CHAPTER 11

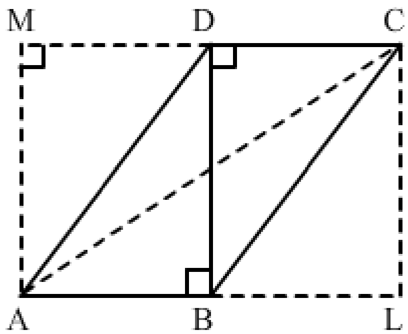
AREA OF PARALLELOGRAMS AND TRIANGLES

EXERCISE11

Answer 1:

(i) No, it does not lie on the same base and between the same parallels.
(ii) No, it does not lie on the same base and between the same parallels.
(iii) Yes, it lies on the same base and between the same parallels. The same base is AB and the parallels are AB and DE.
(iv) No, it does not lie on the same base and between the same parallels.
(v) Yes, it lies on the same base and between the same parallels. The same base is BC and the parallels are BC and AD.
(vi) Yes, it lies on the same base and between the same parallels. The same base is CD and the parallels are CD and BP.

Answer 2:



Given: A quadrilateral *ABCD* and *BD* is a diagonal.
To prove: *ABCD* is a parallelogram.
Construction: Draw AM ⊥ DC and CL ⊥ AB (extend DC and AB). Join AC, the other diagonal of ABCD.

Proof: (quad. ABCD) = area(ΔABD) + area(ΔDCB)
= 2 area(ΔABD) [area(ΔABD) = area(ΔDCB)]

Area(ΔABD) $= \frac{1}{2} \times$ area(quad. $ABCD$) ...(i)

Again, area(quad. $ABCD$) = area(ΔABC) + area(ΔCDA)
= 2 area(Δ ABC) [area(ΔABC) = area(ΔCDA)]

$\therefore$ area(ΔABC) = $\frac{1}{2} \times$ area(quad. $ABCD$) ...(ii)

From (i) and (ii), we have:

area(ΔABD) = area(ΔABC) = $\frac{1}{2} \times$ AB $\times$ BD $= \frac{1}{2} \times$ AB $\times$ CL

$\Rightarrow$ CL = BD

$\Rightarrow$ DC | | AB

Similarly, AD | | BC.

Hence, $ABCD$ is a parallelogram.

$\therefore$ area(| | gm $ABCD$) = base height = 5 $\times$ 7 = 35 cm^2

Answer 3:

area(parallelogram $ABCD$) = base $\times$ height

$\Rightarrow AB \times DL = AD \times BM$

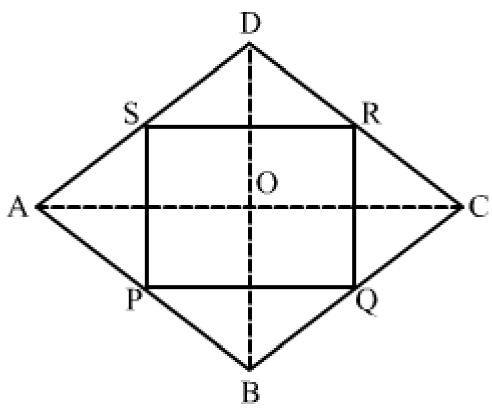
$\Rightarrow 10 \times 6 = AD \times BM$

$\Rightarrow AD \times 8 = 60\ cm^2$

$\Rightarrow AD =$ 7.5 cm

$\therefore AD$ = 7.5 cm

Answer 4:



Let $ABCD$ be a rhombus and P, Q, R and S be the midpoints of AB, BC, CD and DA,

respectively.
Join the diagonals, *AC* and *BD*.
In Δ *ABC*, we have:

$PQ \,||\, AC$ and $PQ = \frac{1}{2} AC$ [By midpoint theorem]

$PQ = \frac{1}{2} \times 16 = 8$ cm

Again, in ΔDAC, the points *S* and *R* area the midpoints of *AD* and *DC*, respectively.

