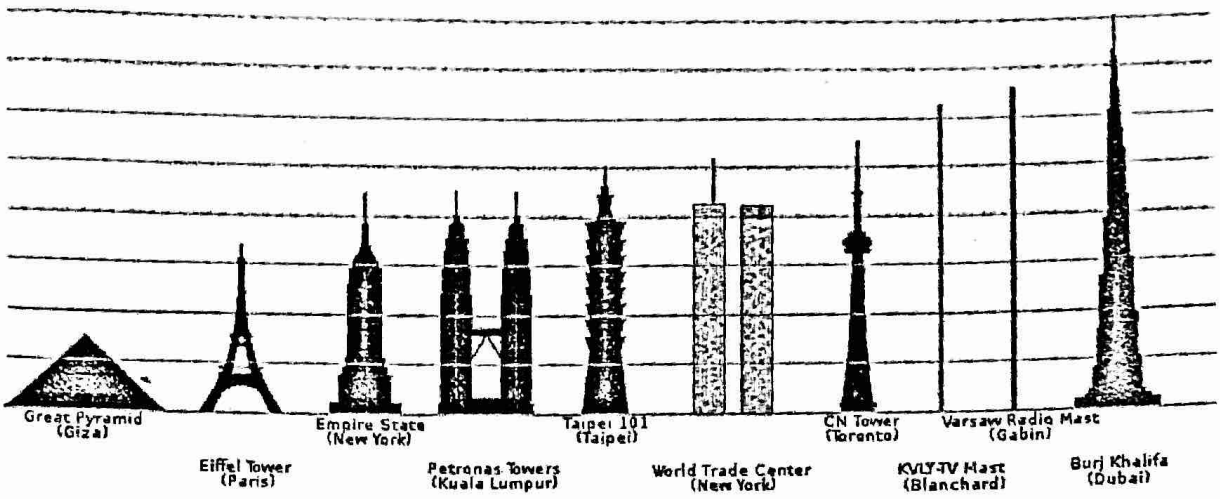
Instructions to Candidates:

Attempt all questions

You are advised to show enough working.
Answers by trial and improvement are not acceptable.

If an answer is not exact, you should give it to 2 decimal places, unless otherwise stated.

1. In 2009, Burj Khalfia (Dubai) was unveiled as the world's tallest building, standing at 2625 feet high.



i) Given that 1 foot = 0.3028 meters, find the height of Burj Khalfia in meters (to 1 decimal place).

ii) If I drew a straight line, which was 1 km long, from a point, X, on the ground, to the very top of the building, how far from the base of the building would X be?

2. Here are some facts about the average human:

A frown uses 43 muscles and a smile uses 17. Every 200 000 frowns creates a wrinkle. A person blinks 6 250 000 times a year. Human blood travels 60 000 miles per day and the number of breaths taken is 23 040 per day. Each breath draws in 4.2 litres of air. Give each answer to the nearest whole number.

i) How many muscles create 100 wrinkles?

ii) How many blinks will have taken place in a classroom of 20 children and one teacher in a one hour lesson?

iii) Calculate the volume of air breathed in a 70 year lifetime. Given that one cubic metre is 1000 litres, how many classrooms of dimensions 10m by 8m by 3m will have the same volume?

iv) Given that the radius of the earth is 3960 miles, how many times around the earth would blood travel in a year?

3. (a) In a group of 35 pupils on a school trip, 14 are wearing hats, 18 are wearing gloves and 11 are wearing neither. Find the probability that a pupil chosen at random:

i) is wearing a hat but no gloves,

ii) is wearing gloves but no hat,

iii) is wearing both.

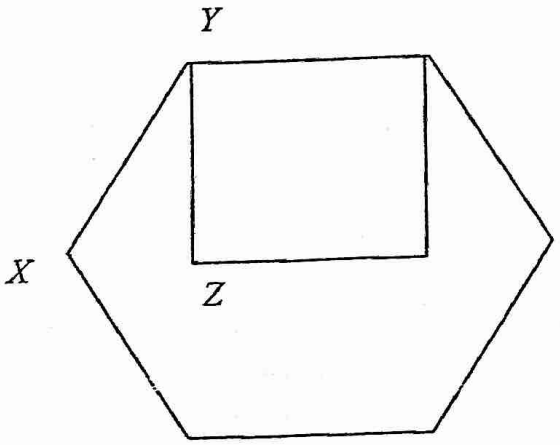
(b) Barry and Teresa are two children in the Jones family. Barry has the same number of sisters and brothers. Teresa has twice as many brothers as sisters. How many children are there in the Jones family?

