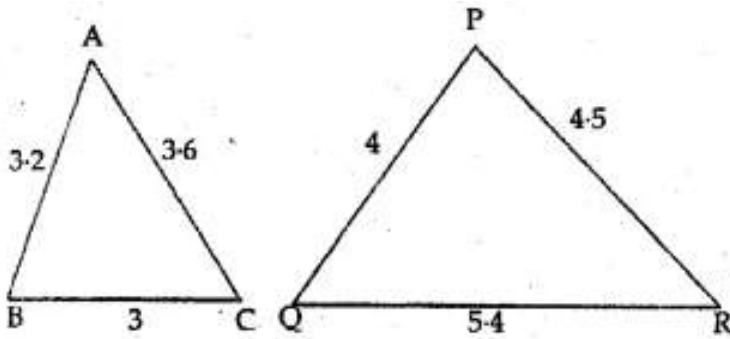
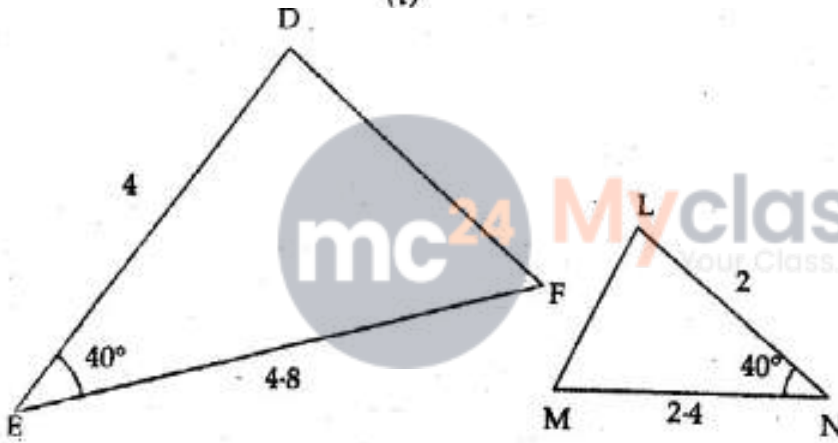


### EXERCISE 13.1

1. State which pairs of triangles in the figure given below are similar. Write the similarity rule used and also write the pairs of similar triangles in symbolic form (all lengths of sides are in cm):



(i)



(ii)

**Solution:-**

(i) From the  $\triangle ABC$  and  $\triangle PQR$

$$AB/PQ = 3.2/4$$

$$= 32/40$$

Divide both numerator and denominator by 8 we get,

$$= 4/5$$

$$AC/PR = 3.6/4.5$$

$$= 36/45$$

Divide both numerator and denominator by 9 we get,

$$= 4/5$$

$$BC/QR = 3/5.4$$

$$= 30/54$$

Divide both numerator and denominator by 6 we get,

$$= 5/9$$

By comparing all the results, the side are not equal.

Therefore, the triangles are not equal.

(ii) From the  $\triangle DEF$  and  $\triangle LMN$

$$\angle E = \angle N = 40^\circ$$

$$\text{Then, } DE/LN = 4/2$$

Divide both numerator and denominator by 2 we get,

$$= 2$$

$$EF/MN = 4.8/2.4$$

$$= 48/24$$

Divide both numerator and denominator by 24 we get,

$$= 2$$

Therefore,  $\triangle DEF \sim \triangle LMN$

**2. It is given that  $\triangle DEF \sim \triangle RPQ$ . Is it true to say that  $\angle D = \angle R$  and  $\angle F = \angle P$  ? Why?**

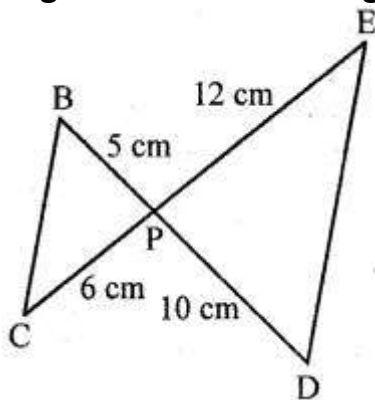
**Solution:-**

From the question is given that,  $\triangle DEF \sim \triangle RPQ$

$$\angle D = \angle R \text{ and } \angle F = \angle Q \text{ not } \angle P$$

No,  $\angle F \neq \angle P$

**3. If in two right triangles, one of the acute angle of one triangle is equal to an acute angle of the other triangle, can you say that the two triangles are similar? Why?**



**Solution:-**

From the figure, two line segments are intersecting each other at P.

In  $\triangle BCP$  and  $\triangle DPE$

$$5/10 = 6/12$$

Dividing LHS and RHS by 2 we get,

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

Therefore,  $\triangle BCD \sim \triangle DEP$

5. It is given that  $\triangle ABC \sim \triangle EDF$  such that  $AB = 5$  cm,  $AC = 7$  cm,  $DF = 15$  cm and  $DE = 12$  cm.

Find the lengths of the remaining sides of the triangles.

**Solution:-**

As per the dimensions give in the questions,



From the question it is given that,

$$\triangle DEF \sim \triangle LMN$$

$$\text{So, } AB/ED = AC/EF = BC/DF$$

$$\text{Consider } AB/ED = AC/EF$$

$$5/12 = 7/EF$$

By cross multiplication,

$$EF = (7 \times 12)/5$$

$$EF = 16.8 \text{ cm}$$

$$\text{Now, consider } AB/ED = BC/DF$$

$$5/12 = BC/15$$

$$BC = (5 \times 15)/12$$

$$BC = 75/12$$

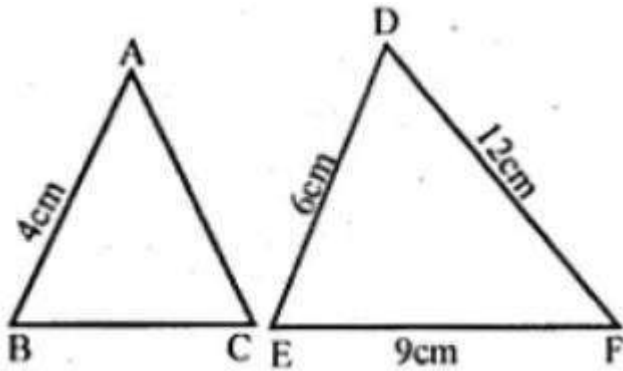
$$BC = 6.25$$

6.

(a) If  $\triangle ABC \sim \triangle DEF$ ,  $AB = 4$  cm,  $DE = 6$  cm,  $EF = 9$  cm and  $FD = 12$  cm, then find the perimeter of  $\triangle ABC$ .

**Solution:-**

As per the dimensions give in the questions,



Now, we have to find out the perimeter of  $\Delta ABC$

Let  $\Delta ABC \sim \Delta DEF$

So,  $AB/DE = AC/DF = BC/EF$

Consider,  $AB/DE = AC/DF$

$$4/6 = AC/12$$

By cross multiplication we get,

$$AC = (4 \times 12)/6$$

$$AC = 48/6$$

$$AC = 8 \text{ cm}$$

Then, consider  $AB/DE = BC/EF$

$$4/6 = BC/9$$

$$BC = (4 \times 9)/6$$

$$BC = 36/6$$

$$BC = 6 \text{ cm}$$

Therefore, the perimeter of  $\Delta ABC = AB + BC + AC$

$$= 4 + 6 + 8$$

$$= 18 \text{ cm}$$

**(b) If  $\Delta ABC \sim \Delta PQR$ , Perimeter of  $\Delta ABC = 32 \text{ cm}$ , perimeter of  $\Delta PQR = 48 \text{ cm}$  and  $PR = 6 \text{ cm}$ , then find the length of  $AC$ .**

**Solution:-**

From the question it is given that,

$\Delta ABC \sim \Delta PQR$

Perimeter of  $\Delta ABC = 32 \text{ cm}$

Perimeter of  $\Delta PQR = 48 \text{ cm}$

So,  $AB/PQ = AC/PR = BC/QR$

Then, perimeter of  $\Delta ABC$ /perimeter of  $\Delta PQR = AC/PR$

$$32/48 = AC/6$$

$$AC = (32 \times 6)/48$$

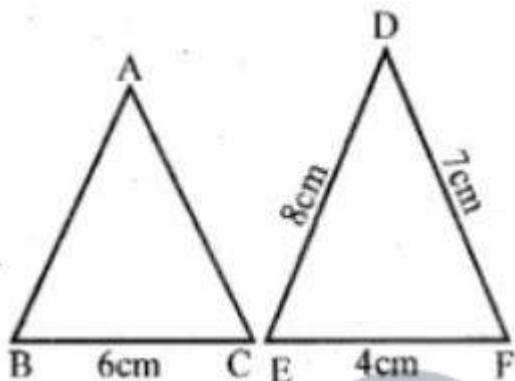
$$AC = 4$$

Therefore, the length of AC = 4 cm.