$\therefore SR \,||\, AC$ and $SR = \frac{1}{2} AC$ [By midpoint theorem]

$SR = \frac{1}{2} * 12 = 6$

Area of PQRS= length × breadth $= 6 \times 8 = 48$ cm^2

Answer 5:

$$\text{area(trapezium)} = \frac{1}{2} \times \text{(sum of parallel sides)} \times \text{(distance between them)}$$
$$= \frac{1}{2} \times (9+6) \times 8$$
$$= 60 \text{ cm}^2$$

Hence, the area of the trapezium is 60 cm^2.

Answer 6:

(i) In ΔBCD,

$DB^2 + BC^2 = DC^2 \Rightarrow DB^2 = 17^2 - 8^2 = 225 \Rightarrow DB = 15$ cm

Area $(\Delta BCD) = \frac{1}{2} \times b \times h = \frac{1}{2} \times 8 \times 15 = 60$ cm^2

In ΔBAD,

$DA^2 + AB^2 = DB^2 \Rightarrow AB^2 = 15^2 - 9^2 = 144 \Rightarrow AB = 12$ cm

Area$(\Delta DAB) = \frac{1}{2} \times b \times h = \frac{1}{2} \times 9 \times 12 = 54$ cm^2

Area of quad. *ABCD* = Area(ΔDAB) + Area(ΔBCD) = $54 + 60 = 114$ cm^2.

(ii) Area of trap(PQRS) = $\frac{1}{2} \times (8+16) \times 8 = 96$ cm^2

Answer 7:

ΔADL is a right angle triangle.
So, $DL = \sqrt{5^2 + 4^2} = \sqrt{9} = 3$ cm

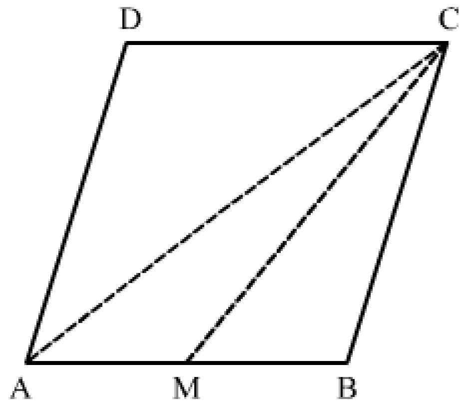
Similarly, in ΔBMC, we have,
$MC = \sqrt{5^2 + 4^2} = \sqrt{9} = 3$ cm
$\therefore DC = DL + LM + MC = 3 + 7 + 3 = 13$ cm
Now, area(trapezium. $ABCD$) = $\frac{1}{2} \times$ (sum of parallel sides) $\times$ (distance between them)
$= \frac{1}{2} \times (7 + 13) \times 4$
$= 40$ cm^2
Hence, $DC = 13$ cm and area of trapezium = 40 cm^2

.

Answer 8:

area(quad. $ABCD$) = area(ΔABD) + area (ΔDBC)
area(ΔABD) = $\frac{1}{2} \times$ base $\times$ height = $\frac{1}{2} \times BD \times AL$ ...(i)
area(ΔDBC) = $\frac{1}{2} \times BD \times CL$ ...(ii)
From (i) and (ii), we get:
area(quad $ABCD$) = $\frac{1}{2} \times BD \times AL + \frac{1}{2} \times BD \times CL$
$\Rightarrow$area(quad $ABCD$) = $\frac{1}{2} \times BD \times (AL + CL)$
Hence, proved.

Answer 9:



Join AC.

AC divides parallelogram ABCD into two congruent triangles of equal area.

area(ΔABC) = area(ΔACD) = $\frac{1}{2}$ × area(ABCD)

M is the midpoint of AB. So, CM is the median.

