MENSURATION MC

Form 6
Vol 2

Part A – Basic Question

9. $AB = CD$ and $DF : FC = 1:2$

$\therefore DF : FC : AB = 1:2:3$

$\because DF : FC = 1:2$

$\therefore BG : GF = (2+1):(2+1+2) = 3:5$

$$\frac{\text{area of } \Delta BEG}{\text{area of } \Delta BCF} = \frac{3\times1}{8\times2} = \frac{3}{16}$$

$$\frac{\text{area of } \Delta ABE}{\text{area of } \Delta BCF} = \frac{3\times1}{2\times2} = \frac{3}{4}$$

Area of $ABFD$: Area of ΔBCF

$=(3+1):(0+2)$

$=2:1$

$\therefore$ Area of $ADFG$

$=$ Area of $ABFD -$ Area of $\Delta ABE +$ Area of ΔBEG

$= 2\times$ Area of $\Delta BCF - \frac{3}{4}$ Area of $\Delta BCF +$ Area of ΔBEG

$= 2\times\frac{16}{3}\times$ Area of $\Delta BEG - \frac{3}{4}\times\frac{16}{3}\times$ Area of $\Delta BEG +$ Area of ΔBEG

$= \frac{23}{3}\times$ Area of ΔBEG

$\therefore$ ratio of area of ΔBEG to area of $ADFG$

$=3:23$

10. $AD = BC$ and $BF : FC = 5 : 3$

$\therefore BF : FC : AD = 5 : 3 : 8$

$\because BF : FC = 5 : 3$

$\therefore AG : GF = (5+3) : (5+3+5) = 8 : 13$

$$\frac{\text{area of } \Delta AEG}{\text{area of } \Delta ABF} = \frac{8 \times 1}{21 \times 2} = \frac{4}{21}$$

Let a be the area of ΔAEG.

$$\frac{a}{a+20} = \frac{4}{21}$$

$$a = \frac{80}{17}$$

$\therefore$ area of $\Delta AEG = \frac{80}{17}$

area of $\Delta ABF = \frac{420}{17}$

$$\frac{\text{area of } \Delta ADE}{\text{area of } \Delta ABF} = \frac{8 \times 1}{5 \times 2} = \frac{4}{5}$$

area of ΔADE

$= \frac{420}{17} \times \frac{4}{5}$

$= \frac{336}{17}$

Area of $ADCF$: Area of ΔABF

$= (8+3) : (0+5)$

$= 11 : 5$

$\therefore$ Area of $DCFG$

$=$ Area of $ADCF -$ Area of $\Delta ADE +$ Area of ΔAEG

$= \frac{420}{17} \times \frac{11}{5} - \frac{336}{17} + \frac{80}{17}$

$= \frac{668}{17}$

Part B - Circle / Sector

2. Area of the shaded region

$$=\frac{1}{2}(2)^2\sin 60^\circ-3\times\frac{60^\circ}{360^\circ}\pi(1)^2$$
$$\approx 0.16125448$$
$$=0.161\text{ cm}^2$$

3. Perimeter of the shaded region

$$=8+(\sqrt{8^2+8^2}-8)+\frac{45^\circ}{360^\circ}2\pi(8)$$
$$\approx 17.59689381$$
$$=17.6\text{ cm}$$

Area of the shaded region

$$=\frac{1}{2}(8)^2-\frac{45^\circ}{360^\circ}\pi(8)^2$$
$$\approx 6.867258771$$
$$=6.87\text{ cm}^2$$

4. A

Area of the shaded region

$$=\frac{1}{2}(8)^2\sin 60^\circ-3\times\frac{60^\circ}{360^\circ}\pi(4)^2$$
$$\approx 2.580071692$$
$$=2.58\text{ cm}^2$$

5. (a)

$$\cos\angle AOB=\frac{OA^2+OB^2-AB^2}{2(OA)(OB)}$$
$$\angle AOB=120^\circ$$

(b) Area of the shaded region

$$=\frac{120^\circ}{360^\circ}\pi(6)^2-\frac{1}{2}(6)^2\sin 120^\circ$$
$$=(12\pi-9\sqrt{3})\text{ cm}^2$$

6. A

Consider sector OAB

Area of minor segment DB

$= \frac{60^\circ}{360^\circ}\pi(6)^2 - \frac{1}{2}(6)^2 \sin 60^\circ$

$= (6\pi - 9\sqrt{3})\ \text{cm}^2$

Area of the shaded region

$= 2 \times$ area of the shaded region OAD

$= 2\times\left[\frac{90^\circ}{360^\circ}\pi(6)^2 - \frac{60^\circ}{360^\circ}\pi(6)^2 - (6\pi - 9\sqrt{3})\right]$

$= 2(9\pi - 6\pi - 6\pi + 9\sqrt{3})$

$= (18\sqrt{3} - 6\pi)\ \text{cm}^2$

7. Let the radius be r cm.

Note that $XZ : BC = 1 : 2$ (mid-point thm.)

$2r = \frac{1}{2}\times 12$

$r = 3$

Area of the shaded region

$= \frac{1}{2}(\frac{12}{2})^2 \sin 60^\circ - \frac{120^\circ}{360^\circ}\pi(3)^2$

≈ 6.163679307

$= 6.16\ \text{cm}^2$

8. D

Denote the centre be O.

$OA = OC = 6$ cm and $AC = 6$ cm

$\therefore \Delta OAC$ is an equilateral triangle.

Area of the shaded region

$= \frac{1}{2}(6)^2 \sin 60^\circ + \frac{120^\circ}{360^\circ}\pi(6)^2$

≈ 53.28756911

$= 53.3\ \text{cm}^2$

9. C

Let $DC = r$ cm

$$2(\frac{60^\circ}{360^\circ}2\pi r + r) = 15$$

$$(\frac{2}{3}\pi + 2)r = 15$$

$$r \approx 3.663544828$$

$$r^2 \approx 13.4215607$$

$\therefore$ Area of the square = 13.4 cm^2