

MARLBOROUGH COLLEGE

ENTRANCE & FOUNDATION SCHOLARSHIPS EXAMINATIONS 2004

Mathematics I

Compulsory Paper

TUESDAY 2nd MARCH 2004

Time: 1 hour 30 minutes

Attempt all questions.

- 1.(a) Use your calculator to find, correct to two decimal places:

$$\frac{1.3^2 + 0.7^2 - 1.1^2}{2 \times 1.3 \times 0.7}$$

- (b) The formula $u = \sqrt{\frac{v^2 - 2E}{m}}$ is used to find the value of u

when $v = -8$, $E = 207$ and $m = 13.5$.
Give this value to three significant figures.

2. The currencies of three African countries are loms, rems and sims.
14 loms are worth exactly 30 rems and 93 sims are worth exactly 42 loms.
What is the smallest number of sims which could be converted into an exact whole number of rems?

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3. Solve the following equations, giving your answers as fractions where necessary:

(a) $3(4 - 2x) - 2(5 + 3x) = 8x$

(b) $5\sqrt{x} - 3 = 2 - \sqrt{x}$

(c) $(3 - 2x)^3 = 3^3/8$

(d) $\frac{1 - 3x}{3 - 2x} = \frac{-5}{6}$

(e) $\sqrt{x} + 3 = \frac{1}{\sqrt{x} - 3}$

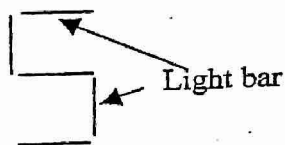
4. I have a list of ten numbers; all of them are positive whole numbers.
The largest is 3 times the smallest.
The mean is 7.7 and the median is 7.5
The mode is 5 and there is one different number that appears twice.
The probability of being greater than 10 is 0.2
The list contains only one square number.
Find the numbers in my list.

5. For this question, you will need to see the diagrams on the inserted sheet
The Boom is solid and is used to separate parts of the pool.

- (a) For the "competition setting". Calculate the volume of the pool and the number of litres it contains.
(One cubic metre holds one million cubic centimetres, and one litre is a thousand cubic centimetres)
- (b) For the "dual use" settings, how long will it take to fill the pool when changing from "Wednesday circus setting" to "swimming and sub aqua" if the water flows in at 240 cubic metres per hour. Give your answer in minutes.
- (c) For SCUBA training, the variable part of the floor is on hinges. The fixed part is 18m by 18m by 2m as shown in the left hand side of diagrams 2, 3 and 4. Assuming that the first section of the right hand side has a constant depth of one metre and the other two sections are inclined at the same angle, Calculate the height, x metres of the deepest depth if the total volume of water is to be 92% of the "competition setting".

6. (a) The clock in my hall (which does not have a second hand) says it is quarter past one. What is the acute angle between the hour hand and the minute hand?
- (b) Give a different time where the angle between the hands is the same as your answer to part (a).
- (c) My bedside alarm is digital and displays 24 hour clock time in hours and minutes. Each digit is made up of light bars:

For example 5 has 5 light bars as shown.



You are given that the digit 1 has two light bars, digits 4 and 7 have four light bars, digits 2, 3 and 5 have five light bars, digits 0, 6 and 9 have six light bars and digit 8 has seven light bars.

So when it is quarter past four in the morning, seventeen light bars are showing. At what time is the maximum number of light bars showing?

7. It is thought that when a snowball melts the volume of water is 30% less than the volume of the original snowball. What radius of snowball is required to produce 245 cm^3 of water? Give your answer to three significant figures.

[The formula for the volume of a ball is $\frac{4}{3}\pi r^3$, where r is its radius.]

8. There is a huge variety in the ways that you can pay for mobile phone use. Two ways are outlined here:

Pay as you go:

The phone costs £79.95, text messages cost 12p each and all calls cost 30p per minute.

Contract:

Monthly rental £13.99, no fee for the phone, text messages cost 10p each and all calls cost 5p per minute. The minimum contract is one year.