CM divides ΔABC in two triangles with equal area.

area(ΔAMC)=area(ΔBMC)= $\frac{1}{2}$ × area(ΔABC)

area(AMCD) = area(ΔACD) + area(ΔAMC)

= area(ΔABC) + area(ΔAMC)

= area(ΔABC) + $\frac{1}{2}$ × area(ΔABC)

⇒24 = $\frac{3}{2}$ × area(ΔABC)

⇒area(ΔABC)=16 cm^2

Answer 10:

area(quad $ABCD$) = area(ΔABD) + area(ΔBDC)

$= \frac{1}{2} \times BD \times AL + 12 \times BD \times CM$

$= \frac{1}{2} \times BD \times (AL + CM)$

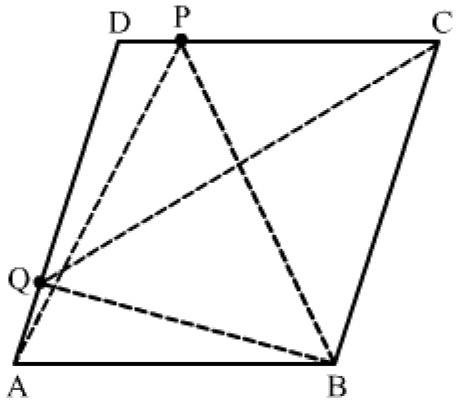
By substituting the values, we have;

area(quad $ABCD$) = $\frac{1}{2} \times 14 \times (8 + 6)$

$= 7 \times 14$

$= 98\ cm^2$

Answer 11:



We know

area(ΔAPB) = $\frac{1}{2}$ × area(ABCD) ....(1)

Similarly,

area(ΔBQC) = $\frac{1}{2}$ × area(ABCD) .....(2)

From (1) and (2)

area(ΔAPB) = area(ΔBQC)

Hence Proved

Answer 12:

(i) We know that parallelograms on the same base and between the same parallels area equal in area

So, area($MNPQ$) = area($ABPQ$) (Same base PQ and MB || PQ) .....(1)

(ii) If a parallelogram and a triangle area on the same base and between the same parallels then the area of the triangle is equal to half the area of the parallelogram.

So, area(ΔATQ) = $\frac{1}{2}$ area($ABPQ$) (Same base AQ and AQ || BP) .....(2)

From (1) and (2)

area(ΔATQ) = $\frac{1}{2}$ area($MNPQ$)

Answer 13:

ΔCDA and ΔCBD lies on the same base and between the same parallel lines.
So, area(ΔCDA) = area(ΔCDB) ...(i)
Subtracting area(ΔOCD) from both sides of equation (i), we get:
area(ΔCDA) −area(ΔOCD) = area(ΔCDB) −area (ΔOCD)
⇒ area(ΔAOD) = area(ΔBOC)

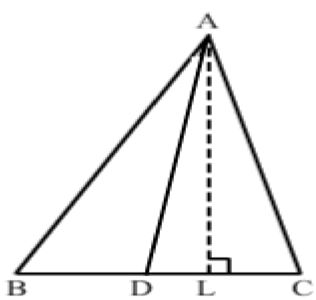
Answer 14:

ΔDEC and ΔDEB lies on the same base and between the same parallel lines.
So, area(ΔDEC) = area(ΔDEB) ...(1)

(i) On adding area(ΔADE) in both sides of equation (1), we get:
area(ΔDEC) + area(ΔADE) = area(ΔDEB) + area(ΔADE)
⇒ area(ΔACD) = area(ΔABE)

(ii) On subtracting area(ODE) from both sides of equation (1), we get:
area(ΔDEC) −area(ΔODE) = area(ΔDEB) −area(ΔODE)
⇒ area(ΔOCE) = area(ΔOBD)

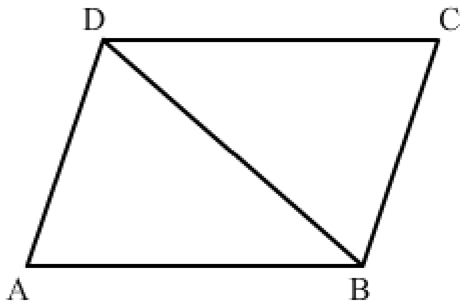
Answer 15:



Let AD is a median of ΔABC and D is the midpoint of BC. AD divides ΔABC in two triangles: ΔABD and ΔADC.
To prove: area(ΔABD) = area(ΔADC)
Construction: Draw $AL \perp BC$.
Proof:
Since D is the midpoint of BC, we have:
$BD = DC$
Multiplying with $\frac{1}{2}$, AL on both sides, we get:

$\frac{1}{2} \times BD \times AL = \frac{1}{2} \times DC \times AL$
$\Rightarrow$ area(ΔABD) = area(ΔADC)

