Mensuration
Exercise 20D

Q1

Answer :

We know:

Area of a triangle = $\frac{1}{2} \times \text{Base} \times \text{Height}$

(i) Base = 42 cm

Height = 25 cm

$\therefore$ Area of the triangle = $\left(\frac{1}{2} \times 42 \times 25\right)$ cm^2 = 525 cm^2

(ii) Base = 16.8 m

Height = 75 cm = 0.75 m [since 100 cm = 1 m]

$\therefore$ Area of the triangle = $\left(\frac{1}{2} \times 16.8 \times 0.75\right)$ m^2 = 6.3 m^2

(iii) Base = 8 dm = (8 × 10) cm = 80 cm [since 1 dm = 10 cm]

Height = 35 cm

$\therefore$ Area of the triangle = $\left(\frac{1}{2} \times 80 \times 35\right)$ cm^2 = 1400 cm^2

Q2

Answer :

Height of a triangle = 2×AreaBase
Here, base = 16 cm and area = 72 cm^2

∴ Height = 2×7216 cm = 9 cm

Q3

Answer :

Height of a triangle = $\frac{2\times Area}{Base}$
Here, base = 28 m and area = 224 m^2

∴ Height = $\left(\frac{2\times224}{28}\right)$ m = 16 m

Q4

Answer :

Base of a triangle = $\frac{2\times Area}{Height}$
Here, height = 12 cm and area = 90 cm^2

∴ Base = $\left(\frac{2\times90}{12}\right)$ cm = 15 cm

Q5

Answer :

Total cost of cultivating the field = Rs. 14580
Rate of cultivating the field = Rs. 1080 per hectare
Area of the field = $\left(\frac{Total\ \ cost}{Rate\ \ per\ \ hectare}\right)$ hectare
= $\left(\frac{14580}{1080}\right)$ hectare
= 13.5 hectare
= (13.5 × 10000) m^2 = 135000 m^2 [since 1 hectare = 10000 m^2]
Let the height of the field be *x* m.
Then, its base will be 3*x* m.
Area of the field = $\left(\frac{1}{2}\times 3x\times x\right)$ m^2 = $\left(\frac{3x^2}{2}\right)$ m^2
∴ $\left(\frac{3x^2}{2}\right)$ = 135000
⇒ $x^2 = \left(135000\times\frac{2}{3}\right) = 90000$
⇒ *x* = $\sqrt{90000}$ = 300
∴ Base = (3 × 300) = 900 m
Height = 300 m

Q6

Answer :

Let the length of the other leg be *h* cm.
Then, area of the triangle = $\left(\frac{1}{2}\times 14.8\times h\right)$ cm^2 = (7.4 *h*) cm^2
But it is given that the area of the triangle is 129.5 cm^2.
∴ 7.4*h* = 129.5
⇒ *h* = $\left(\frac{129.5}{7.4}\right)$ = 17.5 cm
∴ Length of the other leg = 17.5 cm

Q7

Answer :

Here, base = 1.2 m and hypotenuse = 3.7 m

In the right angled triangle:

Perpendicular = $\sqrt{(Hypotenuse)^2 - (Base)^2}$

$= \sqrt{(3.7)^2 - (1.2)^2}$

$= \sqrt{13.69 - 1.44}$

$= \sqrt{12.25}$

$= 3.5$

Area = $\left(\frac{1}{2} \times \text{base} \times \text{perpendicular}\right)$ sq. units

= $\left(\frac{1}{2} \times 1.2 \times 3.5\right)$ m^2

∴ Area of the right angled triangle = 2.1 m^2

Q8

Answer :

In a right angled triangle, if one leg is the base, then the other leg is the height.

Let the given legs be 3*x* and 4*x*, respectively.

Area of the triangle = $\left(\frac{1}{2} \times 3x \times 4x\right)$ cm^2

⇒ 1014 = ($6x^2$)

⇒ 1014 = $6x^2$

⇒ x^2 = $\left(\frac{1014}{6}\right)$ = 169

⇒ *x* = $\sqrt{169}$ = 13

∴ Base = (3 × 13) = 39 cm

Height = (4 × 13) = 52 cm

Q9

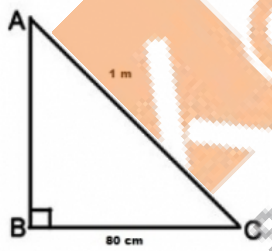
Answer :

Consider a right-angled triangular scarf (ABC).

