Mensuration-I Area of a Trapezium and a Polygon EX-20.1

①

MENSURATION – I

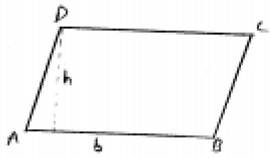
Exercise – 20.1

1. Given: Base (b) = 24 cm

$= 0.24\ m$ [∵ 1 m = 100 cm]

height (h) = 10 cm

$= 0.10\ m$



As we know

Area of Parallelogram

$(A) = b \times h\ m^2$

$= 0.24 \times 0.10$

$= 0.024\ m^2$

Each flooring tile area $= 0.024\ m^2$

let 'n' be no. of such tiles

∴ given $n \times A = 1080\ m^2$

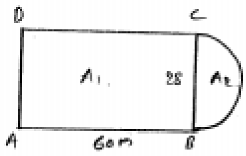
$\Rightarrow n \times 0.024 = 1080$

$\Rightarrow n = \frac{1080}{0.024} = 45000$

∴ The no. of such tiles which cover $1080\ m^2$ are 45,000.

2. Given Plot:

The area of given plot can be given as



$A = A_1 + A_2$

$A_1 =$ Area of Rectangle

$A_2 =$ Area of Semicircle.

2. — continued

A_1 = length × breadth {∵ area of rectangle = $l \times b$}.

= 60×28

= $1680\ m^2$

$A_2 = \frac{\pi r^2}{2}$ {∵ Area of circle $= \pi r^2$

semicircle $= \frac{\pi r^2}{2}$}.

radius $(r) = \frac{BC}{2} = \frac{28}{2}$

$r = 14m$

$\Rightarrow A_2 = \frac{\pi \times (14)^2}{2}$

$= 307.876\ m^2$

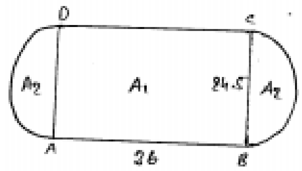
Therefore, Area of Plot $= A_1 + A_2$

$= 1680 + 307.876$

$A = 1987.876\ m^2$

$A = 1988\ m^2$ (rounded off).

3.



Given:- A Play ground of the above shape with given dimensions.

→ radius of semi circle $= \frac{BC}{2} = \frac{24.5}{2} = 12.25m.$

Area of Play ground $A = A_1 + 2A_2$

3 - Continued.

$A_1 = l \times b$

$= 36 \times 24.5$

$= 882 \ m^2$

$2 \cdot A_2 = \cancel{2} \times \frac{\pi r^2}{\cancel{2}} = \pi \times (12.25)^2$

$= 471.435 \ m^2$

Area of Playground $A = A_1 + A_2$

$= 882 + 471.43$

$= 1353.435 \ m^2$

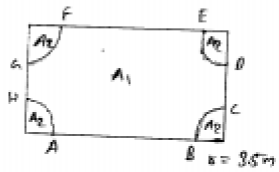
$\therefore$ Area of Play ground is $1353.435 \ m^2$.

4. Given:-

Rectangle Piece

length = 20m

breadth = 15m



Let A_1 = Area of rectangle

A_2 = Area of quadrant Part

The Area of remaining Part after removing corners is $A = A_1 - 4A_2$

$A_1 = 20 \times 15 = 300 \ m^2$

$A_2 = \cancel{4} \times \pi r^2 = \pi (3.5)^2$ [$\because$ four corners form a circle].

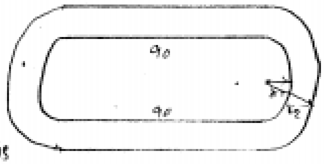
$= 38.48 \ m^2$

$A = A_1 - A_2 = 300 - 38.48$

$A = 261.52 \ m^2$.

5.

Let r_1 be the inner radius and r_2 be the outer radius



we know the side length is 90m

$\therefore$ Perimeter $= 2l + 2\pi r = 400$

$180 + 2\pi r_1 = 400$ [$\because l = 90m$].