Answer 16:



Let *ABCD* be a parallelogram and BD be its diagonal.
To prove: area(ΔABD) = area(ΔCDB)

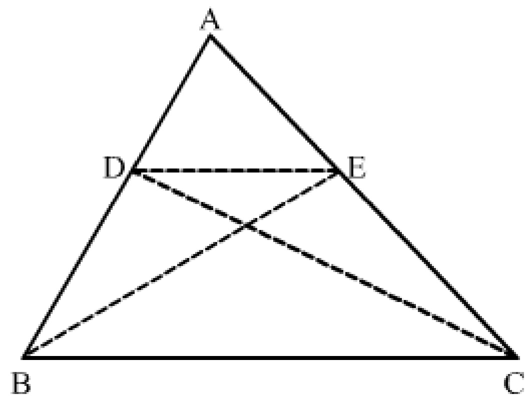
Proof:
In ΔABD and ΔCDB, we have:
$AB = CD$ [Opposite sides of a parallelogram]
$AD = CB$ [Opposite sides of a parallelogram]

$BD = DB$ [Common]
i.e., $\Delta ABD \cong \Delta CDB$ [SSS criteria]
$\therefore$ area(ΔABD) = area(ΔCDB)

Answer 17:

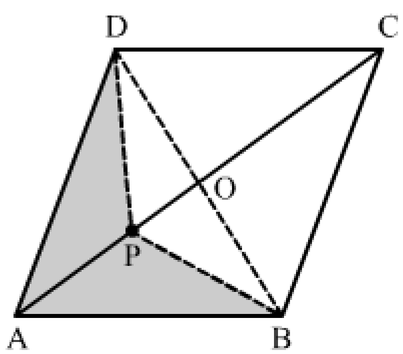
Line segment *CD* is bisected by *AB* at *O* (Given)
CO = OD .....(1)
In ΔCAO,
AO is the median. (From (1))
So, area(ΔCAO) = area(ΔDAO) .....(2)
Similarly,
In ΔCBD,
BO is the median (From (1))
So, area(ΔCBO) = area(ΔDBO) .....(3)
From (2) and (3) we have
area(ΔCAO) + area(ΔCBO) = area(ΔDBO) + area(ΔDAO)
$\Rightarrow$area(ΔABC) = area(ΔABD)

Answer 18:



area(ΔBCD) = area(ΔBCE) (Given)
We know, triangles on the same base and having equal area lie between the same parallels.
Thus, DE || BC.

Answer 19:



Join BD.
Let BD and AC intersect at point O.
O is thus the midpoint of DB and AC.
PO is the median of ΔDPB,
So,
area(ΔDPO)=area(ΔBPO) .....(1)

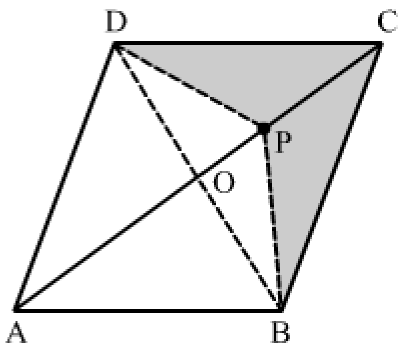
area(ΔADO)=area(ΔABO) .....(2)

Case 1:

(2)−(1)

⇒area(ΔADO)−area(ΔDPO)=area(ΔABO)−area(ΔBPO)
Thus, area(ΔADP) = area(ΔABP)

Case II:



area(ΔADO)+area(ΔDPO)=area(ΔABO)+area(ΔBPO)

Thus, area(ΔADP) = area(ΔABP)

Answer 20:

Given: $BO = OD$
To prove: area(ΔABC) = area(ΔADC)
Proof:
Since $BO = OD$, O is the mid point of BD.
We know that a median of a triangle divides it into two triangles of equal area.
CO is a median of ΔBCD.
i.e., area(ΔCOD) = area (ΔCOB) ...(i)

AO is a median of ΔABD.
i.e., area(ΔAOD) = area(ΔAOB) ...(ii)

From (i) and (ii), we have:
area(ΔCOD) + area(ΔAOD) = area(ΔCOB) + area(ΔAOB)
∴ area(ΔADC) = area(ΔABC)

Answer 21:

Given: D is the midpoint of BC and E is the midpoint of AD.

