

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) $(4.6 \times 10^{-6}) - (7.1 \times 10^{-7})$
 - ii) $(2 \times 10^{-7}) \times (9 \times 10^2)$
 - iii) $(7.2 \times 10^{-3}) \div (6 \times 10^{-5})$

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

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) $\frac{4a^2}{8a^3 - 12a^2}$
 ii) $x^3 + \left(\frac{x}{y^4}\right)$

4. Solve each of these equations for x

- a) $3(4x - 1) - 4(2x + 1) = 13$
 b) $7x^2 - 13 = 15$
 c) $\frac{24}{x - 6} + 5 = \frac{64}{x - 6}$
 d) $(x + 5)(x - 1) - (x + 1)^2 = 2$

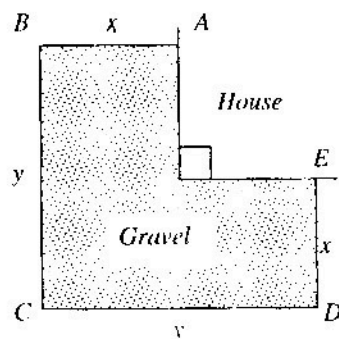
5. Rearrange each of the following formulae to make x the subject

a) $ax + b = c$

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

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. $AB = DE = x \text{ m}$, and $BC = CD = y \text{ m}$.

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

a) Derive the equations

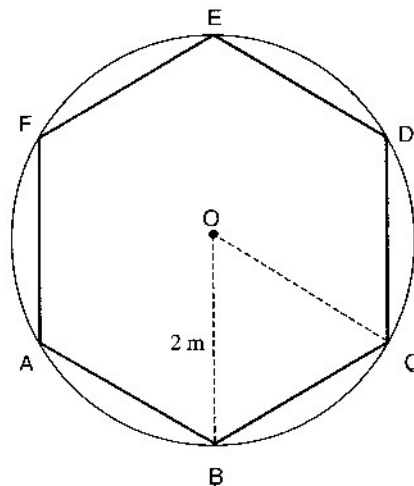
$$x + y = 12$$

$$2xy - x^2 = 48$$

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, $ABCDEF$, is drawn inside the circle as shown above.

- What can you say about triangle OBC ?
- Calculate the perimeter of the hexagon.
- Calculate the perimeter of the circle, leaving your answer as a multiple of π
- Show that the ratio

$$(\text{perimeter of hexagon}) : (\text{perimeter of circle}) = 3 : \pi$$

- Find, in a similar form, an expression for the ratio

$$(\text{area of hexagon}) : (\text{area of circle}).$$

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