$r_1 = 35.01m$

$\therefore r_2 = r_1 + \text{width}$

$= 35.01 + 14 = 49.01m$ [$\because$ given width $= 14m$].

$\therefore$ Area $= 2 \times l \times w + \pi[r_2^2 - r_1^2]$

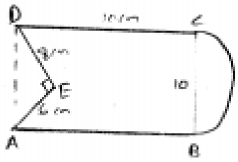
$= 2 \times 90 \times 14 + \pi[49.01^2 - 35.01^2]$

$\therefore = \underline{\underline{6214}}\ m^2$

length of outer track $= 180 + 2\pi r_2$

$= 180 + 2\pi \times 49.01 = \underline{\underline{488}}\ m^2$

6. Area of given figure can be written as



A = Area of ABCD − Area of DEA + Area of Arc BC

$= 10 \times 10 - \left(\frac{1}{2} \times 8 \times 6\right) + \frac{\pi}{2} \times \left(\frac{5}{1}\right)^2$

$= 100 - 24 + 39.26 = 115.3\ cm^2$

7. Given

diameter of wheel = 90cm

No. of revolutions = 315/min

we know that

$$v = r\omega$$

$$v = \frac{0.45 \times 2 \times \pi \times 315 \times 60}{1000} \text{ km/hr}$$

$$v = 53.46 \text{ km/hr.}$$

8. Given, Area of rhombus = 240 cm^2

diagonal d_1 = 16 cm

diagonal d_2 = ?

$$\therefore \quad A = \frac{1}{2} d_1 d_2$$

$$240 = \frac{16 \times d_2}{2} \Rightarrow d_2 = 30 \text{ cm.}$$

9. Given, diagonal d_1 = 7.5cm

diagonal d_2 = 12 cm

$$\text{Area} = \frac{1}{2} \times d_1 \times d_2$$

$$= \frac{1}{2} \times 7.5 \times 12$$

$$= 45 \text{ cm}^2$$

10. Given

lengths of opposite sides

$a = 8m$

$b = 13m$

height $= 24m$

$\therefore$ Area of quadrilateral $A = \frac{1}{2} \times h(a+b)$

$= \frac{1}{2} \times 24(13+8)$

$= \underline{\underline{252\ m^2}}$

11. Given,

Side length of Rhombus $= 6cm$

Altitude $= 4cm$

$\therefore$ other parallel side length $= 6cm$ [$\because$ rhombus].

$\therefore$ Area $= \frac{1}{2} \times 4 \times [6+6]$ [$\because$ Area of quadrilateral $= \frac{1}{2} \times h[a+b]$].

$= \underline{\underline{24\ cm^2}}$

$24 = \frac{1}{2} \times d_1 \times d_2$

$\frac{24 \times 2}{8} = d_2$ [$\because$ diagonal $d_1 = 8cm$].