To prove: area(ΔBEC)= $\frac{1}{2}$ × area(ΔABC)

Proof:

Since E is the midpoint of AD, BE is the median of ΔABD.

We know that a median of a triangle divides it into two triangles of equal areas.

i.e., area(ΔBED) = $\frac{1}{2}$ × area(ΔABD) ...(i)

Also, area(ΔCDE) =$\frac{1}{2}$ × area(ΔADC) ...(ii)

From (i) and (ii), we have:

area(ΔBED) + area(ΔCDE) = $\frac{1}{2}$ × area(ΔABD) + $\frac{1}{2}$ × area(ΔADC)

⇒ area(ΔBEC) = $\frac{1}{2}$ × [area(ΔABD) + area(ΔADC)]

⇒ area(ΔBEC) = $\frac{1}{2}$ × area(ΔABC)

Answer 22:

D is the midpoint of side BC of ΔABC.

⇒ AD is the median of ΔABC.

⇒area(ΔABD)=area(ΔACD)= $\frac{1}{2}$ × area(ΔABC)

E is the midpoint of BD of ΔABD,

⇒AE is the median of ΔABD

⇒area(ΔABE)=area(ΔAED)= $\frac{1}{2}$ × area(ΔABD)= $\frac{1}{4}$ × area(ΔABC)

Also, O is the midpoint of AE,

⇒BO is the median of ΔABE,

⇒area(ΔABO)=area(ΔBOE)= $\frac{1}{2}$ × area(ΔABE)= $\frac{1}{4}$ × area(ΔABD)= $\frac{1}{8}$ × area(ΔABC)

Thus, area(ΔBOE) = $\frac{1}{8}$ × area(ΔABC)

Answer 23:

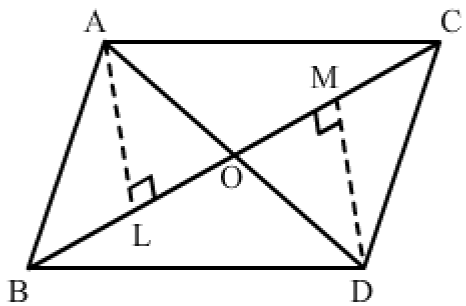
In ΔMQC and ΔMPB,
MC = MB (M is the midpoint of BC)
∠CMQ = ∠BMP (Vertically opposite angles)
∠MCQ = ∠MBP (Alternate interior angles on the parallel lines AB and DQ)
Thus, ΔMQC ≅ ΔMPB (ASA congruency)
⇒area(ΔMQC) = area(ΔMPB)
⇒area(ΔMQC) + area(APMCD) = area(ΔMPB) + area(APMCD)
⇒area(APQD) = area(ABCD)

Answer 24:

We have:
area(quad. *ABCD*) = area(Δ*ACD)* + area(Δ*ABC*)
area(Δ*ABP*) = area(Δ*ACP*) + area(Δ*ABC*)

Δ*ACD* and Δ*ACP* area on the same base and between the same parallels *AC* and *DP*.
∴ area(Δ*ACD*) = area(Δ *ACP*)
By adding area(Δ*ABC*) on both sides, we get:
area(Δ*ACD*) + area(Δ*ABC)* = area(Δ*ACP*) + area(Δ*ABC*)
⇒area (quad. *ABCD*) = area(Δ*ABP*)
Hence, proved.