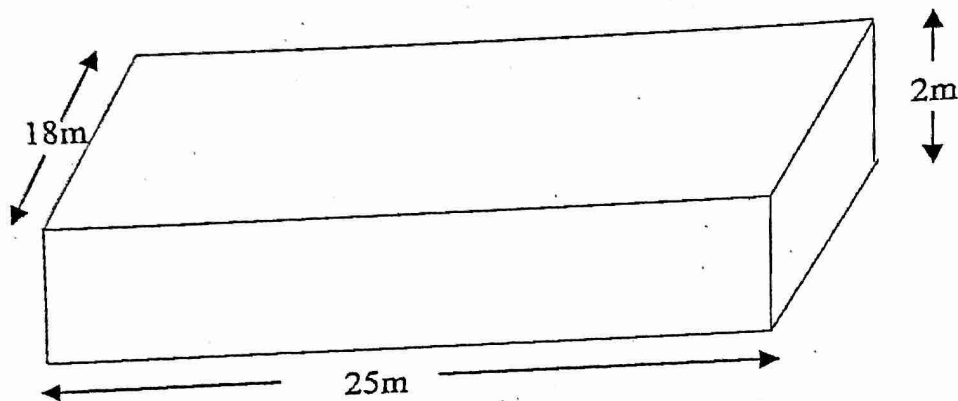
Rose has a monthly contract and sends 50 texts per month, what time on calls should she spend over a year to make having a contract rather than pay as you go worthwhile?

End of examination please check your answers carefully.

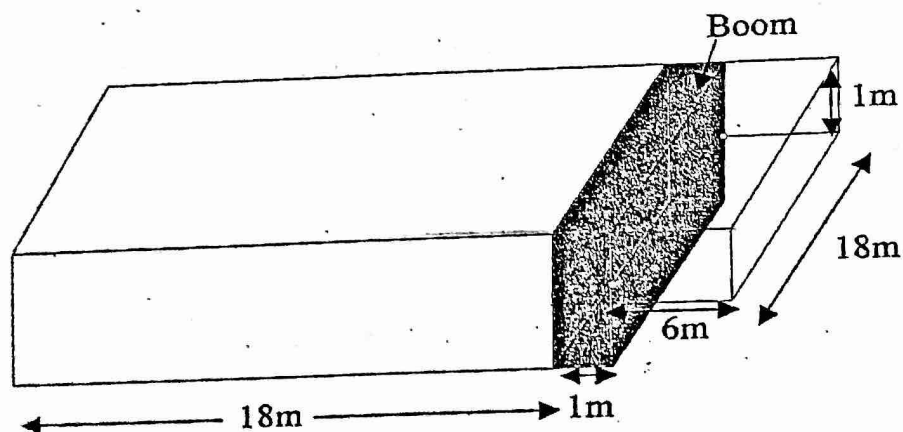
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Here are four examples, they are not to scale:

1. Competition dimensions for matches.



2. Dual use - Wednesday Circus setting

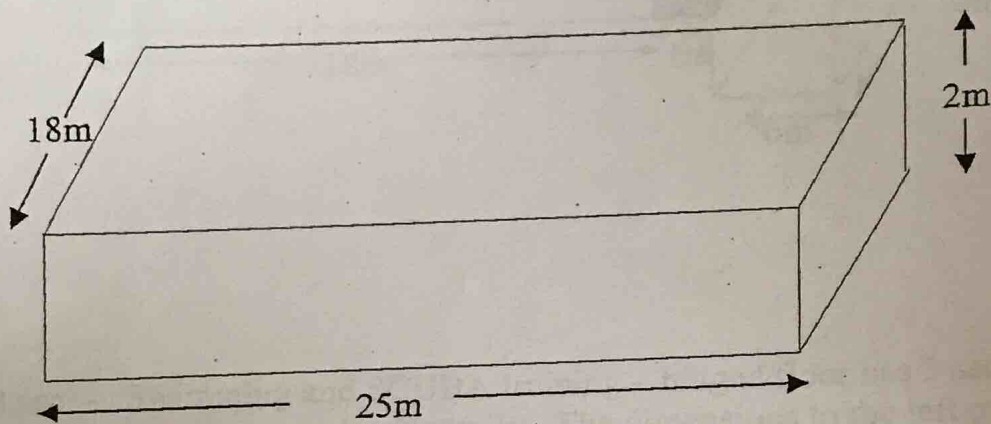


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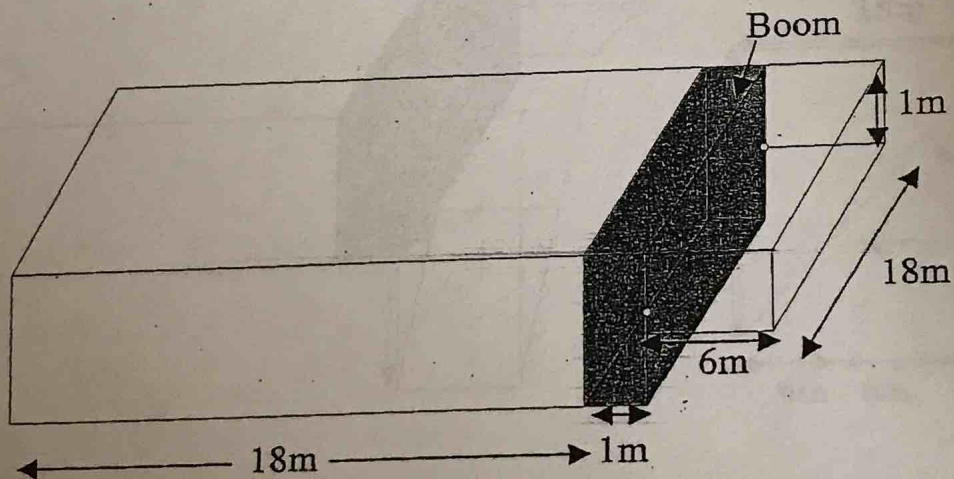
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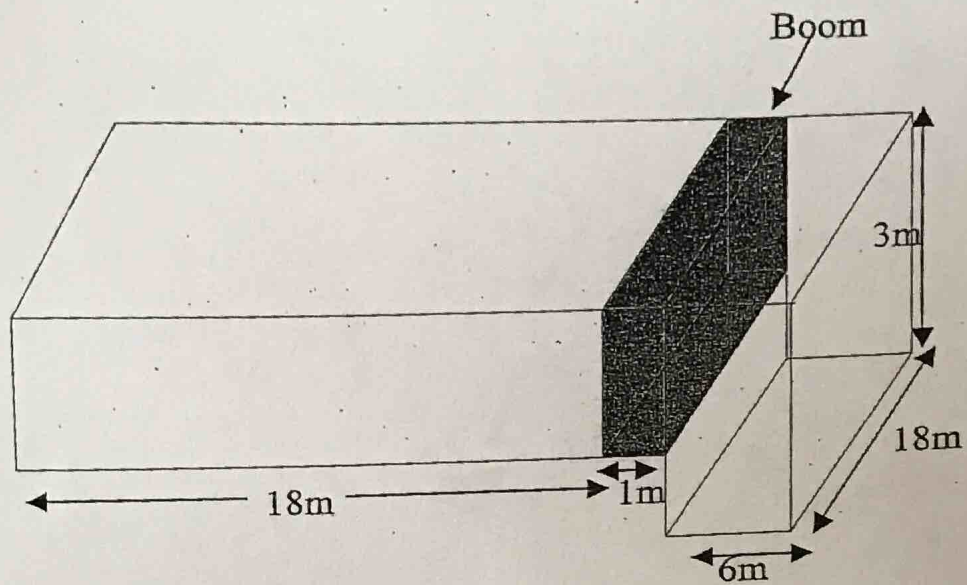


2. Dual use - Wednesday Circus setting



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3 Dual use - Swimming and sub aqua setting



4. Dual use - Swimming and SCUBA training - hinged floor has 3 sections with hinges which are 6m apart horizontally. The dimensions to the left of the boom are as above.