$\therefore d_2 = \underline{\underline{6\ cm}}$

12. Given,

lengths of diagonals

$d_1 = 45\,cm$

$d_2 = 30\,cm$

$$\text{Area} = \frac{1}{2} \times d_1 \times d_2 = \frac{45 \times 30}{2}$$

$$= 675\,cm^2$$

$$\text{Area of } 3000 \text{ tiles} = 675 \times 3000$$

$$= 2025000\,cm^2$$

$$= 202.5\,m^2 \quad \{\because 1\,m^2 = 10^{4}\,cm^2\}.$$

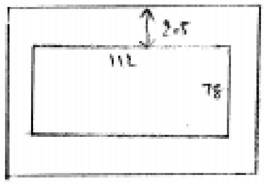
Cost per m^2 is 4/-

$\therefore$ cost for $202.5\,m^2$ is $\Rightarrow 202.5 \times 4$

$= \underline{\underline{810/-}}$

13 Given, inner length $l_1 = 112\,m$

inner breadth $b_1 = 78\,m$



outer length $= l_1 + 2w$

$= 112 + 5 = 117\,m$

outer breadth $= b_1 + 2w = 83\,m$

$$\text{Area of Gravel Path} = l_2 b_2 - l_1 b_1$$

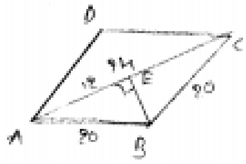
$$= 117 \times 83 - 78 \times 112$$

$$= 975\,m^2$$

$$\text{Cost} = 975 \times 4.5 = 4387.5/-$$

14. Area of rhombus whose sides are 20 cm each

diagonal length = 24 cm



From ΔABE

$AB^2 = AE^2 + EB^2$

$400 - 144 = EB^2$

$EB = 16\ cm.$

$\therefore$ Area of $\Delta AEB = \frac{1}{2} \times 16 \times 12$

$= 96\ cm^2$

$\therefore$ Area of rhombus $= 4 \times \Delta AEB$

$= 4 \times 96$

$= \underline{384\ cm^2}.$

15. Area of square $= 4^2 = 16\ m^2$

diagonal $d_1 = 2\ m$

Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$

$\therefore d_2 = \underline{16\ m}.$

16. Given ,

Side of Rhombus = 14 cm

Altitude h = 16 cm

Area of Quadrilateral (or) Rhombus $= \frac{1}{2} \times h\ (a+b)$

$= \frac{1}{2} \times 16 \times (14+14)$

$= \underline{224\ cm^2}$

17. Given,

Cost of fencing per meter is Rs 0.6/-

Total cost of fencing = Perimeter × cost

1200 = 4a × 0.6 [∵ given]

∴ a = 500m

Area = 500 × 500 = 250000 m^2

Cost for 100 m^2 = Rs 0.5/-

∴ Total cost = 2500 × 0.5

= $\underline{Rs\ 1250}$

18. Given Area of square plot = Area of Rectangular plot

⇒ 84 × 84 = 144 × b

⇒ b = 49m

∴ width = $\underline{49m}$

19. Given,

Area of Rhombus = $84\ m^2$

Perimeter = $40m$

$\therefore\ 4a = 40$

$a = 10m$

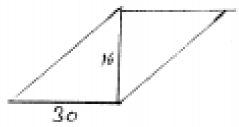
$\Rightarrow \frac{1}{2} \times h\,(2\times10) = 84$ $[\because \frac{1}{2} \times h\,[a+a] = \text{Area}]$.

$h = 8.4m$

20. Given.

Base = $30m$

Altitude = $16m$



Area $= 2\left[\frac{1}{2} \times 30\times16\right]$

$= 480 m^2$ [∵ two times Area of Δ^{le}].

Cost of leveling is Rs 2/- per m^2

∴ Total cost = 480×2 = Rs 960/-.

21. Given,

Rhombus dimensions as

side length = $64m$

Altitude = $16m$

Area $= \frac{1}{2} \times 16 \times [64+64]$

$= 1024\ m^2$

Given Area is equal to Area of a square

$\therefore\ 1024 = a^2$

$\Rightarrow a = 32m$

22. Given

Area of Δ^{le} = Area of Rhombus

$\frac{1}{2} \times b \times h = \frac{1}{2} \times d_1 \times d_2$

$24.8 \times 16.5 = 22 \times d_2$

$d_2 = 18.6\ cm$

Mensuration-I Area of a Trapezium and a Polygon Ex 20.2

EXERCISE – 20.2

1. (i) Given dimensions are

bases = 12 dm = 1.2 m

20 dm = 2.0 m

Altitude = 10 dm = 1.0 m [$\because$ 1 dm = 10^{-1} m].