**7. Calculate the other sides of a triangle whose shortest side is 6 cm and which is similar to a triangle whose sides are 4 cm, 7 cm and 8 cm.**

**Solution:-**

Let us assume that,  $\Delta ABC \sim \Delta DEF$



$\Delta ABC$  is  $BC = 6\text{cm}$

$\Delta ABC \sim \Delta DEF$

So,  $AB/DE = BC/EF = AC/DF$

Consider  $AB/DE = BC/EF$

$$AB/8 = 6/4$$

$$AB = (6 \times 8)/4$$

$$AB = 48/4$$

$$AB = 12$$

Now, consider  $BC/EF = AC/DF$

$$6/4 = AC/7$$

$$AC = (6 \times 7)/4$$

$$AC = 42/4$$

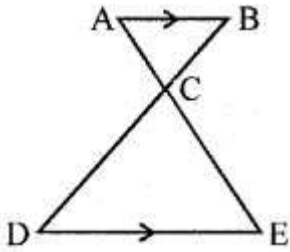
$$AC = 21/2$$

$$AC = 10.5\text{ cm}$$

**8.**

**(a) In the figure given below,  $AB \parallel DE$ ,  $AC = 3\text{ cm}$ ,  $CE = 7.5\text{ cm}$  and  $BD = 14\text{ cm}$ .**

**Calculate CB and DC.**



**Solution:-**

From the question it is given that,

$$AB \parallel DE$$

$$AC = 3 \text{ cm}$$

$$CE = 7.5 \text{ cm}$$

$$BD = 14 \text{ cm}$$

From the figure,

$$\angle ACB = \angle DCE \quad [\text{because vertically opposite angles}]$$

$$\angle BAC = \angle CED \quad [\text{alternate angles}]$$

Then,  $\triangle ABC \sim \triangle CDE$

So,  $AC/CE = BC/CD$

$$3/7.5 = BC/CD$$

By cross multiplication we get,

$$7.5BC = 3CD$$

Let us assume  $BC = x$  and  $CD = 14 - x$

$$7.5 \times x = 3 \times (14 - x)$$

$$7.5x = 42 - 3x$$

$$7.5x + 3x = 42$$

$$10.5x = 42$$

$$x = 42/10.5$$

$$x = 4$$

Therefore,  $BC = x = 4 \text{ cm}$

$$CD = 14 - x$$

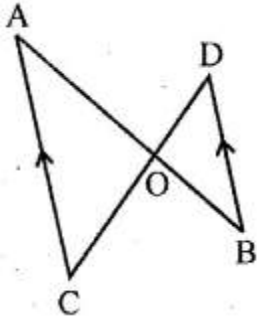
$$= 14 - 4$$

$$= 10 \text{ cm}$$

**(b) In the figure (2) given below,  $CA \parallel BD$ , the lines  $AB$  and  $CD$  meet at  $G$ .**

**(i) Prove that  $\triangle ACO \sim \triangle BDO$ .**

**(ii) If  $BD = 2.4 \text{ cm}$ ,  $OD = 4 \text{ cm}$ ,  $OB = 3.2 \text{ cm}$  and  $AC = 3.6 \text{ cm}$ , calculate  $OA$  and  $OC$ .**



**Solution:-**

(i) We have to prove that,  $\Delta ACO \sim \Delta BDO$ .

So, from the figure

Consider  $\Delta ACO$  and  $\Delta BDO$

Then,

$\angle AOC = \angle BOD$  [from vertically opposite angles]

$\angle A = \angle B$

Therefore,  $\Delta ACO \sim \Delta BDO$

Given,  $BD = 2.4$  cm,  $OD = 4$  cm,  $OB = 3.2$  cm,  $AC = 3.6$  cm,

$\Delta ACO \sim \Delta BDO$

So,  $AO/OB = CO/OD = AC/BD$

Consider  $AC/BD = AO/OB$

$$3.6/2.4 = AO/3.2$$

$$AO = (3.6 \times 3.2)/2.4$$

$$AO = 4.8 \text{ cm}$$

Now, consider  $AC/BD = CO/OD$

$$3.6/2.4 = CO/4$$

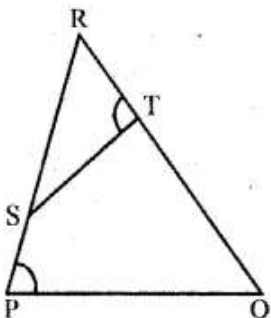
$$CO = (3.6 \times 4)/2.4$$

$$CO = 6 \text{ cm}$$

**9. (a) In the figure**

**(i) given below,  $\angle P = \angle RTS$ .**

**Prove that  $\Delta RPQ \sim \Delta RTS$ .**



**Solution:-**

From the given figure,  $\angle P = \angle RTS$

So we have to prove that  $\triangle RPQ \sim \triangle RTS$

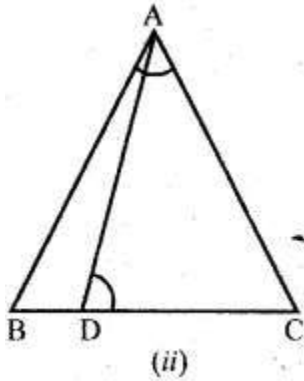
In  $\triangle RPQ$  and  $\triangle RTS$

$\angle R = \angle R$  (common angle for both triangle)

$\angle P = \angle RTS$  (from the question)

$\triangle RPQ \sim \triangle RTS$

**(b) In the figure (ii) given below,  $\angle ADC = \angle BAC$ . Prove that  $CA^2 = DC \times BC$**



**Solution:-**

From the figure,  $\angle ADC = \angle BAC$

So, we have to prove that,  $CA^2 = DC \times BC$

In  $\triangle ABC$  and  $\triangle ADC$

$\angle C = \angle C$  (common angle for both triangle)

$\angle BAC = \angle ADC$  (from the question)

$\triangle ABC \sim \triangle ADC$

Therefore,  $CA/DC = BC/CA$

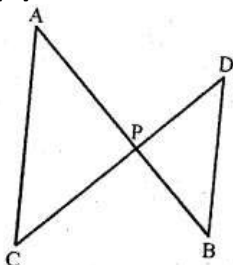
We know that, corresponding sides are proportional,

Therefore,  $CA^2 = DC \times BC$

**10. (a) In the figure (1) given below,  $AP = 2PB$  and  $CP = 2PD$ .**

**(i) Prove that  $\triangle ACP$  is similar to  $\triangle BDP$  and  $AC \parallel BD$ .**

**(ii) If  $AC = 4.5$  cm, calculate the length of  $BD$ .**



**Solution:-**

From the question it is given that,

$$AP = 2PB, CP = 2PD$$

(i) We have to prove that,  $\triangle ACP$  is similar to  $\triangle BDP$  and  $AC \parallel BD$

$$AP = 2PB$$

$$AP/PB = 2/1$$

Then,  $CP = 2PD$

$$CP/PD = 2/1$$

$$\angle APC = \angle BPD \quad \text{[from vertically opposite angles]}$$

So,  $\triangle ACP \sim \triangle BDP$

Therefore,  $\angle CAP = \angle PBD$  [alternate angles]

Hence,  $AC \parallel BD$

(ii)  $AP/PB = AC/BD = 2/1$

$$AC = 2BD$$

$$2BD = 4.5 \text{ cm}$$

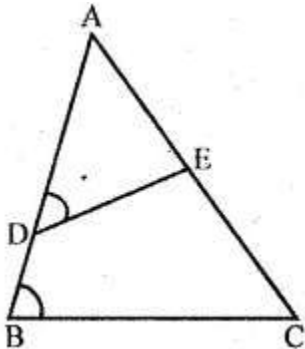
$$BD = 4.5/2$$

$$BD = 2.25 \text{ cm}$$

(b) In the figure (2) given below,  
 $\angle ADE = \angle ACB$ .