Here, ∠B= 90°

BC = 80 cm

AC = 1 m = 100 cm



Now, $AB^2 + BC^2 = AC^2$

⇒ $AB^2 = AC^2 - BC^2 = (100)^2 - (80)^2$

= (10000 - 6400) = 3600

⇒ AB = $\sqrt{3600}$ = 60 cm

Area of the scarf ABC = $\left(\frac{1}{2} \times BC \times AB\right)$ sq. units

= $\left(\frac{1}{2} \times 80 \times 60\right)$ cm^2

= 2400 cm^2 = 0.24 m^2 [since 1 m^2 = 10000 cm^2]

Rate of the cloth = Rs 250 per m^2

∴ Total cost of the scarf = Rs (250 × 0.24) = Rs 60

Hence, cost of the right angled scarf is Rs 60.

Q10

Answer :

(i) Side of the equilateral triangle = 18 cm

Area of the equilateral triangle = $\frac{\sqrt{3}}{4}(\text{Side})^2$ sq. units

$= \frac{\sqrt{3}}{4}(18)^2$ cm^2 = $\left(\sqrt{3} \times 81\right)$ cm^2

= (1.73 × 81) cm^2 = 140.13 cm^2

(ii) Side of the equilateral triangle = 20 cm

Area of the equilateral triangle = $\frac{\sqrt{3}}{4}(\text{Side})^2$ sq. units

$= \frac{\sqrt{3}}{4}(20)^2$ cm^2 = $\left(\sqrt{3} \times 100\right)$ cm^2

= (1.73 × 100) cm^2 = 173 cm^2

Q11

Answer :

It is given that the area of an equilateral triangle is $16\sqrt{3}$ cm^2.

We know:

Area of an equilateral triangle = $\frac{\sqrt{3}}{4}(\text{side})^2$ sq. units

∴ Side of the equilateral triangle = $\left[\sqrt{\left(\frac{4 \times \text{Area}}{\sqrt{3}}\right)}\right]$ cm

$= \left[\sqrt{\left(\frac{4 \times 16\sqrt{3}}{\sqrt{3}}\right)}\right]$ cm = $\left(\sqrt{4 \times 16}\right)$ cm = $\left(\sqrt{64}\right)$ cm = 8 cm

Hence, the length of the equilateral triangle is 8 cm.

Q12

Answer :

Let the height of the triangle be *h* cm.

Area of the triangle = $\left(\frac{1}{2} \times \text{Base} \times \text{Height}\right)$ sq. units

$= \left(\frac{1}{2} \times 24 \times h\right)$ cm^2

Let the side of the equilateral triangle be *a* cm.

Area of the equilateral triangle = $\left(\frac{\sqrt{3}}{4}a^2\right)$ sq. units

$= \left(\frac{\sqrt{3}}{4} \times 24 \times 24\right)$ cm^2 = $\left(\sqrt{3} \times 144\right)$ cm^2

∴ $\left(\frac{1}{2} \times 24 \times h\right) = \left(\sqrt{3} \times 144\right)$

⇒ 12 *h* = $\left(\sqrt{3} \times 144\right)$

⇒ *h* = $\left(\frac{\sqrt{3} \times 144}{12}\right) = \left(\sqrt{3} \times 12\right) = (1.73 \times 12) = 20.76$ cm

∴ Height of the equilateral triangle = 20.76 cm

Q13

Answer :

(i) Let a = 13 m, b = 14 m and c = 15 m

$s = \left(\frac{a+b+c}{2}\right) = \left(\frac{13+14+15}{2}\right) = \left(\frac{42}{2}\right)$ m = 21 m

∴ Area of the triangle = $\sqrt{s(s-a)(s-b)(s-c)}$ sq. units

$= \sqrt{21(21-13)(21-14)(21-15)}$ m^2

$= \sqrt{21 \times 8 \times 7 \times 6}$ m^2

$= \sqrt{3 \times 7 \times 2 \times 2 \times 2 \times 7 \times 2 \times 3}$ m^2

= (2 × 2 × 3 × 7) m^2

= 84 m^2

(ii) Let a = 52 cm, b = 56 cm and c = 60 cm

$s = \left(\frac{a+b+c}{2}\right) = \left(\frac{52+56+60}{2}\right) = \left(\frac{168}{2}\right)$ cm = 84 cm