Area = $\frac{1}{2}$ × Altitude × [sum of bases]

= $\frac{1}{2}$ × 1.0 × [2.0 + 1.2] = 1.6 m^2

(ii) bases = 28 cm = 0.28 m

3 dm = 0.3 m

Altitude = 25 cm = 0.25

Area = $\frac{1}{2}$ × 0.25 × [0.3 + 0.28]

= 0.0725 m^2

(iii) bases = 8 m

60 dm = 6 m

Altitude = 40 dm = 4 m

Area = $\frac{1}{2}$ × 4 × [8 + 6]

= 28 m^2

(iv) bases = 150 cm = 1.5 m

30 dm = 3 m

Altitude = 9 dm = 0.9 m

Area = $\frac{1}{2}$ × 0.9 [1.5 + 3] = 2.025 m^2

2. Given,

base = 15cm = 0.15m $\quad$ [∵ 1cm = 0.01m].

Height = 8cm = 0.08m

Parallel side = 9cm = 0.09m

$$\text{Area} = \frac{1}{2} \times h \times [a+b] = \frac{0.08}{2}[0.15+0.09]$$

$$= 9.6 \times 10^{-3} m^2$$

$$= 96 cm^2$$

3. Given,

Sides are 16dm = 1.6m

22dm = 2.2m

height is 12dm = 1.2m

$$\text{Area} = \frac{1}{2} \times 1.2 [1.6 + 2.2]$$

$$= 2.28 m^2$$

4. Given, Area = $600 cm^2$

Sum of parallel sides = 60cm

∴ Area = $\frac{1}{2} \times$ Altitude × Sum of parallel sides

$$\overset{10}{\cancel{600}} = \frac{1}{2} \times h \times \cancel{60}$$

$$h = 20cm$$

5. Given,

Area $= 65 cm^2$

bases are $13 cm$, $26 cm$

Sum of bases $= 13 + 26 = 39 cm$

$\therefore$ Area $= \frac{1}{2} \times h \times sum$

$65 = \frac{1}{2} \times h \times 39$

$h = \frac{10}{3} cm$

6. Given, Area of trapezium $= 4.2 m^2$

height $= 280 cm = 2.8 m$

$\therefore 4.2 = \frac{1}{2} \times 2.8 \times Sum$

$\therefore$ Sum of bases $= 3 m$

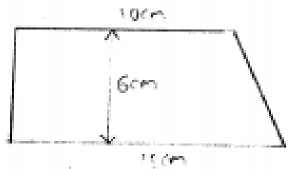
7.

Given,

Sides of trapezium

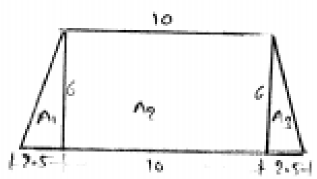
as 10 cm and

15 cm



height (or) distance b/w them be 6cm

7 (i) The figure shows that A_1, A_3 are the areas of two triangles and A_2 be the area of Rectangle.

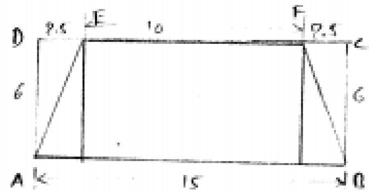


$\therefore \quad A_1 = \frac{1}{2} \times 2.5 \times 6 = 7.5\ cm^2 = A_3$

$A_2 = 10 \times 6 = 60\ cm^2$

Total (or) Trapezium Area $= A_1 + A_2 + A_3 = 60 + 7.5 + 7.5$
$= 75\ cm^2$.

(ii) The given question can be written as



Area of trapezium

$=$ Area of rectangle ABCD $- [$ Area of ΔDEA + Area of $\Delta FCB]$.