4. In a local shop I buy a packet of mints costing m pence, a newspaper costing n pence and a large bar of chocolate costing c pence, (which was the most expensive of the three items).

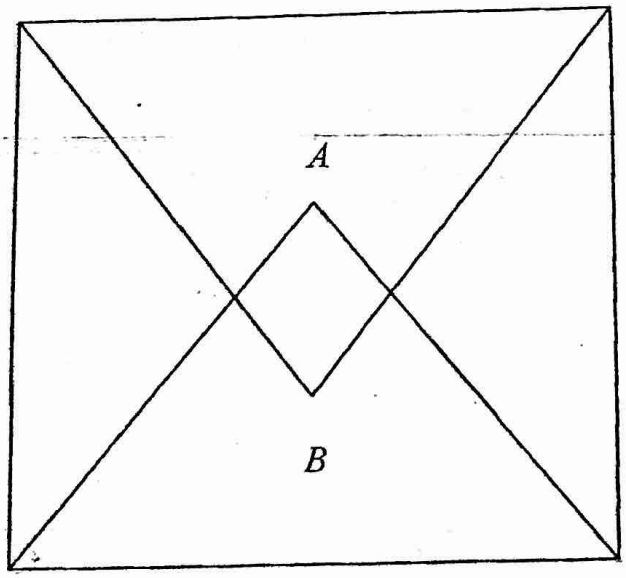
a) In total I spent £2.70. Form an equation to connect m, n and c.
b) The difference in price between the chocolate and the mints was the same as the cost of the newspaper. Use this information to form a second equation connecting m, n and c.
c) Use your two equations to calculate the cost of the chocolate bar.

5.(a) **In this question, the diagrams have not been drawn accurately.**

The diagram shows a square inside a regular hexagon. Find angle YXZ.



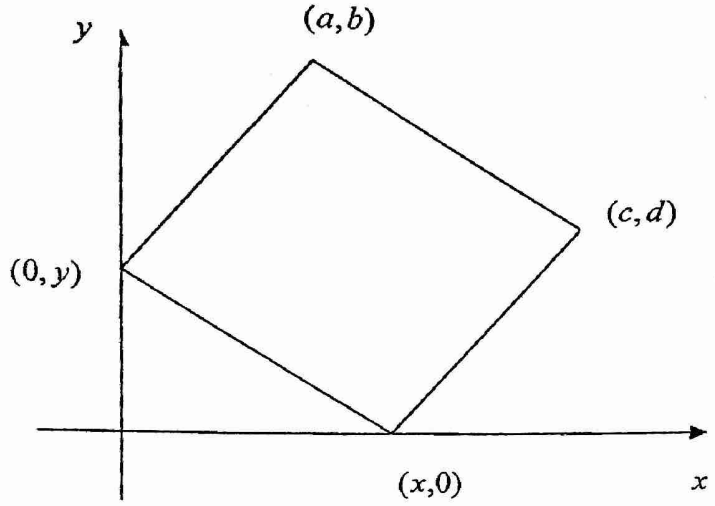
(b) The diagram shows a square of side 6cm containing two overlapping equilateral triangles. Calculate the distance AB.



6. (i) On a co-ordinate grid, a square has two adjacent vertices at (4,0) and (0,3). Find the positive co-ordinates of the remaining two vertices.

(ii) As shown in the diagram below, the vertices of a square are $(x,0),(0,y),(a,b)$ and (c,d).

If $a+b=20$ and $c+d=16$, find the value of $x+y$.



7. A group of schools are planning a hockey tournament where in each week each team will play only one game. (It may be necessary for a team to sit out).
The tournament starts with 4 schools, *A*, *B*, *C* and *D*.

Week 1: *A* plays *B*, *C* plays *D*. Two pitches are used
Week 2: *A* plays *C*, *B* plays *D*. Two pitches are used
Week 3: *A* plays *D*, *B* plays *C*. Two pitches are used.

The tournament is finished when every team has played every other team once.

Copy and complete the following table and give any general rules that you discover.

Number of teams	Number of weeks needed	Number of pitches each time
4	3	2
5		
6		
7		

End of examination, now go back and check your answers