RADLEY

Entrance Scholarships

MATHEMATICS II

March 2015

Time allowed: 1 hour

Show all working. You may use a calculator

1. A coat is advertised at an original price of £100. The price increases by 10%

(a) What is the new price?

In a sale this new price is discounted by 10%

(b) What is the sale price?

(c) Express the sale price as a percentage of the original price

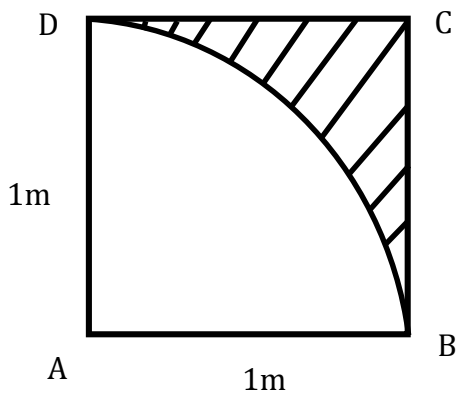
Another item in the shop has a price rise of 20%, and that new price is then discounted by 20% in the sale.

(d) Express the sale price as a percentage of the original price.

A third item has a price rise of x %, and that new price is then discounted by x % in the sale.

(e) Given that the sale price is 19% of the original price, find x.

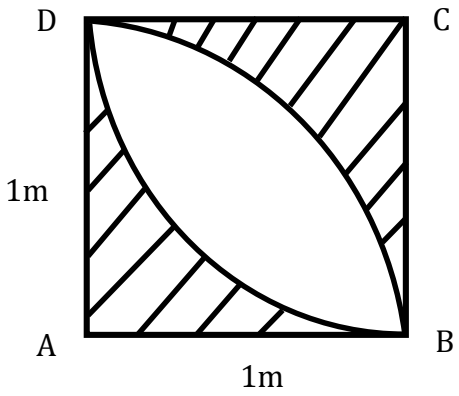
2.



ABCD, a square of side 1m, is split into two regions by drawing a quarter-circle centre A, radius 1m, as in the diagram above. The quarter-circle is unshaded. Leaving all of your answers in terms of π

(a) Calculate the area of the quarter-circle

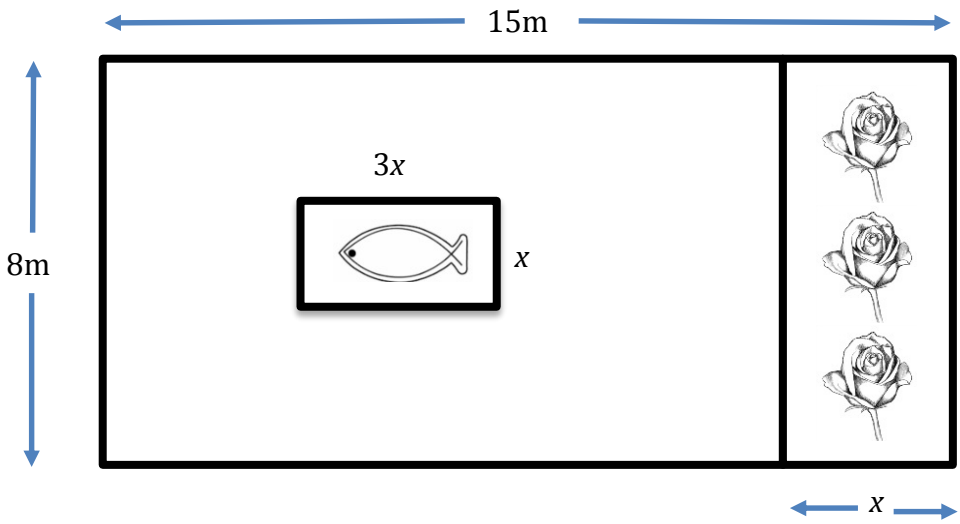
(b) Calculate the area of the shaded region.



Another quarter-circle of radius 1m is added as in the diagram above

(c) Calculate the area of the unshaded region.

3.



The diagram shows a rectangular garden that is 15 metres long by 8 metres wide.

Along one side is a rose bed that is x metres wide.

In another part is a fish pond that is $3x$ metres long by x metres wide.