$\therefore$ Area of rectangle ABCD $= 15 \times 6 = 90\ cm^2$

Area of ΔDEF (or) FCB $= \frac{1}{2} \times 2.5 \times 6 = 7.5\ cm^2$

$\therefore$ Area of Trapezium $= 90 - [7.5 + 7.5]$
$= \underline{\underline{75\ cm^2}}$

8. Given,

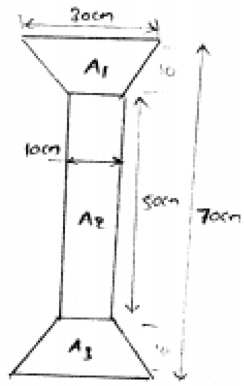
Area of Trapezium = $960\ cm^2$

& Parallel sides are 34 cm & 46cm

$\therefore$ Area = $\frac{1}{2} \times h \times [34 + 46]$

$$\frac{960 \times 2}{[34+46]} = h = 24\ cm$$

9. The Area of the figure can be given as.



$A_1 + A_2 + A_3 = A.$

where A_1 = Area of Trapezium

A_2 = Area of Rectangle

A_3 = Area of Trapezium

$A_1 = \frac{1}{2} \times 10 \times [30+10] = 200\ cm^2$

$A_2 = 50 \times 10 = 500\ cm^2$

$A_3 = \frac{1}{2} \times 10 \times [30+10] = 200\ cm^2$

$A = 200 + 500 + 200 = \underline{\underline{900\ cm^2}}$

10. Given

Top surface of table is trapezium

parallel sides are 1m & 1.2m

distance b/w them is 0.8

$\therefore \quad A = \frac{1}{2} \times 0.8 \times [1 + 1.2]$

$= 0.4 \times 2.2$

$= \underline{\underline{0.88\ m^2}}$

11. Given

Top width = 10 m

bottom width = 6m

Area = $72\ m^2$

$\therefore \quad Area = \frac{1}{2} \times h \times [10 + 6]$

$\frac{72 \times 2}{16} = h. = \underline{\underline{9\ m}}$

12. Given

Area of trapezium = $91\ cm^2$

height = 7 cm

let 'l' be one of length of side

given other is longer by 8cm

$\therefore$ other side is $(l+8)$

12 $\therefore$ Area $= \frac{1}{2} \times h \times [a+b]$

$91 = \frac{1}{2} \times 7 \times [l + l+8]$

$\frac{91 \times 2}{7} = 2l + 8$

$l = 9$ cm

$\therefore$ one side is 9 cm

other side is 17 cm.

13. Given,

Area $= 384\,cm^2$

Height $= 12$ cm

ratio $= 3:5$

$\therefore \quad 384 = \frac{1}{2} \times 12 \times 8a$

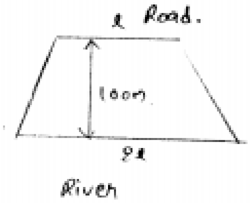
$a = 8.$

$\therefore$ Sides are 8×3, 5×8 = 24 cm, 40 cm.

14. Given

Area $= 10500\,m^2$

height $= 100$ m



$\therefore \quad 10500 = \frac{1}{2} \times 100 \times [l + 2l]$

$l = 70$ m.

$\therefore$ The length of side on river side is $\underline{140\,m}$

15. Area of trapezium = 1586 cm^2

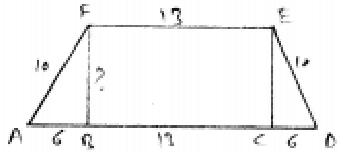
distance = 26 cm

one side = 38 cm   let 'x' be other side.

$$1586 = \frac{1}{2} \times 26 \times [38 + x]$$

$$x = 84 cm$$

16. Given parallel sides lengths are 25cm & 13cm other two are 10cm each.



from $\triangle ABF$

$$AF^2 = AB^2 + FB^2$$

$$100 - 36 = FB^2$$

$$\therefore FB = 8 cm$$

$$\therefore \text{Area} = \frac{1}{2} \times 8 \times [13 + 25]$$

$$= 152 \ cm^2$$

17. Same as the above problem figure

$\triangle ABF$ $AF = 15 cm$

$$\therefore 15^2 - 36 = FB^2 \Rightarrow FB = 3\sqrt{21} \ cm$$

$$\text{Area} = \frac{1}{2} \times 3\sqrt{21} \times [25 + 13] = 57\sqrt{21} \ cm^2$$

