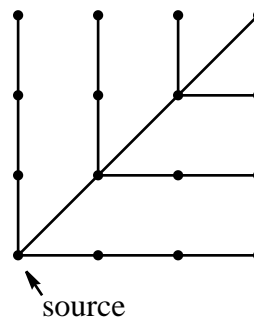Please show your work on all questions

    1.

The diagram on the right shows a branch-
ing structure which distributes nutrients
from the source at the lower corner to
points on a square grid. Find the total
length of the branches and the average dis-
tance of each point from the source. Show
your working.

source

2. Suppose the primordia of a flower emerge and grow out radially with a constant divergence
   of angle of 70°.

   (a) Write the angle 70° as a fraction of a complete revolution in simplest terms.

   (b) How many straight line parastichies would emerge in this growth pattern?

   (c) Express this fraction as a continued fraction.

(d) Find an approximation to the continued fraction and hence write down how many curved parastichies you would expect to see.

3. The rectangle below grows isometrically by adding gnomons.
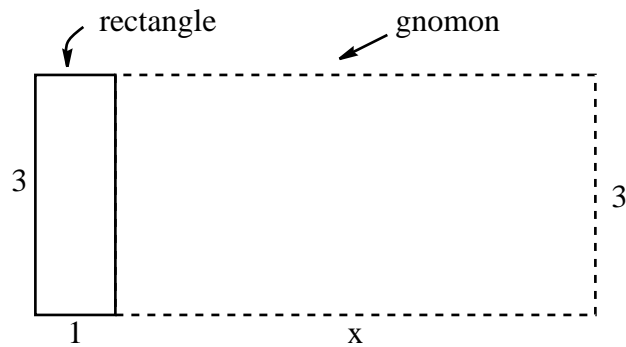
(a) What is the meaning of the term gnomon?

(b) One possible gnomon is shown. Find the dimensions of this gnomon (find x).

(c) Draw two other shapes that could be used as gnomons to this rectangle instead.

4. (a) What are the symmetry groups of the figures below. (you do not need to make a group table).

   (b) Describe what the symmetries are in words.

   (c) Draw lines or shapes on the figures to *increase* the number of symmetries and write down what the new symmetry group is.
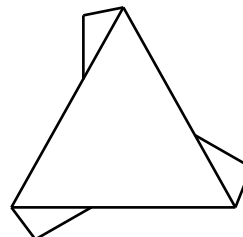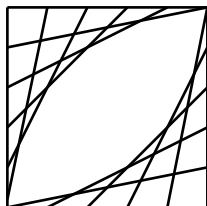
5. Draw two different figures that demonstrate each of the symmetry groups below.

   (a) C_8

   (b) D_5

   (c) C_3