(i) Prove that  $\triangle ABC$  and  $\triangle AED$  are similar.

(ii) If  $AE = 3 \text{ cm}$ ,  $BD = 1 \text{ cm}$  and  $AB = 6 \text{ cm}$ , calculate  $AC$ .



**Solution:-**

From the given figure,

(i)  $\angle A = \angle A$  (common angle for both triangles)

$\angle ACB = \angle ADE$  [given]

Therefore,  $\triangle ABC \sim \triangle AED$

(ii) from (i) proved that,  $\triangle ABC \sim \triangle AED$

So,  $BC/DE = AB/AE = AC/AD$

$$\begin{aligned}AD &= AB - BD \\ &= 6 - 1 = 5\end{aligned}$$

Consider,  $AB/AE = AC/AD$

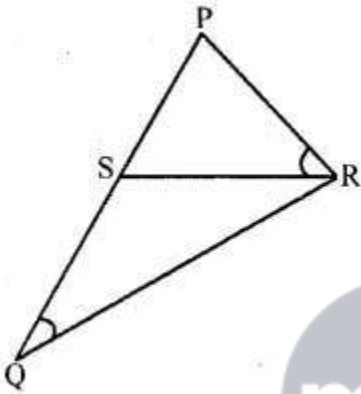
$$6/3 = AC/5$$

$$AC = (6 \times 5)/3$$

$$AC = 30/3$$

$$AC = 10 \text{ cm}$$

(c) In the figure (3) given below,  $\angle PQR = \angle PRS$ . Prove that triangles PQR and PRS are similar. If  $PR = 8 \text{ cm}$ ,  $PS = 4 \text{ cm}$ , calculate PQ.



**Solution:-**

From the figure,

$$\angle P = \angle P$$

(common angle for both triangles)

$$\angle PQR = \angle PRS$$

[from the question]

So,  $\Delta PQR \sim \Delta PRS$

$$\text{Then, } PQ/PR = PR/PS = QR/SR$$

Consider  $PQ/PR = PR/PS$

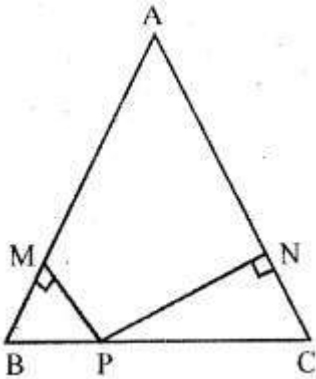
$$PQ/8 = 8/4$$

$$PQ = (8 \times 8)/4$$

$$PQ = 64/4$$

$$PQ = 16 \text{ cm}$$

11 . In the given figure, ABC is a triangle in which  $AB = AC$ . P is a point on the side BC such that  $PM \perp AB$  and  $PN \perp AC$ . Prove that  $BM \times NP = CN \times MP$ .



**Solution:-**

From the question it is given that, ABC is a triangle in which  $AB = AC$ .

P is a point on the side BC such that  $PM \perp AB$  and  $PN \perp AC$ .

We have to prove that,  $BM \times NP = CN \times MP$

Consider the  $\Delta ABC$

$AB = AC$  ... [from the question]

$\angle B = \angle C$  ... [angles opposite to equal sides]

Then, consider  $\Delta BMP$  and  $\Delta CNP$

$\angle M = \angle N$

Therefore,  $\Delta BMP \sim \Delta CNP$

So,  $BM/CN = MP/NP$

By cross multiplication we get,

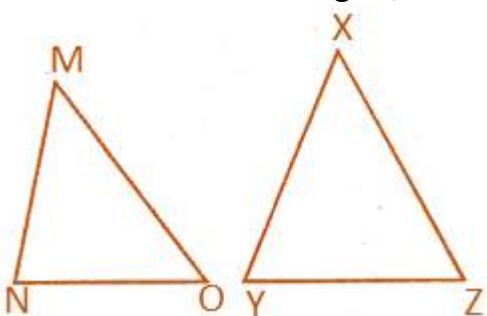
$BM \times NP = CN \times MP$

Hence it is proved.

**12. Prove that the ratio of the perimeters of two similar triangles is the same as the ratio of their corresponding sides.**

**Solution:-**

Consider the two triangles,  $\Delta MNO$  and  $\Delta XYZ$



From the question it is given that, two triangles are similar triangles

So,  $\Delta MNO \sim \Delta XYZ$

If two triangles are similar, the corresponding angles are equal and their corresponding

sides are proportional.

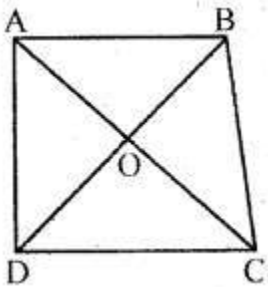
$$MN/XY = NO/YZ = MO/XZ$$

$$\text{Perimeter of } \triangle MNO = MN + NO + MO$$

$$\text{Perimeter of } \triangle XYZ = XY + YZ + XZ$$

$$\begin{aligned} \text{Therefore, } (MN/XY = NO/YZ = MO/XZ) &= (MN/XY + NO/YZ + MO/XZ) \\ &= \text{Perimeter of } \triangle MNO / \text{perimeter of } \triangle XYZ \end{aligned}$$

**13. In the adjoining figure, ABCD is a trapezium in which  $AB \parallel DC$ . The diagonals AC and BD intersect at O. Prove that  $AO/OC = BO/OD$**



Using the above result, find the values of  $x$  if  $OA = 3x - 19$ ,  $OB = x - 4$ ,  $OC = x - 3$  and  $OD = 4$ .

**Solution:-**

From the given figure, ABCD is a trapezium in which  $AB \parallel DC$ ,

The diagonals AC and BD intersect at O.

So we have to prove that,  $AO/OC = BO/OD$

Consider the  $\triangle AOB$  and  $\triangle COD$ ,

$$\angle AOB = \angle COD$$

... [vertically opposite angles]

$$\angle OAB = \angle OCD$$

Therefore,  $\triangle AOB \sim \triangle COD$

$$\text{So, } OA/OC = OB/OD$$

Now by using above result we have to find the value of  $x$  if  $OA = 3x - 19$ ,  $OB = x - 4$ ,  $OC = x - 3$  and  $OD = 4$ .

$$OA/OC = OB/OD$$

$$(3x - 19)/(x - 3) = (x - 4)/4$$

By cross multiplication we get,

$$(x - 3)(x - 4) = 4(3x - 19)$$

$$x^2 - 4x - 3x + 12 = 12x - 76$$

$$x^2 - 7x + 12 - 12x + 76 = 0$$

$$x^2 - 19x + 88 = 0$$

$$x^2 - 8x - 11x + 88 = 0$$

$$x(x - 8) - 11(x - 8) = 0$$

$$(x - 8)(x - 11) = 0$$

$$\text{Take } x - 8 = 0$$

$$x = 8$$

$$\text{Then, } x - 11 = 0$$

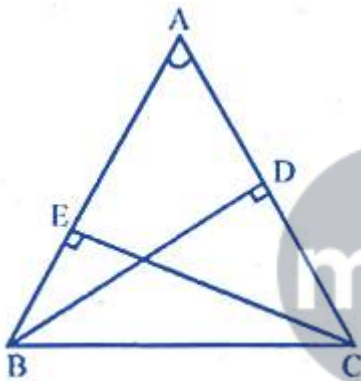
$$x = 11$$

Therefore, the value of  $x$  is 8 and 11.

