Entrance Scholarships

MATHEMATICS II

1st March 2012

Time allowed 1 hour

Show all working.

You may use a calculator

RADLEY

1. Every year the value of a car depreciates by 20%. I buy a car for £20,000

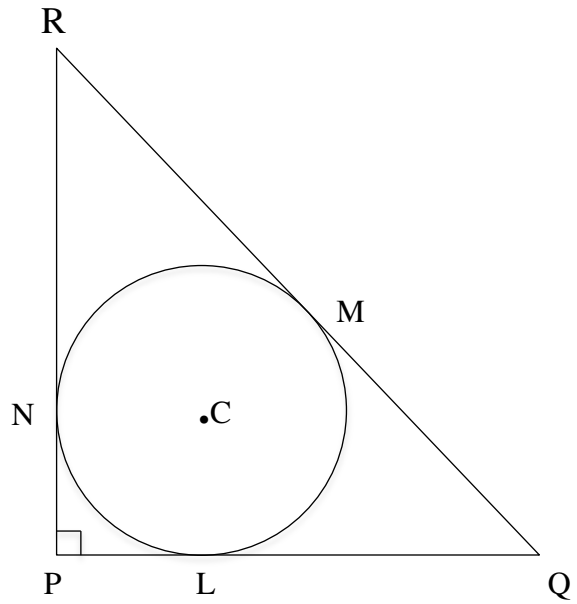
(a) How much is it worth after 1 year?

(b) How much is it worth after 2 years?

(c) How much is it worth after 5 years?

(d) How many whole years does it take until it is worth less than £1000?

2.



The diagram shows a circle, centre C, that just fits inside a right-angled, isosceles triangle, PQR. The circle touches the triangle at L, M and N. The length RQ = 2cm.

(a) Write down the length MQ.

(b) Write down the length LQ

(c) Use Pythagoras's Theorem to show that PQ = $\sqrt{2}\ cm$

(d) Write down the radius of the circle

(e) Show that the ratio

(area of a triangle PQR) : (area of circle centre C) = 1 : $\pi(3 - 2\sqrt{2})$

3. Solve the following equations for x and y

(a) $2^x \times 2^5 = 2^9$

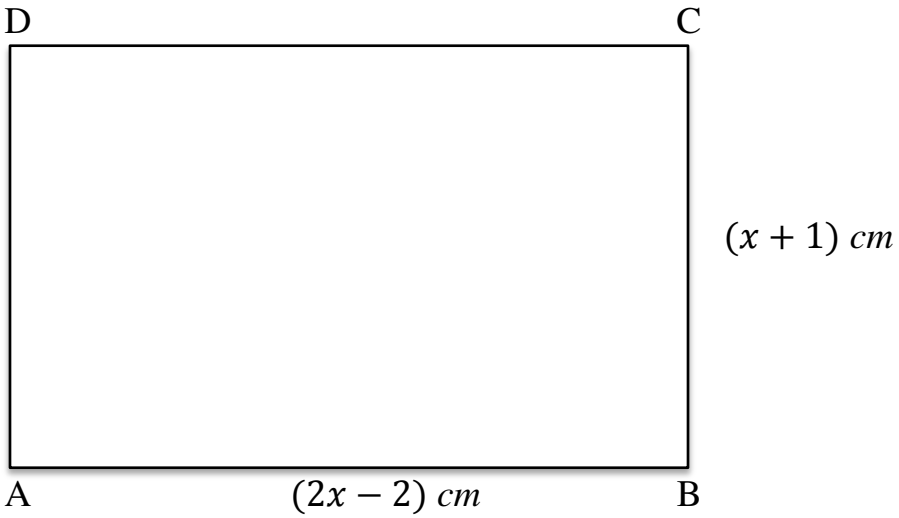
(b) $\frac{2^4}{2^x} = 2^{-6}$

(c) $2^{x+1} \times 2^{3x-4} = 2^{7-x}$

(d) $2^x \times 2^y = 2^9$
$2^{3x} \times 2^{-y} = 2^7$

(Note: in part (d) there are two equations to be solved simultaneously, so you need to give a value for x and a value for y).

4.



ABCD is a rectangle in which AB = $(2x - 2)$ *cm* and BC = $(x + 1)$ *cm*.

(a) If the perimeter of the rectangle is $50\ cm$, find x

(b) If the area of the rectangle is $198\ cm^2$, find x

(c) If the length AC = $10\ cm$, write down an equation and show that

$(5x + 19)(x - 5) = 0$ and hence find x.

5. (a) Copy and complete the following table:

x	2	3	4	5	6	7	8	9	10
x^3	8	27							1000
$x^3 - 1$	7	26							999

(b) Copy and complete this table as well:

x	2	3	4	5	6	7	8	9	10
$x^2 + x + 1$	7	13							111

Use your tables to answer parts (c) – (f)

(c) Calculate $\frac{2^3-1}{2^2+2+1}$

(d) Calculate $\frac{3^3-1}{3^2+3+1}$

(e) Calculate $\frac{4^3-1}{4^2+4+1}$

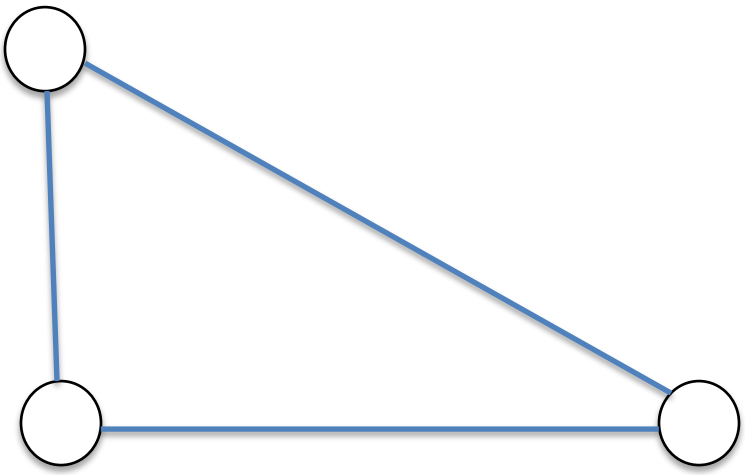
(f) Calculate $\frac{10^3-1}{10^2+10+1}$

(g) Calculate $\frac{1000^3-1}{1000^2+1000+1}$

(h) Write down a formula that summarises all of the above calculations.

(i) Justify your formula.

6. I have three discs, and I want to colour them red, blue or green. These discs are connected by three pieces of string, as shown in the diagram below



All of the discs are to be coloured

(a) In how many different ways is it possible to do this, if those discs that are at either end of a piece of string have to be of different colour?

(b)



In how many ways is this possible if I use only two pieces of string, as shown above?

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