Answer 25:



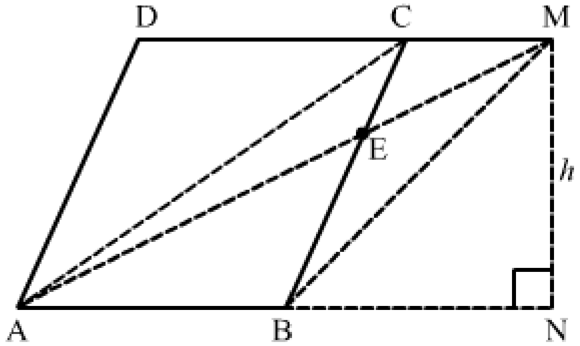
Given: Δ*ABC* and Δ*DBC* area on the same base *BC*.
area(Δ*ABC*) = area(Δ*DBC*)
To prove: BC bisects AD

Construction: Draw $AL \perp BC$ and $DM \perp BC$.
Proof:
Since ΔABC and ΔDBC area on the same base BC and they have equal area, their altitudes must be equal.
i.e., $AL = DM$
Let AD and BC intersect at O.
Now, in ΔALO and ΔDMO, we have:
$AL = DM$
$\angle ALO = \angle DMO = 90^{o}$
$\angle AOL = \angle DOM$ (Vertically opposite angles)
i.e., $\Delta ALO \cong \Delta DMO$
$OA = OD$
Hence, BC bisects AD.

Answer 26:

In ΔMDA and Δ MCP,
$\angle DMA = \angle CMP$ (Vertically opposite angles)
$\angle MDA = \angle MCP$ (Alternate interior angles)
AD = CP (Since AD = CB and CB = CP)
So, $\Delta MDA \cong \Delta MCP$ (ASA congruency)
$\Rightarrow$DM = MC (CPCT)
$\Rightarrow$M is the midpoint of DC
$\Rightarrow$BM is the median of Δ BDC
$\Rightarrow$area(Δ BMC) = area(Δ DMB) = 7 cm^2
area(Δ BMC) + area(Δ DMB) = area(Δ DBC) = 7 + 7 = 14 cm^2
Area of parallelogram ABCD = 2 × area(Δ DBC) = 2 × 14 = 28 cm^2

Answer 27:



Join BM and AC.

area(Δ ADC) = $\frac{1}{2}$ × b × h

= $\frac{1}{2}$ ×DC ×h

area(Δ ABM) = $\frac{1}{2}$ ×AB ×h

AB = DC (Since ABCD is a parallelogram)

So, area(Δ ADC) = area(Δ ABM)

⇒area(Δ ADC) + area(Δ AMC) = area(Δ ABM) + area(Δ AMC)

⇒area(Δ ADM) = area(ABMC)

Hence Proved

Answer 28:

Given: *ABCD* is a parallelogram and *P*, *Q*, *R and S* area the midpoints of sides AB, BC, CD and DA, respectively.

To prove: area(parallelogram *PQRS*) = $\frac{1}{2}$ × area(parallelogram *ABCD*)

Proof:

In Δ*ABC*, *PQ* || *AC* and *PQ* = $\frac{1}{2}$ × *AC* [By midpoint theorem]

Again, in Δ*DAC*, the points *S* and *R* area the mid points of *AD* and *DC*, respectively.

∴ SR || *AC* and *SR* = $\frac{1}{2}$ × *AC* [By midpoint theorem]

Now, *PQ* || *AC* and *SR* || *AC*

⇒ *PQ* || *SR*

Also, *PQ* = *SR* = $\frac{1}{2}$ × *AC*

∴ *PQ* || *SR* and *PQ* = *SR*

Hence, *PQRS* is a parallelogram.

Now, area(parallelogram *PQRS*) = area(Δ*PSQ*) + area(Δ*SRQ*) ...(i)
also,

area(parallelogram *ABCD*) = area(parallelogram *ABQS*)+area(parallelogram *SQCD*) ...(ii)

Δ*PSQ* and parallelogram *ABQS* area on the same base and between the same parallel lines.
So, area(Δ*PSQ*) =12 × area(parallelogram *ABQS*) ...(iii)
Similarly, Δ*SRQ* and parallelogram *SQCD* area on the same base and between the same parallel lines.
So, area(Δ*SRQ*) = 12 × area(parallelogram *SQCD*) ...(iv)
Putting the values from (iii) and (iv) in (i), we get:

area(parallelogram *PQRS*) $=\frac{1}{2}$ × area(parallelogram *ABQS*) + $\frac{1}{2}$ × area(parallelogram *SQCD*)

From (ii), we get:

area(parallelogram(*PQRS*) = $\frac{1}{2}$ × area(parallelogram *ABCD*)

Answer 29:

CF is median of ΔABC.