**14. In  $\triangle ABC$ ,  $\angle A$  is acute.  $BD$  and  $CE$  are perpendicular on  $AC$  and  $AB$  respectively. Prove that  $AB \times AE = AC \times AD$ .**

**Solution:-**

Consider the  $\triangle ABC$ ,



So, we have to prove that,  $AB \times AE = AC \times AD$

Now, consider the  $\triangle ADB$  and  $\triangle AEC$ ,

$$\angle A = \angle A$$

[common angle for both triangles]

$$\angle ADB = \angle AEC$$

[both angles are equal to  $90^\circ$ ]

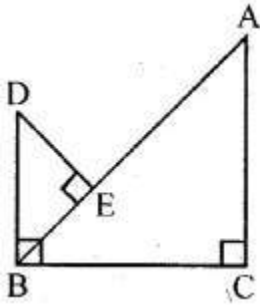
$$\triangle ADB \sim \triangle AEC$$

$$\text{So, } AB/AC = AD/AE$$

By cross multiplication we get,

$$AB \times AE = AC \times AD$$

**15. In the given figure,  $DB \perp BC$ ,  $DE \perp AB$  and  $AC \perp BC$ . Prove that  $BE/DE = AC/BC$**



**Solution:-**

From the figure,  $DB \perp BC$ ,  $DE \perp AB$  and  $AC \perp BC$

We have to prove that,  $BE/DE = AC/BC$

Consider the  $\triangle ABC$  and  $\triangle DEB$ ,

$$\angle C = 90^\circ$$

$$\angle A + \angle ABC = 90^\circ$$

[from the figure equation (i)]

Now in  $\triangle DEB$

$$\angle DBE + \angle ABC = 90^\circ$$

[from the figure equation (ii)]

From equation (i), we get

$$\angle A = \angle DBE$$

Then, in  $\triangle ABC$  and  $\triangle DBE$

$$\angle C = \angle E$$

[both angles are equal to  $90^\circ$ ]

So,  $\triangle ABC \sim \triangle DBE$

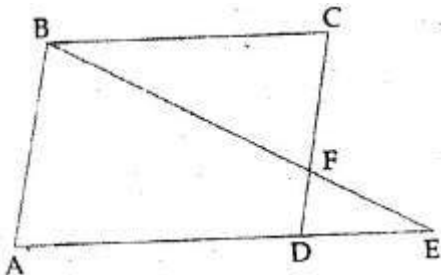
Therefore,  $AC/BE = BC/DE$

By cross multiplication, we get

$$AC/BC = BE/DE$$

16.

(a) In the figure (1) given below, E is a point on the side AD produced of a parallelogram ABCD and BE intersects CD at F. show that  $\triangle ABE \sim \triangle CFB$ .



**Solution:-**

From the figure, ABCD is a parallelogram,

Then, E is a point on AD and produced and BE intersects CD at F.

We have to prove that  $\triangle ABE \sim \triangle CFB$

Consider  $\triangle ABE$  and  $\triangle CFB$

$$\angle A = \angle C$$

[opposite angles of a parallelogram]

$$\angle ABE = \angle BFC$$

[alternate angles are equal]

$$\triangle ABE \sim \triangle CFB$$

**(b) In the figure (2) given below, PQRS is a parallelogram; PQ = 16 cm, QR = 10 cm. L is a point on PR such that RL : LP = 2 : 3. QL produced meets RS at M and PS produced at N.**

**(i) Prove that triangle RLQ is similar to triangle PLN. Hence, find PN.**

**Solution:-**

From the question it is give that,

Consider the  $\triangle RLQ$  and  $\triangle PLN$ ,

$$\angle RLQ = \angle NLP \quad \text{[vertically opposite angles are equal]}$$

$$\angle RQL = \angle LNP \quad \text{[alternate angle are equal]}$$

Therefore,  $\triangle RLQ \sim \triangle PLN$

$$\text{So, } QR/PN = RL/LP = 2/3$$

$$QR/PN = 2/3$$

$$10/PN = 2/3$$

$$PN = (10 \times 3)/2$$

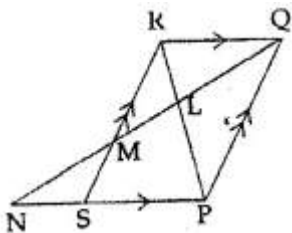
$$PN = 30/2$$

$$PN = 15 \text{ cm}$$

Therefore,  $PN = 15 \text{ cm}$



**(ii) Name a triangle similar to triangle RLM. Evaluate RM.**



**Solution:-**

From the figure,

Consider  $\triangle RLM$  and  $\triangle QLP$

$$\text{Then, } \angle RLM = \angle QLP \quad \text{[vertically opposite angles are equal]}$$

$$\angle LRM = \angle LPQ \quad \text{[alternate angles are equal]}$$

Therefore,  $\triangle RLM \sim \triangle QLP$

$$\text{Then, } RM/PQ = RL/LP = 2/3$$

$$\text{So, } RM/16 = 2/3$$

$$RM = (16 \times 2)/3$$

$$RM = 32/3$$

$$RM = 10\frac{2}{3}$$

**17. The altitude BN and CM of  $\Delta ABC$  meet at H. Prove that**

**(i)  $CN \times HM = BM \times HN$**

**(ii)  $HC/HB = \sqrt{(CN \times HN)/(BM \times HM)}$**

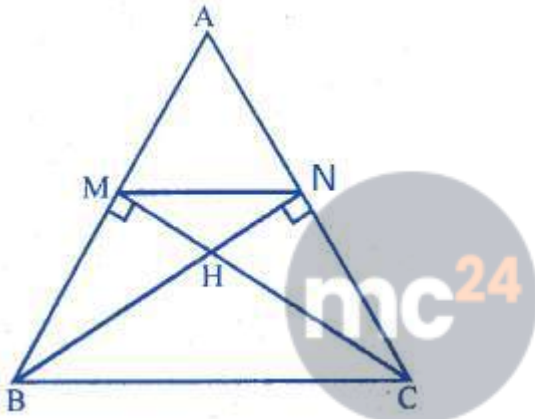
**(iii)  $\Delta MHN \sim \Delta BHC$**

**Solution:-**

Consider the  $\Delta ABC$ ,

Where, the altitude BN and CM of  $\Delta ABC$  meet at H.

and construction: join MN



(i) We have to prove that,  $CN \times HM = BM \times HN$

In  $\Delta BHM$  and  $\Delta CHN$

$$\angle BHM = \angle CHN$$

[because vertically opposite angles are equal]

$$\angle M = \angle N$$

[both angles are equal to  $90^\circ$ ]

Therefore,  $\Delta BHM \sim \Delta CHN$

$$\text{So, } HM/HN = BM/CN = HB/HC$$

Then, by cross multiplication we get

$$CN \times HM = BM \times HN$$

(ii) Now,  $HC/HB = \sqrt{(HN \times CN)/(HM \times BM)}$

$$= \sqrt{(CN \times HN)/(BM \times HM)}$$

Because, M and N divide AB and AC in the same ratio.

