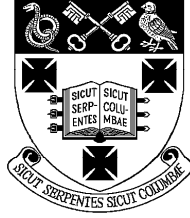


RADLEY COLLEGE
Entrance Scholarships



MATHEMATICS II

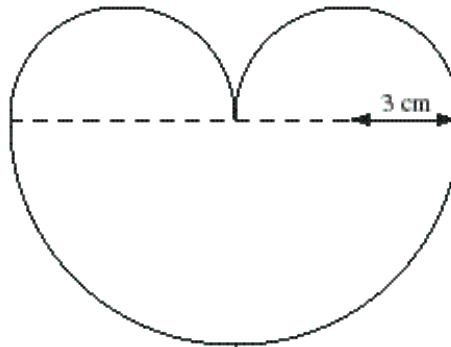
Thursday 9th March 2000

Time allowed - 2 hours

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

Show all working.

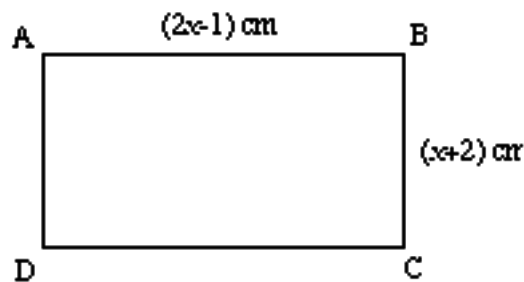
1. A badge consists of two semicircles of radius 3 cm attached to a semicircle of radius 6 cm as in the diagram below



- a) Calculate the perimeter of the badge,
b) Calculate the area of one face of the badge.
2. In June I bought three apples and four oranges and paid £1.24. In August the cost of apples and oranges had each risen by 4p per fruit. I bought two apples and five oranges and paid £1.86.
- a) How much could I have saved by buying those fruit which I bought in August in June?
b) Use simultaneous equations to calculate the cost of one apple in June.

3. I invest £100 in a bank which pays 10% compound interest. This means that after one year my money is worth £110, and after two years it is worth £121.
- How much is my money worth after three years?
 - How much is my money worth after five years?
 - After how many years will my money be worth more than £1000?
- (You are advised to try to find a quick method for part (c))

4. The diagram shows a rectangle ABCD with lengths of sides given in terms of x

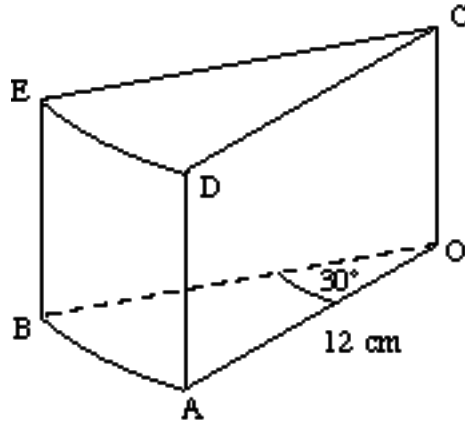


Using algebra

- Find the value of x such that the perimeter of the rectangle is 32 cm.
 - Find the value of x such that the rectangle is a square.
 - Find the value of x such that the area of the rectangle is $(2x^2)\text{cm}^2$.
5. A man sets off to bicycle from Oxford to Cambridge, a distance of 100 miles. He averages a speed of v miles per hour. Three hours after the man has started his bicycle ride his wife sets off to complete the same journey. But she drives, and her speed in her car is on average 30 mph faster than her husbands' speed on his bicycle.
- Write down, in terms of v , expressions for
 - the time taken for the man to cycle to Cambridge
 - the time taken for the woman to drive to Cambridge
 - Hence write down an equation for v , and show that it simplifies to

$$v^2 + 30v - 1000 = 0$$
 - Solve this equation to find the value of v .