∴ Area of the triangle = $\sqrt{s(s-a)(s-b)(s-c)}$ sq. units

$= \sqrt{84(84-52)(84-56)(84-60)}$ cm^2

$= \sqrt{84 \times 32 \times 28 \times 24}$ cm^2

$= \sqrt{12 \times 7 \times 4 \times 8 \times 4 \times 7 \times 3 \times 8}$ cm^2

$= \sqrt{2 \times 2 \times 3 \times 7 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 7 \times 3 \times 2 \times 2 \times 2}$ cm^2

= (2 × 2 × 2 × 2 × 2 × 2 × 3 × 3 × 7) m^2

= 1344 cm^2

(iii) Let a = 91 m, b = 98 m and c = 105 m

$s = \left(\frac{a+b+c}{2}\right) = \left(\frac{91+98+105}{2}\right) = \left(\frac{294}{2}\right)$ m = 147 m

∴ Area of the triangle = $\sqrt{s(s-a)(s-b)(s-c)}$ sq. units

$= \sqrt{147(147-91)(147-98)(147-105)}$ m^2

$= \sqrt{147 \times 56 \times 49 \times 42}$ m^2

$= \sqrt{3 \times 49 \times 8 \times 7 \times 49 \times 6 \times 7}$ m^2

$= \sqrt{3 \times 7 \times 7 \times 2 \times 2 \times 2 \times 7 \times 7 \times 7 \times 2 \times 3 \times 7}$ m^2

= (2 × 2 × 3 × 7 × 7 × 7) m^2

= 4116 m^2

Q14

Answer :

Let a = 33 cm, b = 44 cm and c = 55 cm

Then, $s = \frac{a+b+c}{2} = \left(\frac{33+44+55}{2}\right)$ cm $= \left(\frac{132}{2}\right)$ cm = 66 cm

∴ Area of the triangle = $\sqrt{s(s-a)(s-b)(s-c)}$ sq. units

$= \sqrt{66(66-33)(66-44)(66-55)}$ cm^2

$= \sqrt{66 \times 33 \times 22 \times 11}$ cm^2

$= \sqrt{6 \times 11 \times 3 \times 11 \times 2 \times 11 \times 11}$ cm^2

= (6 × 11 × 11) cm^2 = 726 cm^2

Let the height on the side measuring 44 cm be h cm.

Then, Area $= \frac{1}{2} \times b \times h$

⇒ 726 cm^2 = $\frac{1}{2} \times 44 \times h$

⇒ $h = \left(\frac{2 \times 726}{44}\right)$ cm = 33 cm.

∴ Area of the triangle = 726 cm^2

Height corresponding to the side measuring 44 cm = 33 cm

Q15

Answer :

Let $a = 13x$ cm, $b = 14x$ cm and $c = 15x$ cm

Perimeter of the triangle = $13x + 14x + 15x = 84$ (given)

$\Rightarrow 42x = 84$

$\Rightarrow x = \frac{84}{42} = 2$

$\therefore a = 26$ cm , $b = 28$ cm and $c = 30$ cm

$s = \frac{a+b+c}{2} = \left(\frac{26+28+30}{2}\right)$ cm $= \left(\frac{84}{2}\right)$ cm = 42 cm

$\therefore$ Area of the triangle = $\sqrt{s(s-a)(s-b)(s-c)}$ sq. units

$= \sqrt{42(42-26)(42-28)(42-30)}$ cm^2

$= \sqrt{42 \times 16 \times 14 \times 12}$ cm^2

$= \sqrt{6 \times 7 \times 4 \times 4 \times 2 \times 7 \times 6 \times 2}$ cm^2

= (2 ×4 × 6 × 7) cm^2 = 336 cm^2

Hence, area of the given triangle is 336 cm^2.

Q16

Answer :

Let $a = 42$ cm, $b = 34$ cm and $c = 20$ cm

Then, $s = \frac{a+b+c}{2} = \left(\frac{42+34+20}{2}\right)$ cm $= \left(\frac{96}{2}\right)$ cm = 48 cm

$\therefore$ Area of the triangle = $\sqrt{s(s-a)(s-b)(s-c)}$ sq. units

$= \sqrt{48(48-42)(48-34)(48-20)}$ cm^2

$= \sqrt{48 \times 6 \times 14 \times 28}$ cm^2

$= \sqrt{6 \times 2 \times 2 \times 2 \times 6 \times 14 \times 2 \times 14}$ cm^2

= (2 × 2 × 6 × 14) cm^2 = 336 cm^2

Let the height on the side measuring 42 cm be h cm.