(iii) Now consider  $\Delta MHN$  and  $\Delta BHC$

$$\angle MHN = \angle BHC$$

[because vertically opposite angles are equal]

$$\angle MNH = \angle HBC$$

[because alternate angles are equal]

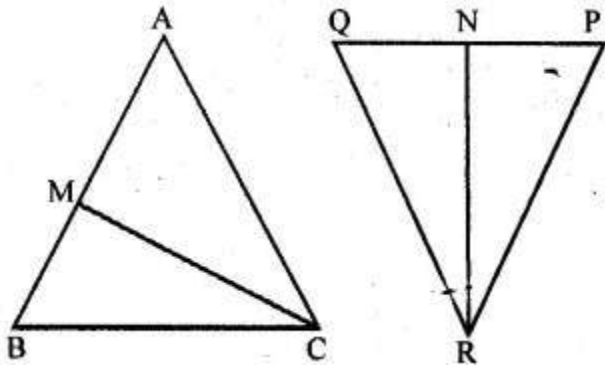
Therefore,  $\Delta MHN \sim \Delta BHC$

18. In the given figure, CM and RN are respectively the medians of  $\Delta ABC$  and  $\Delta PQR$ . If  $\Delta ABC \sim \Delta PQR$ , prove that:

(i)  $\Delta AMC \sim \Delta PNR$

(ii)  $CM/RN = AB/PQ$

(iii)  $\Delta CMB \sim \Delta RNQ$



**Solution:-**

From the given figure it is given that, CM and RN are respectively the medians of  $\Delta ABC$  and  $\Delta PQR$ .

(i) We have to prove that,  $\Delta AMC \sim \Delta PNR$

Consider the  $\Delta ABC$  and  $\Delta PQR$

As  $\Delta ABC \sim \Delta PQR$

$\angle A = \angle P$ ,  $\angle B = \angle Q$  and  $\angle C = \angle R$

And also corresponding sides are proportional

$AB/PQ = BC/QR = CA/PR$

Then, consider the  $\Delta AMC$  and  $\Delta PNR$ ,

$\angle A = \angle P$

$AC/PR = AM/PN$

Because,  $AB/PQ = \frac{1}{2} AB / \frac{1}{2} PQ$

$AB/PQ = AM/PN$

Therefore,  $\Delta AMC \sim \Delta PNR$

(ii) From solution(i)  $CM/RN = AM/PN$

$CM/RN = 2AM/2PN$

$CM/RN = AB/PQ$

(iii) Now consider the  $\Delta CMB$  and  $\Delta RNQ$

$\angle B = \angle Q$

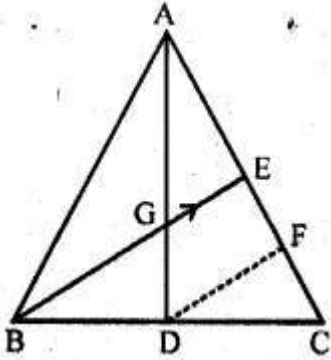
$BC/QP = BM/QN$

Therefore,  $\Delta CMB \sim \Delta RNQ$

19. In the adjoining figure, medians AD and BE of  $\triangle ABC$  meet at the point G, and DF is drawn parallel to BE. Prove that

(i)  $EF = FC$

(ii)  $AG : GD = 2 : 1$



**Solution:-**

From the figure it is given that, medians AD and BE of  $\triangle ABC$  meet at the point G, and DF is drawn parallel to BE.

(i) We have to prove that,  $EF = FC$

From the figure, D is the midpoint of BC and also DF parallel to BE.

So, F is the midpoint of EC

Therefore,  $EF = FC$

$$= \frac{1}{2} EC$$

$$EF = \frac{1}{2} AE$$

(ii) Now consider the  $\triangle AGE$  and  $\triangle ADF$

Then,  $(BG \text{ or } GE) \parallel DF$

Therefore,  $\triangle AGE \sim \triangle ADF$

So,  $AG/GD = AE/EF$

$$AG/GD = 1/\frac{1}{2}$$

$$AG/GD = 1 \times (2/1)$$

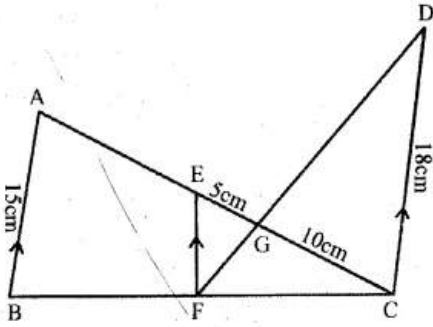
Therefore,  $AG : GD = 2 : 1$

**20.**

(a) In the figure given below, AB, EF and CD are parallel lines. Given that  $AB = 15$  cm,  $EG = 5$  cm,  $GC = 10$  cm and  $DC = 18$  cm. Calculate

(i) EF

(ii) AC.



**Solution:-**

From the figure it is given that, AB, EF and CD are parallel lines.

(i) Consider the  $\triangle EFG$  and  $\triangle CGD$

$\angle EGF = \angle CGD$  [Because vertically opposite angles are equal]

$\angle FEG = \angle GCD$  [alternate angles are equal]

Therefore,  $\triangle EFG \sim \triangle CGD$

Then,  $EG/GC = EF/CD$

$$5/10 = EF/18$$

$$EF = (5 \times 18)/10$$

Therefore,  $EF = 9$  cm

(ii) Now, consider the  $\triangle ABC$  and  $\triangle EFC$

$EF \parallel AB$

So,  $\triangle ABC \sim \triangle EFC$

Then,  $AC/EC = AB/EF$

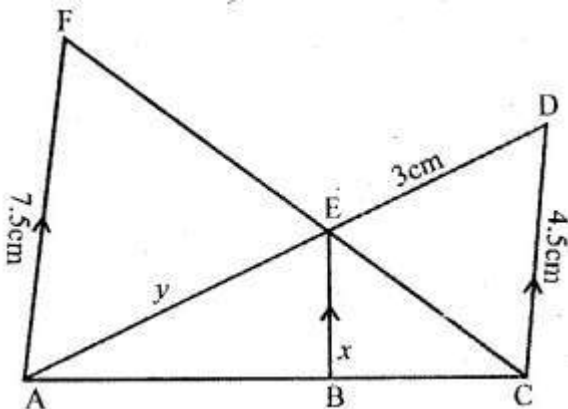
$$AC/(5 + 10) = 15/9$$

$$AC/15 = 15/9$$

$$AC = (15 \times 15)/9$$

Therefore,  $AC = 25$  cm

**(b) In the figure given below, AF, BE and CD are parallel lines. Given that  $AF = 7.5$  cm,  $CD = 4.5$  cm,  $ED = 3$  cm,  $BE = x$  and  $AE = y$ . Find the values of  $x$  and  $y$ .**



**Solution:-**

From the figure, AF, BE and CD are parallel lines.

Consider the  $\triangle AEF$  and  $\triangle CED$

$\angle AEF$  and  $\angle CED$  [because vertically opposite angles are equal]

$\angle F = \angle C$  [alternate angles are equal]

Therefore,  $\triangle AEF \sim \triangle CED$

So,  $AF/CD = AE/ED$

$$7.5/4.5 = y/3$$

By cross multiplication,

$$y = (7.5 \times 3)/4.5$$

$$y = 5 \text{ cm}$$

So, similarly in  $\triangle ACD$ ,  $BE \parallel CD$

Therefore,  $\triangle ABE \sim \triangle ACD$

$$EB/CD = AE/AD$$

$$x/CD = y/y + 3$$

$$x/4.5 = 5/(5 + 3)$$

$$x/4.5 = 5/8$$

$$x = (4.5 \times 5)/8$$

$$x = 22.5/8$$

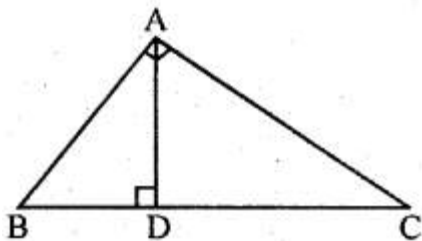
$$x = 225/80$$

$$x = 45/16$$

$$x = 2\frac{13}{16}$$



21. In the given figure,  $\angle A = 90^\circ$  and  $AD \perp BC$  If  $BD = 2 \text{ cm}$  and  $CD = 8 \text{ cm}$ , find  $AD$ .