18. Area $= 28cm^2$

Side 1 $= 6cm$

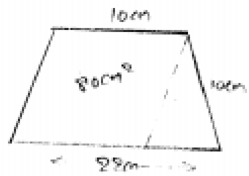
height $= 4cm$ $\qquad A = \frac{1}{2} \times h [a+b]$

$\therefore \quad 28 = \frac{1}{2} \times 4 \times [6+x]$

$\frac{28}{2} = 6 + x$

$x = 8cm$

19. Area of Parallelogram is $80cm^2$



we know

$b \times h = 80$

$10 \times h = 80$

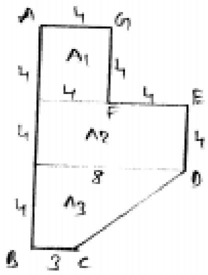
$h = 8\ cm$

Area of Trapezium $= \frac{1}{2} \times 8 \times [10+22]$

$= \frac{1}{2} \times 8 \times 32$

$= \underline{128\ cm^2}$

20. The given figure can be split into a Square, Rectangle and a Trapezium.



A_1 = Square area

$= 4 \times 4 = 16cm^2$

A_2 = Rectangle area

$= 4 \times 8 = 32cm^2$

A_3 = Trapezium Area

$= \frac{1}{2} \times 4 \times [8+3] = 22cm^2$

Total Area (A) $= A_1 + A_2 + A_3$

$= 16 + 32 + 22$

$= \underline{70\ cm^2}$

Mensuration-I Area of a Trapezium and a Polygon Ex 20.3

EXERCISE – 20.3

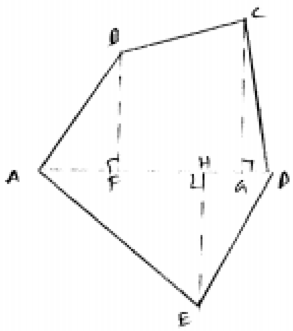
1\. Given $AD = 10cm$, $CG = 7cm$

$AG = 8cm$, $EH = 3cm$.

$AH = 6cm$

$AF = 8cm$

$BF = 5cm$



Area of Pentagon =

Area of Δ AED +

Area of Δ ABF + Area of ΔGDC +

Area of Trapezium BCGF.

Area of $\Delta AED = \frac{1}{2} \times AD \times EH$

$= \frac{1}{2} \times 10 \times 3 = 15 \ cm^2$

Area of $\Delta ABF = \frac{1}{2} \times AF \times BF = \frac{1}{2} \times 5 \times 5 = 12.5 cm^2$

Area of $\Delta GDC = \frac{1}{2} \times GD \times GC = \frac{1}{2} \times 2 \times 7 = 7 cm^2$

$[\because AD - AG = GD]$.

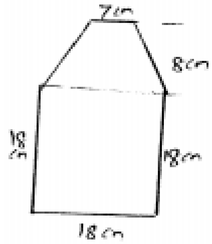
Area of $BCGF = \frac{1}{2} \times 3 \times [5+7] = 18 \ cm^2$

$[\because FG = 3]$.

$\therefore$ Total Area $= 15 + 12.5 + 7 + 8$

$= 52.5 \ cm^2$

2\. (i)



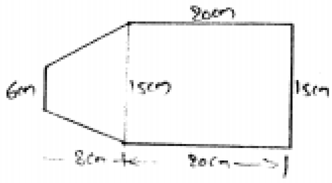
Area = rectangle area + Trapezium area

$= 18 \times 18 + \frac{1}{2} \times 8 \times [7+18]$

$= 424 \text{ cm}^2$

(ii)

Area = rectangle area + Trapezium area



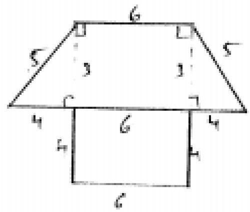
$= 20 \times 15 + \frac{1}{2} \times 8 \times [6+15]$

$= 384 \text{ cm}^2$

(iii) Area = rectangle area + Trapezium area

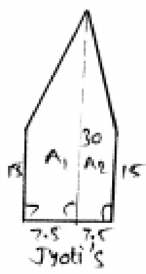
$= 4 \times 6 + \frac{1}{2} \times 3 \times [14+6]$

$= 54 \text{ cm}^2$



3\.