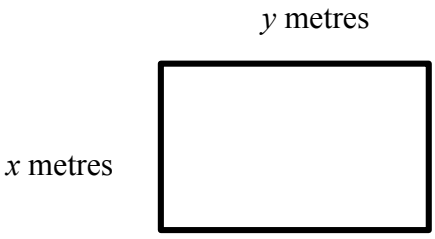
The rest of the garden is lawn.

(a) Given that the area of the lawn is 104 m^2, write down an equation for x, and deduce that

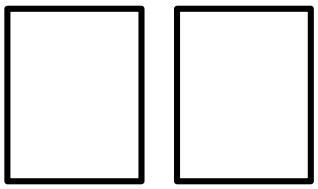
$$(3x - 4)(x + 4) = 0$$

(b) Hence find the value of x.

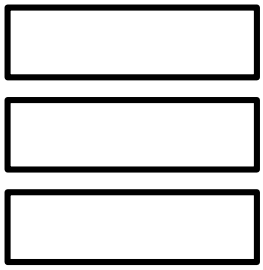
4.



The diagram above shows a rectangle that is x metres wide by y metres long.



When the rectangle is cut vertically down the middle it makes two identical new rectangles, as in the diagram above. The perimeter of each new rectangle is 109 cm.



When the original rectangle is cut horizontally into three identical new rectangles, the perimeter of each new rectangle is 138 cm.

Use simultaneous equations to find the values of x and y.

5. For an integer, n, the product of all the integers between 1 and n is denoted by $n!$

So, for example, $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$

and $3! = 3 \times 2 \times 1 = 6$

(a) Calculate $\frac{3!}{2!}$

(b) Calculate $\frac{4!}{3!}$

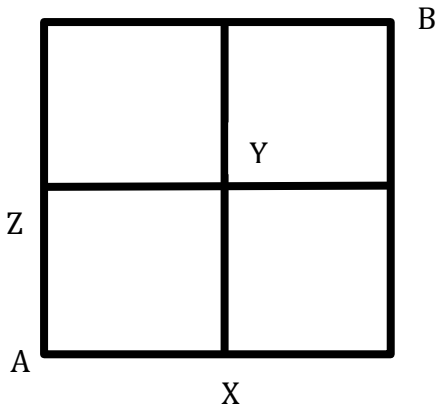
(c) Calculate $\frac{5!}{4!}$

(d) Calculate $\frac{100!}{99!}$

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

(f) Justify your formula.

6.



A town has only straight roads, and each of these roads runs north / south or east / west.

You are at point A and want to get to B.

You walk along the roads, and can only walk in an easterly or a northerly direction.

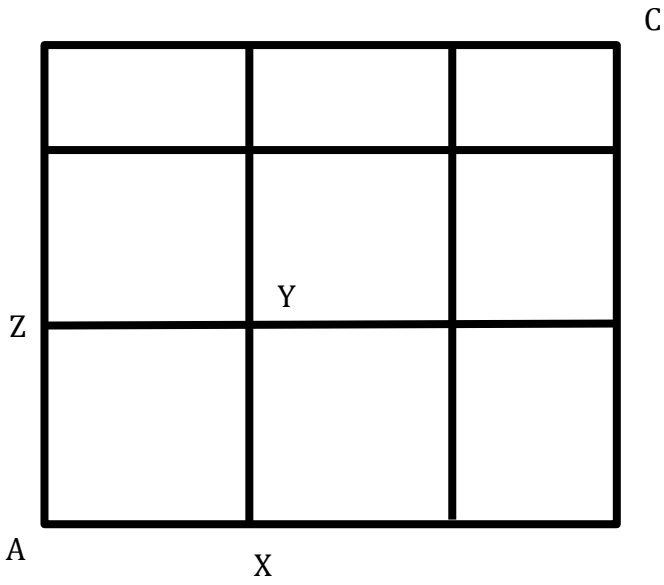
X, Y and Z are junctions on your journey.

(a) Show that there are three possible routes from X to B.

(b) Write down the number of possible routes from Y to B.

(c) Write down the number of possible routes from Z to B.

(d) Hence deduce the total number of possible routes from A to B.



Suppose you now want to get from A to C

(e) Making your method clear, work out how many different routes are possible.