**Solution:-**

From the figure, consider  $\triangle ABC$ ,

So,  $\angle A = 90^\circ$

And  $AD \perp BC$

$\angle BAC = 90^\circ$

Then,  $\angle BAD + \angle DAC = 90^\circ$

... [equation (i)]

Now, consider  $\triangle ADC$

$$\angle ADC = 90^\circ$$

$$\text{So, } \angle DCA + \angle DAC = 90^\circ$$

... [equation (ii)]

From equation (i) and equation (ii)

We have,

$$\angle BAD + \angle DAC = \angle DCA + \angle DAC$$

$$\angle BAD = \angle DCA$$

... [equation (iii)]

So, from  $\triangle BDA$  and  $\triangle ADC$

$$\angle BDA = \angle ADC$$

... [both the angles are equal to  $90^\circ$ ]

$$\angle BAD = \angle DCA$$

... [from equation (iii)]

Therefore,  $\triangle BDA \sim \triangle ADC$

$$BD/AD = AD/DC = AB/AC$$

Because, corresponding sides of similar triangles are proportional

$$BD/AD = AD/DC$$

By cross multiplication we get,

$$AD^2 = BD \times CD$$

$$AD^2 = 2 \times 8 = 16$$

$$AD = \sqrt{16}$$

$$AD = 4$$

**22. A 15 metres high tower casts a shadow of 24 metres long at a certain time and at the same time, a telephone pole casts a shadow 16 metres long. Find the height of the telephone pole.**

**Solution:-**

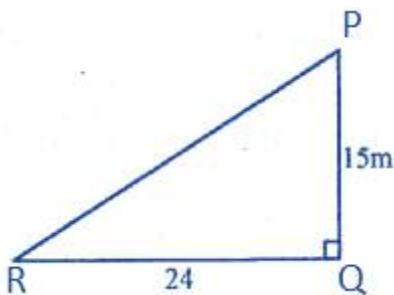
From the question it is given that,

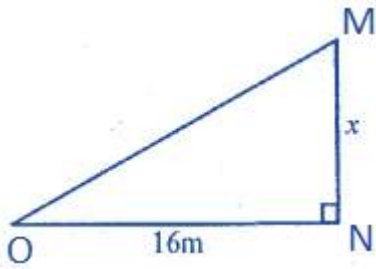
Height of a tower  $PQ = 15\text{m}$

It's shadow  $QR = 24\text{ m}$

Let us assume the height of a telephone pole  $MN = x$

It's shadow  $NO = 16\text{ m}$





Given, at the same time,

$$\Delta PQR \sim \Delta MNO$$

Therefore,  $PQ/MN = ON/RQ$

$$15/x = 24/16$$

By cross multiplication we get,

$$x = (15 \times 16)/24$$

$$x = 240/24$$

$$x = 10$$

Therefore, height of pole = 10 m.

**23. A street light bulb is fixed on a pole 6 m above the level of street. If a woman of height casts a shadow of 3 m, find how far she is away from the base of the pole?**

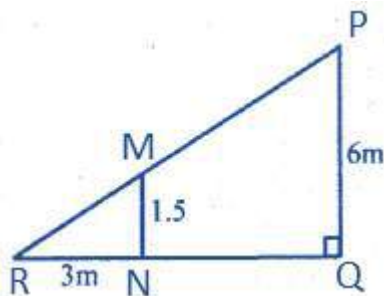
**Solution:-**

From the question it is given that,

Height of pole (PQ) = 6m

Height of a woman (MN) = 1.5m

So, shadow NR = 3m



Therefore, pole and woman are standing in the same line

$$PM \parallel MR$$

$$\Delta PRQ \sim \Delta MNR$$

So,  $RQ/RN = PQ/MN$

$$(3 + x)/3 = 6/1.5$$

$$(3 + x)/3 = 60/15$$

$$(3 + x)/3 = 4/1$$

$$(3 + x) = 12$$

$$X = 12 - 3$$

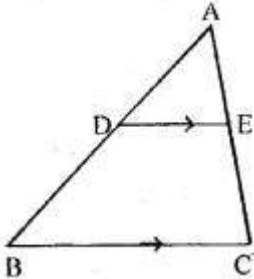
$$X = 9\text{m}$$

Therefore, women is 9m away from the pole.



### EXERCISE 13.2

1. (a) In the figure (i) given below if  $DE \parallel BG$ ,  $AD = 3$  cm,  $BD = 4$  cm and  $BC = 5$  cm. Find (i)  $AE : EC$  (ii)  $DE$ .



**Solution:-**

From the figure,

$DE \parallel BC$ ,  $AD = 3$  cm,  $BD = 4$  cm and  $BC = 5$  cm

(i)  $AE : EC$

So,  $AD/BD = AE/EC$

$AE/EC = AD/BD$

$AE/EC = 3/4$

$AE : EC = 3 : 4$

(ii) consider  $\triangle ADE$  and  $\triangle ABC$

$\angle D = \angle B$

$\angle E = \angle C$

Therefore,  $\triangle ADE \sim \triangle ABC$

Then,  $DE/BC = AD/AB$

$DE/5 = 3/(3 + 4)$

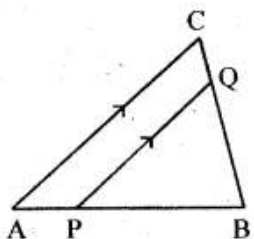
$DE/5 = 3/7$

$DE = (3 \times 5)/7$

$DE = 15/7$

$DE = 2\frac{1}{7}$

(b) In the figure (ii) given below,  $PQ \parallel AC$ ,  $AP = 4$  cm,  $PB = 6$  cm and  $BC = 8$  cm. Find  $CQ$  and  $BQ$ .



**Solution:-**

From the figure,

$PQ \parallel AC$ ,  $AP = 4$  cm,  $PB = 6$  cm and  $BC = 8$  cm

$\angle BQP = \angle BCA$  ... [because alternate angles are equal]

Also,  $\angle B = \angle B$  ... [common for both the triangles]

Therefore,  $\triangle ABC \sim \triangle BPQ$

Then,  $BQ/BC = BP/AB = PQ/AC$

$BQ/BC = 6/(6 + 4) = PQ/AC$

$BQ/BC = 6/10 = PQ/AC$

$BQ/8 = 6/10 = PQ/AC$  ... [because  $BC = 8$  cm given]

Now,  $BQ/8 = 6/10$

$BQ = (6/10) \times 8$

$BQ = 48/10$

$BQ = 4.8$  cm

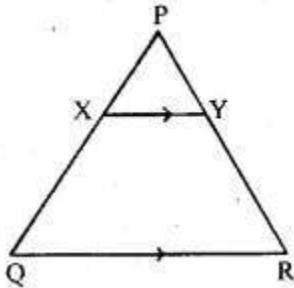
Also,  $CQ = BC - BQ$

$CQ = (8 - 4.8)$  cm

$CQ = 3.2$  cm

Therefore,  $CQ = 3.2$  cm and  $BQ = 4.8$  cm

(c) In the figure (iii) given below, if  $XY \parallel QR$ ,  $PX = 1$  cm,  $QX = 3$  cm,  $YR = 4.5$  cm and  $QR = 9$  cm, find  $PY$  and  $XY$ .



**Solution:-**

From the figure,

$XY \parallel QR$ ,  $PX = 1$  cm,  $QX = 3$  cm,  $YR = 4.5$  cm and  $QR = 9$  cm,

So,  $PX/QX = PY/YR$

$1/3 = PY/4.5$

By cross multiplication we get,

$(4.5 \times 1)/3 = PY$

$PY = 45/30$

$PY = 1.5$

Then,  $\angle X = \angle Q$

$$\angle Y = \angle R$$

So,  $\Delta PXY \sim \Delta PQR$

Therefore,  $XY/QR = PX/PQ$

$$XY/9 = 1/(1 + 3)$$

$$XY/9 = \frac{1}{4}$$

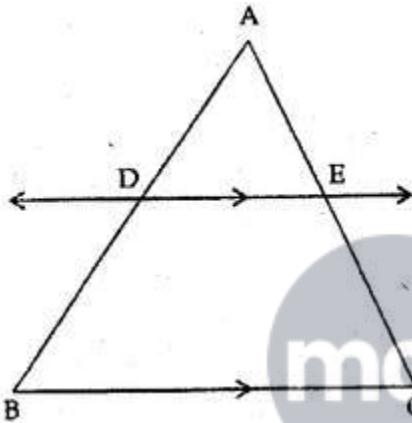
$$XY = 9/4$$

$$XY = 2.25$$

2. In the given figure,  $DE \parallel BC$ .

(i) If  $AD = x$ ,  $DB = x - 2$ ,  $AE = x + 2$  and  $EC = x - 1$ , find the value of  $x$ .

