RADLEY COLLEGE
Entrance Scholarships

MATHEMATICS I

Friday 15th February 2002

Time allowed $1\frac{1}{2}$ hours

You may try the questions in any order and are not expected to complete them all.

Show all working.

1. (No calculating aids are to be used in this question)

   a) Work out exactly

   i) 9.31×60.8

   ii) $17.429 \div 2.9$

   b) Give the answers to the following as fractions in their simplest form

   i) $\frac{3}{20} + \frac{1}{4}$

   ii) $3\frac{4}{5} \times 3\frac{3}{4}$

   iii) $\left(3\frac{1}{4} - 2\frac{1}{2}\right) \div 1\frac{1}{8}$

   c) Give the answers to the following in standard form.

   i) $\left(4.6 \times 10^{-6}\right) - \left(7.1 \times 10^{-7}\right)$

   ii) $\left(2 \times 10^{-7}\right) \times \left(9 \times 10^{2}\right)$

   iii) $\left(7.2 \times 10^{-3}\right) \div \left(6 \times 10^{-5}\right)$

2. (No calculating aids are to be used in this question)

Work out as simply as possible

a) $863^2 - 137^2$

b) $(54 \times 67) + 67^2 - (67 \times 21)$

c) $(42 \times 65) - (19 \times 35) + (65 \times 23) - (16 \times 35)$

d) $\dfrac{701 \times 361 - 361^2}{170 \times 36.1}$

3. a) Multiply out and simplify

i) $(3a - 2b)(a + 2b)$

ii) $(x - 2y)(x^2 + 2xy + 4y^2)$

b) Factorise fully

i) $18a^2b - 24ab^2$

ii) $5x^2 - 20y^2$

iii) $2x^2 - x - 1$

c) Simplify

i) $\dfrac{4a^2}{8a^3 - 12a^2}$

ii) $x^3 \div \left(\dfrac{x}{y^4}\right)$

4. Solve each of these equations for x

a) $3(4x - 1) - 4(2x + 1) = 13$

b) $7x^2 - 13 = 15$

c) $\dfrac{24}{x - 6} + 5 = \dfrac{64}{x - 6}$

d) $(x + 5)(x - 1) - (x + 1)^2 = 2$

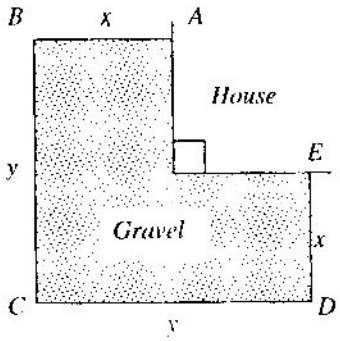
5. Rearrange each of the following formulae to make x the subject

a) $ax + b = c$

b) $\frac{x - a}{x \quad b} = c$

c) $\sqrt{x + a} = b$

6.



The diagram shows the right-angled corner of a house. The owner wishes to place gravel in the symmetrical L shaped region as shown above. $AB = DE = x\ m$, and $BC = CD = y\ m$.

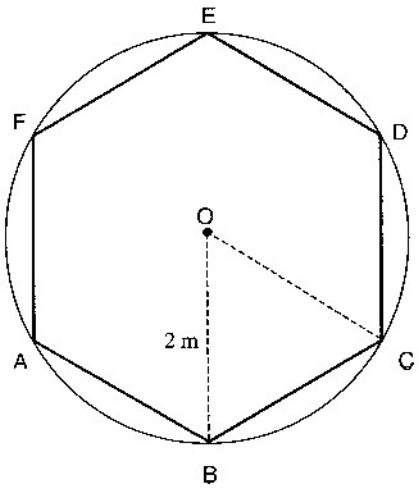
You are given that the distance $ABCDE = 24\ m$, and that the area of the gravelled region is $48\ m^2$.

a) Derive the equations
$x + y = 12$
$2xy - x^2 = 48$

b) Hence show that $x^2 - 8x + 16 = 0$

c) Solve the above equation for x.

7.



The diagram shows a circle of radius 2 m. A regular hexagon, $ABCDEFA$, is drawn inside the circle as shown above.

a) What can you say about triangle OBC?

b) Calculate the perimeter of the hexagon.

c) Calculate the perimeter of the circle, leaving your answer as a multiple of π

d) Show that the ratio

(perimeter of hexagon) : (perimeter of circle) = 3 : π

e) Find, in a similar form, an expression for the ratio

(area of hexagon) : (area of circle).

8. The following assertions are claimed to be true for all positive integers n. Some are always true, and some are sometimes false. For those which are always true, explain why. For those which are sometimes false write down a value of n to show this.

1.	n^2+1	is always odd
2.	n^2+n	is always even
3.	$2n+1$	is always odd
4.	n^3-1	is always prime
5.	n^3-n	is always a multiple of six
6.	n^2+n+11	is always prime