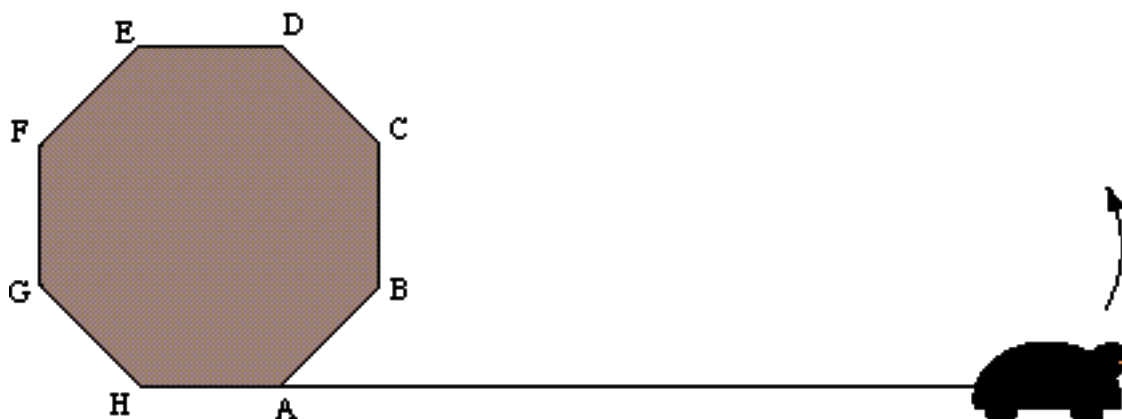
6. The Radley College Scholarship Beetle is tackling a wedge of cheese, as shown below



OAB rests on a horizontal table with C directly above O , D directly above A and E directly above B . OAB is a sector from a circle of radius 12 cm and angle 30° . $OC = AD = BE = 9\text{ cm}$. The Radley College Scholarship Beetle is at A and waits to get to E . Find how far it goes to it.

- follows the edges from A to O to C to E .
 - crawls straight across the surface from A to C and then along the edge from C to E .
 - crawls around the edge from A to B , and then up the edge from B to E .
 - crawls over the curved surface $ABED$ from A to E by the shortest route possible.
- 7.
- A groundsman wishes to roll a cricket pitch which is 22 yards long. If $1\text{ m} = 1.09$ yards calculate the pitch length in metres, giving your answer to 2 significant figures.
 - The cylindrical roller that he uses is of diameter 0.7 m . Calculate how many turns, to the nearest whole number, that the roller will make each time he rolls the length of the pitch once.
 - At the end of the season he wishes to repaint the roller. Calculate the area, including the ends, that will need to be covered if the roller is 1 m long, giving your answer to 1 decimal place.
 - If the tin of paint he uses says that it will cover 5 m^2 what percentage of the paint should he have left, again giving your answer to 1 decimal place.

8. The Radley College Scholarship Tortoise is tethered from a corner A at a box of octagonal cross-section as shown below. The octagon is regular with sides of length 2m.



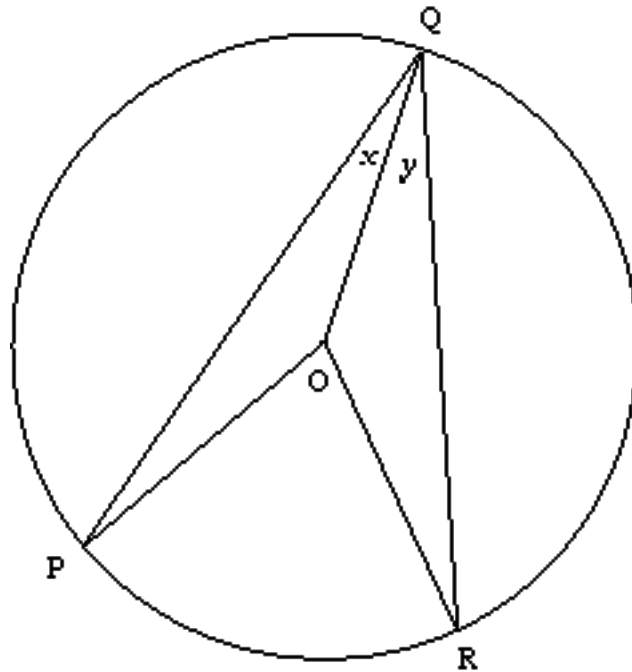
As usual, the box is placed on a large lawn. The length of the string, AT is 8m.

- Initially H , A and T lie on a straight line, with the string taut. The tortoise sets off in an anticlockwise direction keeping the string taut. How far does he walk before bumping into the box at E ?
 - If, instead, the tortoise is able to let the string go slack find the total area of Hi grass which he is able to reach.
9. A new mathematical symbol “ \sim ” has been invented. It has been decided that for any two numbers x and y , “ $x \sim y$ ” means $3x = 2y$.