(ii) If  $DB = x - 3$ ,  $AB = 2x$ ,  $EC = x - 2$  and  $AC = 2x + 3$ , find the value of  $x$ .



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**Solution:-**

(i) From the figure, it is given that,

Consider the  $\Delta ABC$ ,

$$AD/DB = AE/EC$$

$$x/(x - 2) = (x + 2)/(x - 1)$$

By cross multiplication we get,

$$X(x - 1) = (x - 2)(x + 2)$$

$$x^2 - x = x^2 - 4$$

$$-x = -4$$

$$x = 4$$

(ii) From the question it is given that,

$$DB = x - 3, AB = 2x, EC = x - 2 \text{ and } AC = 2x + 3$$

Consider the  $\Delta ABC$ ,

$$AD/DB = AE/EC$$

$$2x/(x - 2) = (2x + 3)/(x - 3)$$

By cross multiplication we get,

$$2x(x - 2) = (2x + 3)(x - 3)$$

$$2x^2 - 4x = 2x^2 - 6x + 3x - 9$$

$$2x^2 - 4x - 2x^2 + 6x - 3x = -9$$

$$-7x + 6x = -9$$

$$-x = -9$$

$$x = 9$$

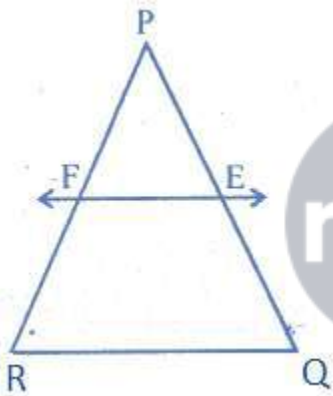
**3. E and F are points on the sides PQ and PR respectively of a  $\Delta PQR$ . For each of the following cases, state whether  $EF \parallel QR$ :**

**(i)  $PE = 3.9$  cm,  $EQ = 3$  cm,  $PF = 8$  cm and  $RF = 9$  cm.**

**Solution:-**

From the given dimensions,

Consider the  $\Delta PQR$



$$\text{So, } PE/EQ = 3.9/3$$

$$= 39/30$$

$$= 13/10$$

$$\text{Then, } PF/FR = 8/9$$

By comparing both the results,

$$13/10 \neq 8/9$$

Therefore,  $PE/EQ \neq PF/FR$

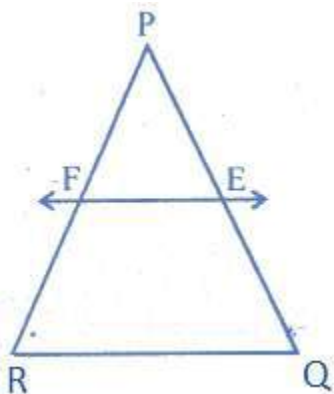
So,  $EF$  is not parallel to  $QR$

**(ii)  $PQ = 1.28$  cm,  $PR = 2.56$  cm,  $PE = 0.18$  cm and  $PF = 0.36$  cm.**

**Solution:-**

From the dimensions given in the question,

Consider the  $\Delta PQR$



$$\begin{aligned}\text{So, } PQ/PE &= 1.28/0.18 \\ &= 128/18 \\ &= 64/9\end{aligned}$$

$$\begin{aligned}\text{Then, } PR/PF &= 2.56/0.36 \\ &= 256/36 \\ &= 64/9\end{aligned}$$

By comparing both the results,

$$64/9 = 64/9$$

Therefore,  $PQ/PE = PR/PF$

So, EF is parallel to QR.

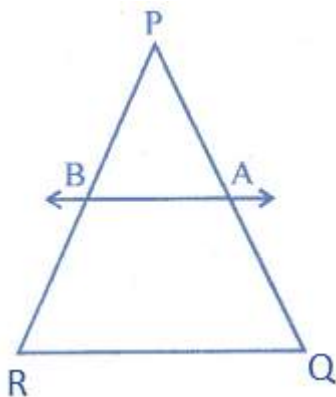


**4. A and B are respectively the points on the sides PQ and PR of a triangle PQR such that  $PQ = 12.5$  cm,  $PA = 5$  cm,  $BR = 6$  cm and  $PB = 4$  cm. Is  $AB \parallel QR$ ? Give reasons for your answer.**

**Solution:-**

From the dimensions given in the question,

Consider the  $\Delta PQR$



$$\begin{aligned}\text{So, } PQ/PA &= 12.5/5 \\ &= 2.5/1\end{aligned}$$

$$\begin{aligned}PR/PB &= (PB + BR)/PB \\ &= (4 + 6)/4 \\ &= 10/4 \\ &= 2.5\end{aligned}$$

By comparing both the results,

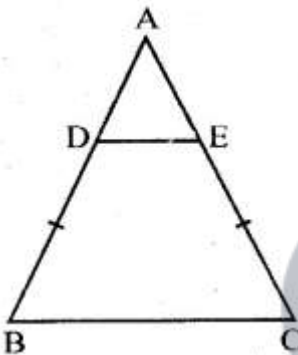
$$2.5 = 2.5$$

Therefore,  $PQ/PA = PR/PB$

So, AB is parallel to QR.

5.

(a) In figure (i) given below,  $DE \parallel BC$  and  $BD = CE$ . Prove that ABC is an isosceles triangle.



**Solution:-**

From the question it is given that,

$DE \parallel BC$  and  $BD = CE$

So, we have to prove that ABC is an isosceles triangle.

Consider the triangle ABC,

$$AD/DB = AE/EC$$

$$\text{Given, } DB = EC \quad \dots \text{ [equation (i)]}$$

$$\text{Then, } AD = AE \quad \dots \text{ [equation (ii)]}$$

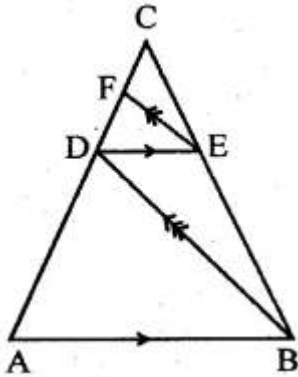
By adding equation (i) and equation (ii) we get,

$$AD + DB = AE + EC$$

$$\text{So, } AB = AC$$

Therefore,  $\triangle ABC$  is an isosceles triangle.

(b) In figure (ii) given below,  $AB \parallel DE$  and  $BD \parallel EF$ . Prove that  $DC^2 = CF \times AC$ .



**Solution:-**

From the figure it is given that,  $AB \parallel DE$  and  $BD \parallel EF$ .

We have to prove that,  $DC^2 = CF \times AC$

Consider the  $\Delta ABC$ ,

$$DC/CA = CE/CB \quad \dots \text{ [equation (i)]}$$

Now, consider  $\Delta CDE$

$$CF/CD = CE/CB \quad \dots \text{ [equation (ii)]}$$

From equation (i) and equation (ii),

$$DC/CA = CF/CD$$

$$DC/AC = CF/DC$$

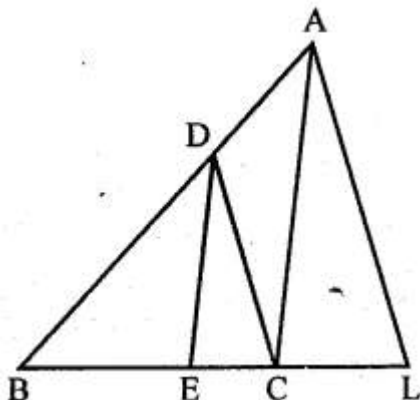
By cross multiplication we get,

$$DC^2 = CF \times AC$$



6.