Then, Area $= \frac{1}{2} \times b \times h$

$\Rightarrow$ 336 cm^2 = $\frac{1}{2} \times 42 \times h$

$\Rightarrow h = \left(\frac{2 \times 336}{42}\right)$ cm = 16 cm

$\therefore$ Area of the triangle = 336 cm^2

Height corresponding to the side measuring 42 cm = 16 cm

Q17

Answer :

Let each of the equal sides be a cm.

$b = 48$ cm

$a = 30$ cm

Area of the triangle = $\left\{\frac{1}{2} \times b \times \sqrt{a^2 - \frac{b^2}{4}}\right\}$ sq. units

$= \left\{\frac{1}{2} \times 48 \times \sqrt{(30)^2 - \frac{(48)^2}{4}}\right\}$ cm^2 = $\left(24 \times \sqrt{900 - \frac{2304}{4}}\right)$ cm^2

= $\left(24 \times \sqrt{900 - 576}\right)$ cm^2 = $\left(24 \times \sqrt{324}\right)$ cm^2 = (24 × 18) cm^2 = 432 cm^2

$\therefore$ Area of the triangle = 432 cm^2

Q18

Answer :

Let each of the equal sides be a cm.

$a + a + 12 = 32 \Rightarrow 2a = 20 \Rightarrow a = 10$

$\therefore b = 12$ cm and $a = 10$ cm

Area of the triangle = $\left\{\frac{1}{2} \times b \times \sqrt{a^2 - \frac{b^2}{4}}\right\}$ sq. units

$= \left\{\frac{1}{2} \times 12 \times \sqrt{100 - \frac{144}{4}}\right\}$ cm^2 = $\left(6 - \sqrt{100 - 36}\right)$ cm^2

= $\left(6 \times \sqrt{64}\right)$ cm^2 = (6 × 8) cm^2

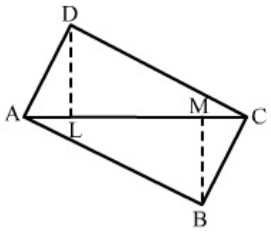
= 48 cm^2

Q19

Answer :

We have:

AC = 26 cm, DL = 12.8 cm and BM = 11.2 cm



Area of $\Delta ADC = \frac{1}{2} \times AC \times DL$

$= \frac{1}{2} \times 26 \text{ cm} \times 12.8 \text{ cm} = 166.4 \text{ cm}^2$

Area of $\Delta ABC = \frac{1}{2} \times AC \times BM$

$= \frac{1}{2} \times 26 \text{ cm} \times 11.2 \text{ cm} = 145.6 \text{ cm}^2$

$\therefore$ Area of the quadrilateral $ABCD$ = Area of ΔADC + Area of ΔABC

$= (166.4 + 145.6) \text{ cm}^2$

$= 312 \text{ cm}^2$

Q20

Answer :

First, we have to find the area of ΔABC and ΔACD.

For ΔACD:

Let a = 30 cm, b = 40 cm and c = 50 cm

$s = \left(\frac{a+b+c}{2}\right) = \left(\frac{30+40+50}{2}\right) = \left(\frac{120}{2}\right) = 60 \text{ cm}$

$\therefore$ Area of triangle ACD = $\sqrt{s(s-a)(s-b)(s-c)}$ sq. units

$= \sqrt{60(60-30)(60-40)(60-50)} \text{ cm}^2$

$= \sqrt{60 \times 30 \times 20 \times 10} \text{ cm}^2$

$= \sqrt{360000} \text{ cm}^2$

$= 600 \text{ cm}^2$

For ΔABC:

Let a = 26 cm, b = 28 cm and c = 30 cm

$s = \left(\frac{a+b+c}{2}\right) = \left(\frac{26+28+30}{2}\right) = \left(\frac{84}{2}\right) = 42 \text{ cm}$

$\therefore$ Area of triangle ABC = $\sqrt{s(s-a)(s-b(s-c))}$ sq. units

$= \sqrt{42(42-26)(42-28)(42-30)} \text{ cm}^2$

$= \sqrt{42 \times 16 \times 14 \times 12} \text{ cm}^2$

$= \sqrt{2 \times 3 \times 7 \times 2 \times 2 \times 2 \times 2 \times 2 \times 7 \times 3 \times 2 \times 2} \text{ cm}^2$