(i) Jyoti's diagram Area:-



$A_1 = \frac{1}{2} \times 7.5 \times [15+30]$

$= 168.75$

$A_2 = \frac{1}{2} \times 7.5 \, [15+30]$

$= 168.75$

Total Area $= 2 \times 168.75 = \underline{\underline{337.5}} \ m^2$

(ii) Kavita's diagram Area:-

A_1 = Area of triangle

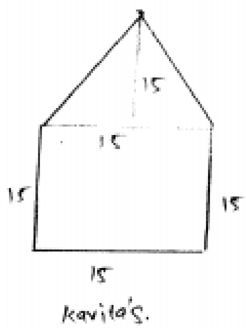
$= \frac{1}{2} \times 15 \times 15$

$= 112.5 \ m^2$

A_2 = Area of rectangle

$= 15 \times 15$

$= 225$



Total $= A_1 + A_2 = 112.5 + 225$

$= \underline{337.5} \ m^2$

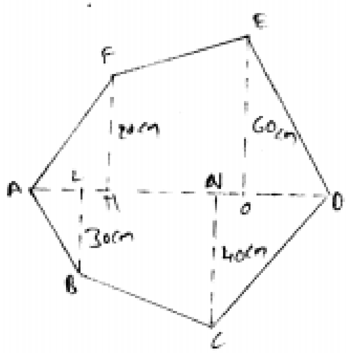
$\therefore$ Both the areas are equal

4. Given,

$AL = 10cm$, $AO = 60cm$.

$AM = 20cm$, $AD = 90cm$

$AN = 50\ cm$



from figure:

$FM = 20cm$, $NC = 40cm$

$OE = 60cm$

$LB = 30cm$

Area of polygon = Area of $\triangle AFM$ + Area of $\triangle ODE$ + Area of $\triangle ALB$ + Area of $\triangle DNC$ + Area of trapezium FEOM + Area of trapezium LOBC.

Area of $\triangle AFM = \frac{1}{2} \times AM \times FM = \frac{1}{2} \times 20 \times 20 = 200 cm^2$

Area of $\triangle ODE = \frac{1}{2} \times 30 \times 60 = 900 cm^2$

Area of $\triangle ALB = \frac{1}{2} \times AL \times LB = \frac{1}{2} \times 10 \times 30 = 150 cm^2$

Area of $\triangle DNC = \frac{1}{2} \times DN \times NC = \frac{1}{2} \times 40 \times 40 = 800 cm^2$

Area of FEOM $= \frac{1}{2} \times 30 \times [20+60] = 1200 cm^2$

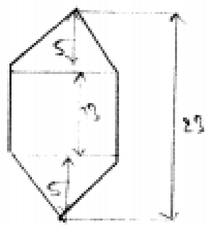
Area of LOCB $= \frac{1}{2} \times 40 \times [40+30] = 1400 cm^2$

Total Area $= 1400 + 1200 + 800 + 150 + 900 + 200$

$= 5050 cm^2$

5. Area of regular hexagon

= Area of $\triangle MNO$ + Area of rectangle MOPR + Area of $\triangle RPQ$



$\Rightarrow$ Area of $\triangle MNO = \frac{1}{2} \times 5 \times 13\sqrt{3}$

Area of $\triangle RPQ = \frac{1}{2} \times 5 \times 13\sqrt{3}$

Area of MRPQ $= 13 \times 13\sqrt{3}$

Area of regular hexagon $= 405.29\ m^2$