⇒area(ΔBCF) = $\frac{1}{2}$ (ΔABC) .....(1)

Similarly, BE is the median of ΔABC,

⇒area(ΔABE) = $\frac{1}{2}$ (ΔABC) .....(2)

From (1) and (2) we have
area(ΔBCF) = area(ΔABE)
⇒area(ΔBCF) − area(ΔBFG) = area(ΔABE) − area(ΔBFG)
⇒area(ΔBCG) = area(AFGE)
.

Answer 30:

Given: D is a point on BC of Δ*ABC*, such that BD = $\frac{1}{2}DC$

To prove: area(Δ*ABD*) = 13area(Δ*ABC*)
Construction: Draw AL ⊥ BC.
Proof:
In Δ*ABC*, we have:
BC = *BD* + *DC*
⇒ BD + 2 BD = 3 × BD
Now, we have:

area(Δ*ABD*) = $\frac{1}{2}$ × BD × AL

area(ΔABC) = $\frac{1}{2}$ × BC × AL

⇒ area(ΔABC) = $\frac{1}{2}$ × $3BD \times AL = 3 \times (\frac{1}{2} \times BD \times AL)$

⇒ area(ΔABC) = 3 × area(ΔABD)

∴ area(ΔABD) = $\frac{1}{3}$ area(ΔABC)

Answer 31:

E is the midpoint of CA.
So, AE = EC .....(1)
Also, BD = $\frac{1}{2}$ CA (Given)
So, BD = AE .....(2)
From (1) and (2) we have
BD = EC
BD || CA and BD = EC so, BDEC is a parallelogram
BE acts as the median of ΔABC
so, area(ΔBCE) = area(ΔABE) = 12area(ΔABC) .....(1)
area(ΔDBC) = area(ΔBCE) .....(2)

From (1) and (2)
area(ΔABC) = 2area(ΔDBC)

Answer 32:

Given: *ABCDE* is a pentagon. *EG* || *DA* and *CF* || *DB*.
To prove: area(pentagon *ABCDE*) = area(Δ*DGF)*
Proof:
area(pentagon *ABCDE*) = area(Δ*DBC*) + area(Δ*ADE*) + area(Δ*ABD*) ...(i)
Also, area(Δ*DGF)* = area(Δ*DBF*) + area(Δ*ADG*) + area(Δ*ABD*) ...(ii)

Now, ΔDBC and Δ*DBF* lie on the same base and between the same parallel lines.
∴ area(Δ*DBC*) = area(Δ*DBF*) ...(iii)
Similarly, ΔADE and ΔA*DG* lie on same base and between the same parallel lines.
∴ area(Δ*ADE*) = area(Δ*ADG*) ...(iv)

From (iii) and (iv), we have:
area(Δ*DBC*) + area(Δ*ADE*) = area(Δ*DBF*) + area(Δ*ADG*)
Adding area(Δ*ABD*) on both sides, we get:
area(Δ*DBC*) + area(Δ*ADE*) + area(Δ*ABD*) = area (Δ*DBF*) + area(Δ*ADG*) + area(Δ*ABD*)

By substituting the values from (i) and (ii), we get:
area(pentagon $ABCDE$) = area(ΔDGF)

Answer 33:

area(ΔCFA)=area(ΔCFB)

(Triangles on the same base CF and between the same parallels CF || BA will be equal in area)
⇒area(ΔCFA)−area(ΔCFG)
=area(ΔCFB)−area(ΔCFG)
⇒area(ΔAFG)=area(ΔCBG)

Hence Proved

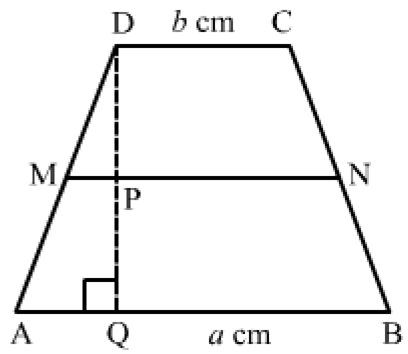
Answer 34:

