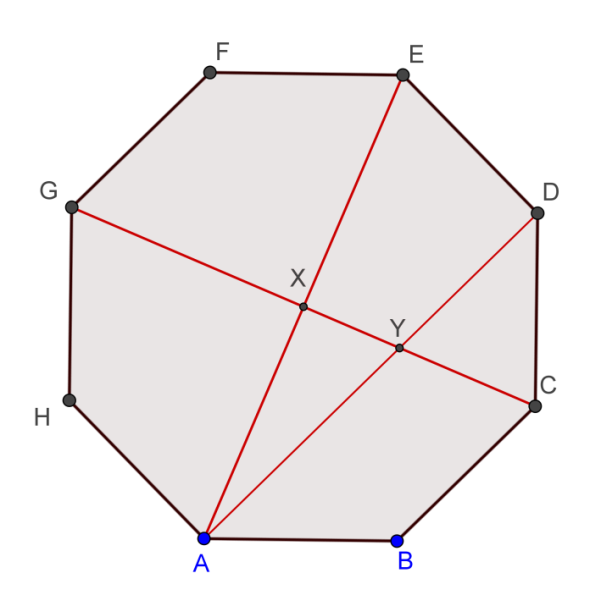
**Polygons**

**1.** (Warm-up on Pythagoras Theorem)

Given a regular octagon ABCDEFGH with

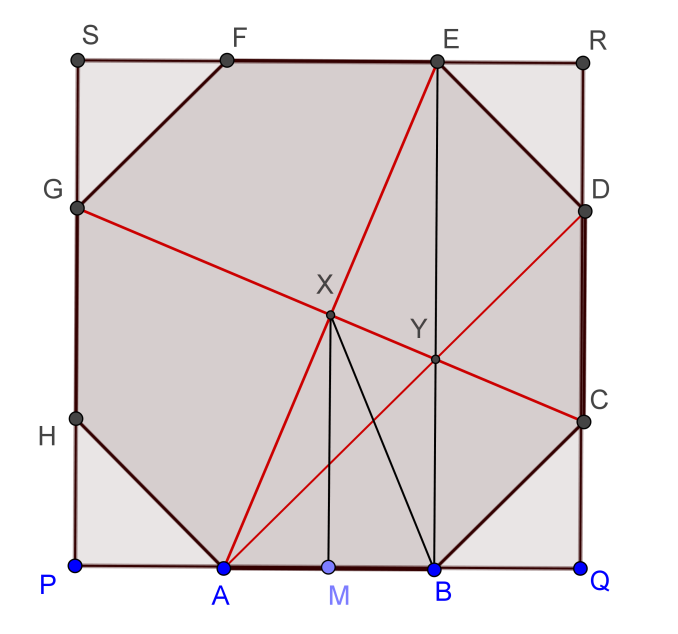
sides 2 cm.

**(a)** If AE intersects CG at X.

Find the length of AX.

**(b)** If AD cuts CG at Y.

Find the length of XY.



**1. (a)** Draw a square outside touching the sides of the octagon as in the diagram.

It can be seen that X is the centre of both

the octagon and the square.

By Pythagoras Theorem on ,

So the side of the square is .

By Pythagoras Theorem on ,

**cm**

**(b)** Note that is right angled and .

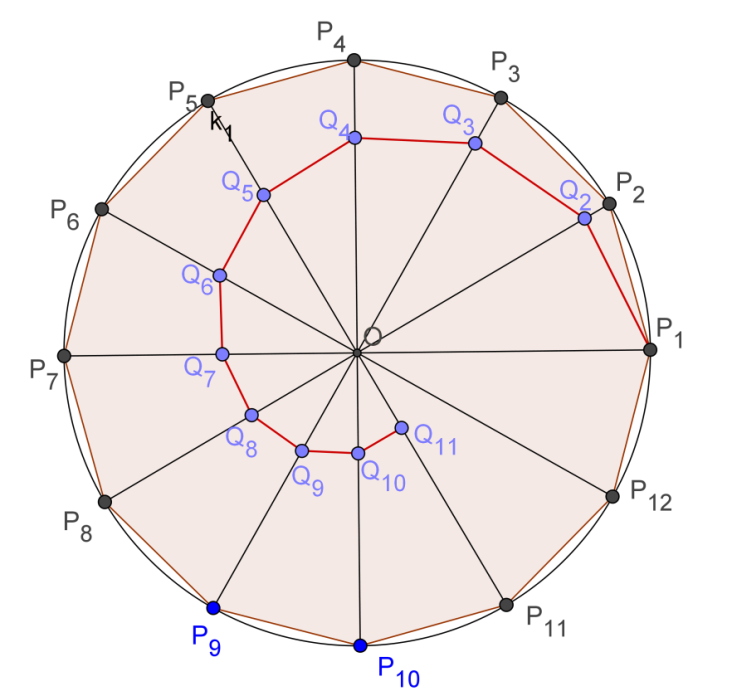
By Pythagoras Theorem,

Note that AE is perpendicular to CG.

Apply Pythagoras Theorem on .

**cm**

**2.** A dodecagon of is placed inside a circle of radius 1 cm, and the twelve dividing points are joined to the circle's centre, producing twelve rays. Starting from a segment is drawn perpendicular to the next ray in the anti-clockwise sense; and from the foot of this perpendicular another perpendicular segment is drawn to the next ray, and so on forever.

** Taking** .

**(a)** Find the limit of the sum of the lengths of these segments:

**(b)** Find the limit of the area of the triangles :

.

**(c)** (For more able students)

Instead of starting with the circle divided into twelve equal parts, we now to divide it into n equal parts. Let .

**(i)** Find the sum of the lengths:

**(ii)** Find the limit of the area of the triangles :

**2. (a)** Consider the triangle .

Let .

Then

Sum of the lengths:

, which is an infinite geometric series

, where the common ratio .

cm

**(b)**

The limit of the area of the triangles :

, where the common ratio

cm

**(c) (i)** Consider the triangle .

Let .

Then

Sum of the lengths:

**(ii)** Note that :

The limit of the area of the triangles :

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