Given that x and y are non-zero whole numbers (not necessarily positive) and that $x \sim y$, decide, giving a reason, which of the following statements are true and which are false:

- x must be an even number.
- y must be an odd number.
- x must be bigger than y .
- x must be smaller than y .
- $6x = 4y$.
- y^2 is bigger than x^2 .

10.



PQ and R are points on the circumference of a circle. O is the centre of the circle.

$$\angle PQQ = x \quad \angle RQQ = y$$

Give your answers in terms of x and y and stating reasons.

What is

- i) $\angle QPO$
- ii) $\angle POQ$
- iii) $\angle QRO$
- iv) $\angle ROQ$
- v) $\angle POR$

What do you notice about the relationship between $\angle POR$ and $\angle PQR$?

11. A visitor to the millennium dome walks through a grand entrance hall and is given a choice of entry into one of three zones A, B or C. After visiting each zone the visitor has to go back into the entrance hall before entering another zone.

One visitor, Joe Bloggs, decides to tick off each zone after he has visited it. Given that his tick list ensures that no zone is visited more than once, what is the probability that he

- a) she selects zones A, B, C in that order?
- b) she doesn't select zone A as any of her three choices?

12. In an exam a candidate is asked to draw a graph for each of the following equations

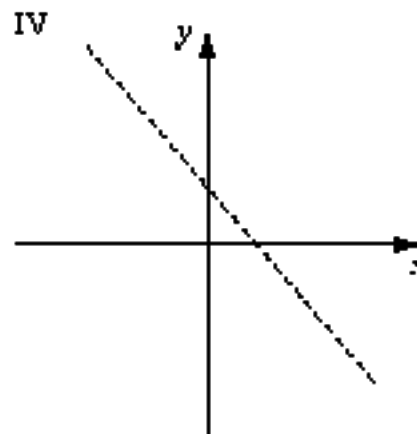
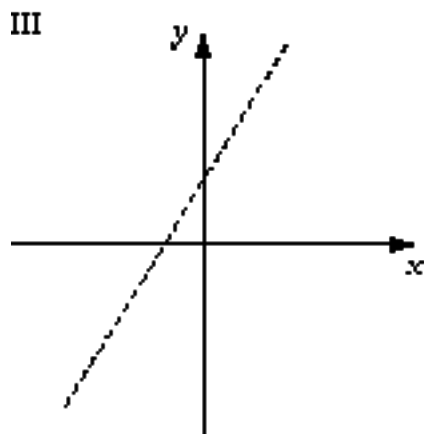
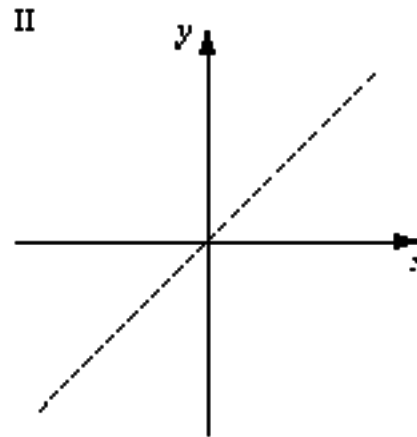
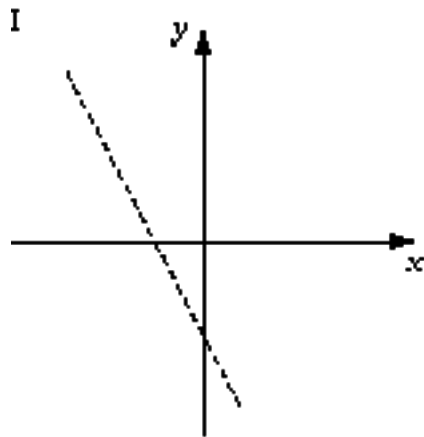
A. $y = 2x$

B. $y = 2x - 3$

C. $2x + y = 5$

D. $2x - y = 7$

A poor candidate submits the following diagrams I, II, III, IV



A kind examiner decides that three of the candidate's graphs could correspond to three of the equations, in some order, but that one graph has no possible equation from the list, A, B, C, D above

- Identify the three graphs which the examiner has allowed, and attach them to their equation.
- Sketch a graph for the equation which is left over.
- Suggest an equation for the graph which is left over.