Given: D is a point on BC of Δ ABC, such that BD : DC = $m : n$
To prove: area(ΔABD) : area(ΔADC) = $m : n$
Construction: Draw $AL \perp BC$.
Proof:
area(ΔABD) = $\frac{1}{2} \times BD \times AL$ ...(i)
area(ΔADC) = $\frac{1}{2} \times DC \times AL$ ...(ii)
Dividing (i) by (ii), we get:

$$\frac{\text{area}(\Delta ABD)}{\text{area}(\Delta ADC)} = \frac{\frac{1}{2} \times BD \times AL}{\frac{1}{2} \times DC \times AL}$$

$$\frac{\text{BD}}{\text{DC}} = \frac{m}{n}$$
∴ area(ΔABD) : area(ΔADC) = $m : n$

Answer 35:



Construction: Draw a perpendicular from point D to the opposite side AB, meeting AB at Q and MN at P.

Let length DQ = *h*

Given, M and N area the midpoints of AD and BC respectively.

So, MN || AB || DC and MN = $\frac{1}{2}$ (AB+DC)=($\frac{a+b}{2}$)

M is the mid point of AD and MP || AB so by converse of mid point theorem,

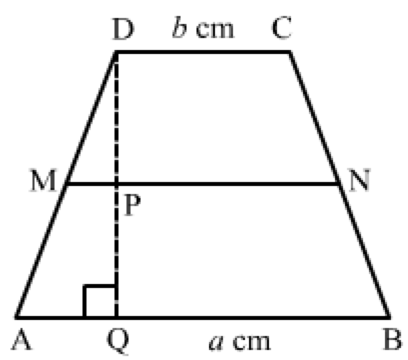
MP || AQ and P will be the mid point of DQ.

area(DCNM)= $\frac{1}{2}$ ×DP(DC+MN)= $\frac{1}{2}$ $h(b+\frac{a+b}{2})$= $\frac{h}{4}$ $(a+3b)$

area(MNBA)= $\frac{1}{2}$ ×PQ(AB+MN)= $\frac{1}{2}$ $h(a+\frac{a+b}{2})$= $\frac{h}{4}$ $(b+3a)$

area(DCNM) : area(MNBA) = $(a + 3b) : (3a + b)$

Answer 36:



Construction: Draw a perpendicular from point D to the opposite side CD, meeting CD at Q and EF at P.

Let length AQ = h
Given, E and F area the midpoints of AD and BC respectively.
So, EF || AB || DC and EF = $\frac{1}{2}$ (AB+DC)=($\frac{a+b}{2}$)

E is the mid point of AD and EP || AB so by converse of mid point theorem,
EP || DQ and P will be the mid point of AQ.
area(ABFE)= $\frac{1}{2}$ ×AP(AB+EF)=12h(b+$\frac{a+b}{2}$)= $\frac{h}{4}$ (a+3b)
area(EFCD)= $\frac{1}{2}$ ×PQ(CD+EF)=12h(a+$\frac{a+b}{2}$)= $\frac{h}{4}$ (b+3a)
area(ABEF) : area(EFCD) = (a + 3b) : (3a + b)
Here a = 24 cm and b = 16 cm
So,

$$\frac{\text{area(ABEF)}}{\text{area(EFCD)}} = \frac{24+3\times16}{16+3\times24} = \frac{9}{11}$$

Answer 37:

In ΔPAC,
PA || DE and E is the midpoint of AC
So, D is the midpoint of PC by converse of midpoint theorem.
Also, DE=$\frac{1}{2}$ PA .....(1)
Similarly, DE=$\frac{1}{2}$ AQ .....(2)
From (1) and (2) we have
PA = AQ
ΔABQ and ΔACP area on same base PQ and between same parallels PQ and BC
area(ΔABQ) = area(ΔACP)

Answer 38:

In ΔRSC and ΔPQB
∠CRS = ∠BPQ (CD || AB) so, corresponding angles area equal)
∠CSR = ∠BQP (SC || QB so, corresponding angles area equal)
SC = QB (BQSC is a parallelogram)
So, ΔRSC ≅ΔPQB (AAS congruency)
Thus, area(ΔRSC) = area(ΔPQB)