Transformations - Extension Questions

1) Draw x and y axes and label them from -8 to 8 on each axis. Draw the triangle T with vertices (4,2), (8,3) and (6,5).

This question is concerned with the following eight transformations:

I = the identity transformation (ie "don't move the shape at all")
P = rotation 90° anticlockwise around the origin
Q = rotation 180° around the origin
R = rotation 90° clockwise around the origin
X = reflection in the x-axis
Y = reflection in the y-axis
J = reflection in the line y = x
K = reflection in the line y = -x

To save space, we write "the image of T after the transformation P" as P(T)
So "the image of P(T) after the transformation X" can be written as X(P(T))

(a) Plot P(T) and Y(P(T)). Which of the above transformations has the same effect as P followed by Y? (ie which transformation would take T directly to Y(P(T))?)
(b) Plot Q(T) and Y(Q(T)). Which of the above transformations has the same effect as Q followed by Y? (ie which transformation would take T directly to Y(Q(T))?)
(c) Draw up the following table, which shows the effect of combining the above transformations in all possible ways, and fill it in. (The results from parts (a) and (b) have been filled in for you, and so have one or two more.)

		Second Transformation							
		I	P	Q	R	X	Y	J	K
	I			Q					
	P						J		
First	Q						X		
Transformation	R								
	X					I			
	Y								
	J								
	K								

(d) These 8 transformations are called a 'GROUP'; their 'combination table' has certain similarities with a multiplication 'tables square'. Look at the table and note down:
(i) any ways in which it is like a tables square
(ii) any ways in which it differs from a tables square
(iii) any patterns you notice; can you explain them?

2) (a) P^2 means "P followed by P". Write down the single transformation which is equivalent to (i) P^2 (ii) P^3 (iii) P^4 (iv) P^5
   (b) The ORDER of a transformation S is the lowest power n for which S^n is the identity element I. Write down the order of each of the transformations in the table above.
   (c) What can you say in general about the order of (i) reflections (ii) translations (iii) rotations?