$= (2 \times 2 \times 2 \times 2 \times 3 \times 7) \text{ cm}^2$

$= 336 \text{ cm}^2$

$\therefore$ Area of the given quadrilateral ABCD = Area of ΔACD + Area of ΔABC

$= (600 + 336) \text{ cm}^2 = 936 \text{ cm}^2$

Q21

Answer :

Area of the rectangle = AB × BC

$= 36 \text{ m} \times 24 \text{ m}$

$= 864 \text{ m}^2$

Area of the triangle $= \frac{1}{2} \times AD \times FE$

$= \frac{1}{2} \times BC \times FE$ [since AD = BC]

$= \frac{1}{2} \times 24 \text{ m} \times 15 \text{ m}$

$= 12 \text{ m} \times 15 \text{ m} = 180 \text{ m}^2$

$\therefore$ Area of the shaded region = Area of the rectangle − Area of the triangle

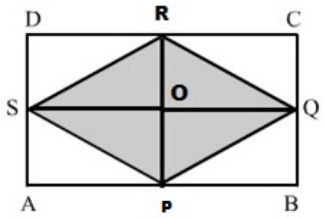
$= (864 - 180) \text{ m}^2$

$= 684 \text{ m}^2$

Q22

Answer :

Join points *PR* and *SQ*.
These two lines bisect each other at point *O*.



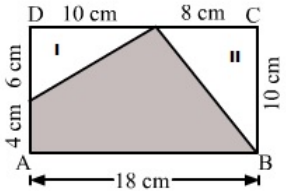
Here, *AB* = *DC* = *SQ* = 40 cm
AD = *BC* =*RP* = 25 cm

Also, $OP = OR = \frac{RP}{2} = \frac{25}{2}$ = 12.5 cm
From the figure we observe:
Area of Δ*SPQ* = Area of Δ*SRQ*
∴ Area of the shaded region = 2 × (Area of Δ*SPQ*)
= 2 × ($\frac{1}{2}$× *SQ* ×*OP*)
= 2 × ($\frac{1}{2}$ × 40 cm × 12.5 cm)
= 500 cm^2

Q23

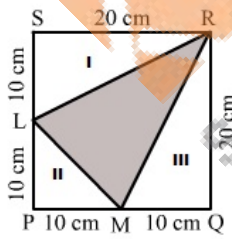
Answer :

(i) Area of rectangle ABCD = (10 cm x 18 cm) = 180 cm^2



Area of triangle I = $\left(\frac{1}{2} \times 6 \times 10\right)$ cm^2 = 30 cm^2
Area of triangle II = $\left(\frac{1}{2} \times 8 \times 10\right)$ cm^2 = 40 cm^2
∴ Area of the shaded region = {180 - (30 + 40)} cm^2 = { 180 - 70}cm^2 = 110 cm^2

(ii) Area of square ABCD = (Side)^2 = (20 cm)^2 = 400 cm^2



Area of triangle I = $\left(\frac{1}{2} \times 10 \times 20\right)$ cm^2 = 100 cm^2
Area of triangle II = $\left(\frac{1}{2} \times 10 \times 10\right)$ cm^2 = 50 cm^2
Area of triangle III = $\left(\frac{1}{2} \times 10 \times 20\right)$ cm^2 = 100 cm^2
∴ Area of the shaded region = {400 - (100 + 50 + 100)} cm^2 = { 400 - 250}cm^2 = 150 cm^2

Q24

Answer :

Let ABCD be the given quadrilateral and let BD be the diagonal such that BD is of the length 24 cm.
Let AL ⊥ BD and CM ⊥ BD
Then, AL = 5 cm and CM = 8 cm
Area of the quadrilateral ABCD = (Area of ΔABD + Area of ΔCBD)
= $\left[\left(\frac{1}{2} \times BD \times AL\right) + \left(\frac{1}{2} \times BD \times CM\right)\right]$ sq. units
= $\left[\left(\frac{1}{2} \times 24 \times 5\right) + \left(\frac{1}{2} \times 24 \times 8\right)\right]$ cm^2
= (60 + 96) cm^2 = 156 cm^2

∴ Area of the given quadrilateral = 156 cm