Solution

Method- 1

Let the point of intersection of the semicircles with AB & AC, be D & E respectively. Let the point of intersection of the two semicircles be F.

Join BE. $\angle AEB = 90°$ (angle inscribed in the semicircle)

Since, AB = BC, BE is therefore the perpendicular bisector of AC.

∴ E is the midpoint of AC. Similarly D is the midpoint of AB.

Join FE & AF

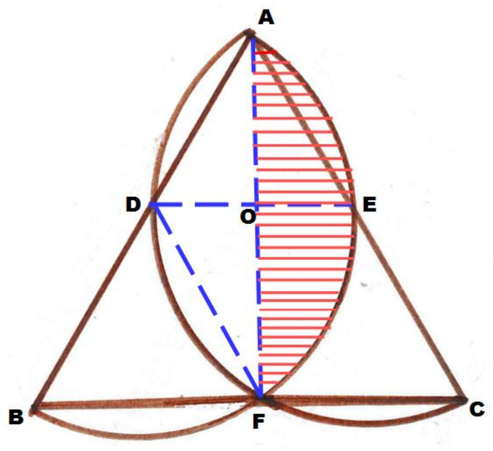
Both the semicircles will intersect at the midpoint of BC only.

If we assume that one semicircle intersects BC at F and the other semicircle intersects BC at F_1. Then we will get $\angle AFB = 90°$ and also $\angle AF_1B = 90°$.

∴ A F_1 and AF will always coincide and both the semicircles will intersect each other only at the midpoint of BC at F.

∴Δs ADE, DBF, CEF & DEF are all equilateral Δs with their side measurings 2.

∴ $\angle ADF = 120°$



The area of the shaded portion of above diagram is

Sector DAF - ΔADF

$= \frac{120}{360} \times \frac{22}{7} \times 2^2$ - ΔADF -----------------------1

Let AF & DE cut at O

ΔADF = ΔADO +ΔDFO

The angles of both the Δs are 30°, 60°, 90°

Since AD = 2,

OD = 1 ; and AO = $\sqrt{3}$

$\therefore$ ΔADF = $2\left(\frac{1\times\sqrt{3}}{2}+\frac{1\times\sqrt{3}}{2}\right)=\sqrt{3}$

$\therefore$ 1 ⟶ the shaded area = $\left(\frac{1}{3}\times\frac{22}{7}\times 2^2\right)$-$2\sqrt{3}$

= 4.19 – 1.732

= **2.46**

We have found half of the given shaded area

$\therefore$The area of the shaded portion = 2×2.46 = **4.92 units**

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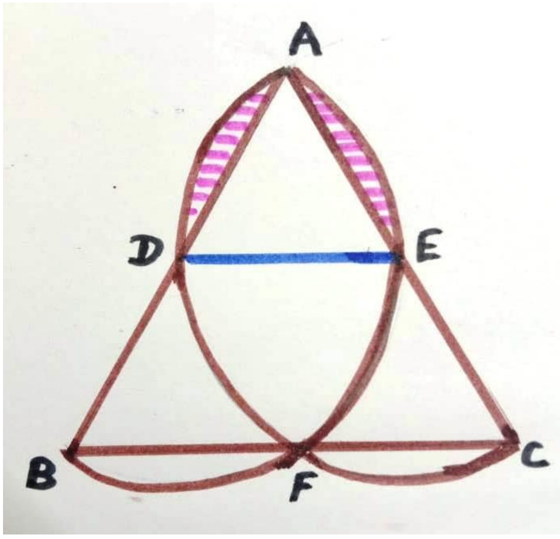
Method – 2

In the above diagram two shaded areas are there.

Let us find out the area of one of them.



Δ ADE is an equilateral Δ (Proved above).

One of the shade areas = sector EDA - Δ EAD

$= \left(\frac{60}{360}\times\pi\times 2^2\right)$-$\sqrt{3}\left(\frac{2^2}{4}\right)$

$= \left(\frac{1}{6}\times\frac{22}{7}\times 4\right)$-$\sqrt{3}$

$=\frac{44}{21}-\sqrt{3}$ **= 2.095-1.732 = 0.363**

There are two shaded areas.

$\therefore$ **Half of the area of shaded portion given in the problem**

= (2×0.363) + ΔADE

=(0.726 + $\sqrt{3}$)

= 0.726+1.732 = 2.458 = 2.46

$\therefore$ **area of given shaded portion = 2 × 2.46 = 4.92 units**

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- DR. M. RAJACLIMAX

FOUNDER CHAIRMAN