(a) In the figure (i) given below,  $CD \parallel LA$  and  $DE \parallel AC$ . Find the length of  $CL$  if  $BE = 4$  cm and  $EC = 2$  cm.



**Solution:-**

From the given figure,  $CD \parallel LA$  and  $DE \parallel AC$ ,

Consider the  $\Delta BCA$ ,

$$BE/BC = BD/BA$$

By using the corollary of basic proportionality theorem,

$$BE/(BE + EC) = BD/AB$$

$$4/(4 + 2) = BD/AB \quad \dots \text{ [equation (i)]}$$

Then, consider the  $\triangle BLA$

$$BC/BL = BD/AB$$

By using the corollary of basic proportionality theorem,

$$6/(6 + CL) = BD/AB \quad \dots \text{ [equation (ii)]}$$

Now, combining the equation (i) and equation (ii), we get

$$6/(6 + CL) = 4/6$$

By cross multiplication we get,

$$6 \times 6 = 4 \times (6 + CL)$$

$$24 + 4CL = 36$$

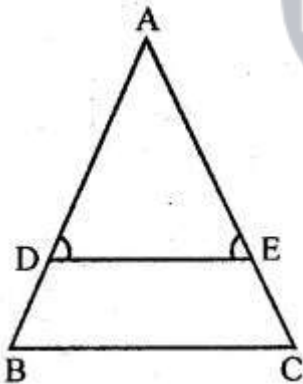
$$4CL = 36 - 24$$

$$CL = 12/4$$

$$CL = 3 \text{ cm}$$

Therefore, the length of CL is 3 cm.

**(b) In the give figure,  $\angle D = \angle E$  and  $AD/BD = AE/EC$ . Prove that BAC is an isosceles triangle.**



**Solution:-**

From the given figure,  $\angle D = \angle E$  and  $AD/BD = AE/EC$ ,

We have to prove that, BAC is an isosceles triangle

So, consider the  $\triangle ADE$

$$\angle D = \angle E \quad \dots \text{ [from the question]}$$

$$AD = AE \quad \dots \text{ [sides opposite to equal angles]}$$

Consider the  $\triangle ABC$ ,

$$\text{Then, } AD/DB = AE/EC \quad \dots \text{ [equation (i)]}$$

Therefore, DE parallel to BC

Because  $AD = AE$

$DB = EC$  ... [equation (ii)]

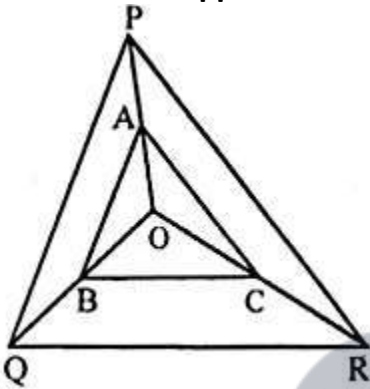
By adding equation (i) and equation (ii) we get,

$AD + DB = AE + EC$

$AB = AC$

Therefore,  $\Delta ABC$  is an isosceles triangle.

**7. In the adjoining given below, A, B and C are points on OP, OQ and OR respectively such that  $AB \parallel PQ$  and  $AC \parallel PR$ . show that  $BC \parallel QR$ .**



**Solution:-**

Consider the  $\Delta POQ$

$AB \parallel PQ$

... [given]

So,  $OA/AP = OB/BQ$

... [equation (i)]

Then, consider the  $\Delta OPR$

$AC \parallel PR$

$OA/AP = OC/CR$

... [equation (ii)]

Now by comparing both equation (i) and equation (ii),

$OB/BQ = OC/CR$

Then, in  $\Delta OQR$

$OB/BQ = OC/CR$

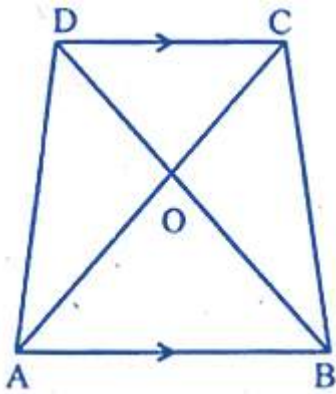
Therefore,  $BC \parallel QR$

**8. ABCD is a trapezium in which  $AB \parallel DC$  and its diagonals intersect each other at O. Using Basic Proportionality theorem, prove that  $AO/BO = CO/DO$**

**Solution:-**

From the question it is given that,

ABCD is a trapezium in which  $AB \parallel DC$  and its diagonals intersect each other at O



Now consider the  $\Delta OAB$  and  $\Delta OCD$ ,

$$\angle AOB = \angle COD$$

[because vertically opposite angles are equal]

$$\angle OBA = \angle ODC$$

[because alternate angles are equal]

$$\angle OAB = \angle OCD$$

[because alternate angles are equal]

Therefore,  $\Delta OAB \sim \Delta OCD$

$$\text{Then, } OA/OC = OB/OD$$

$$AO/OB = CO/DO$$

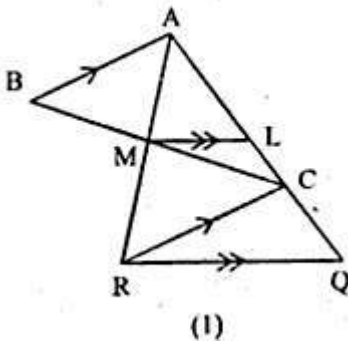
... [by alternate angles]

9.

(a) In the figure (1) given below,  $AB \parallel CR$  and  $LM \parallel QR$ .

(i) Prove that  $BM/MC = AL/LQ$

(ii) Calculate  $LM : QR$ , given that  $BM : MC = 1 : 2$ .



**Solution:-**

From the question it is given that,  $AB \parallel CR$  and  $LM \parallel QR$

(i) We have to prove that,  $BM/MC = AL/LQ$

Consider the  $\Delta ARQ$

$$LM \parallel QR$$

... [from the question]

$$\text{So, } AM/MR = AL/LQ$$

... [equation (i)]

Now, consider the  $\Delta AMB$  and  $\Delta MCR$

$$\angle AMB = \angle CMR$$

... [because vertically opposite angles are equal]

$$\angle MBA = \angle MCR$$

... [because alternate angles are equal]

$$\text{Therefore, } AM/MR = BM/MC$$

... [equation (ii)]

From equation (i) and equation (ii) we get,

$$BM/MR = AL/LQ$$

(ii) Given,  $BM : MC = 1 : 2$

$$AM/MR = BM/MC$$

$$AM/MR = \frac{1}{2}$$

... [equation (iii)]

$$LM \parallel QR$$

... [given from equation]

$$AM/MR = LM/QR$$

... [equation (iv)]

$$AR/AM = QR/LM$$

$$(AM + MR)/AM = QR/LM$$

$$1 + MR/AM = QR/LM$$

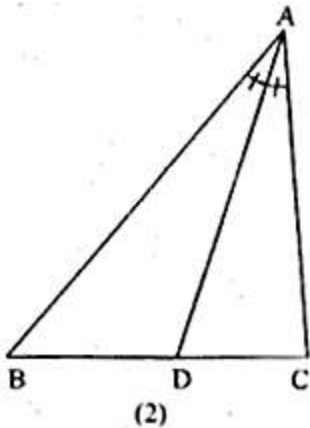
$$1 + (2/1) = QR/LM$$

$$3/1 = QR/LM$$

$$LM/QR = 1/3$$

Therefore, the ratio of LM: QR is 1: 3.

(b) In the figure (2) given below AD is bisector of  $\angle BAC$ . If  $AB = 6$  cm,  $AC = 4$  cm and  $BD = 3$  cm, find BC



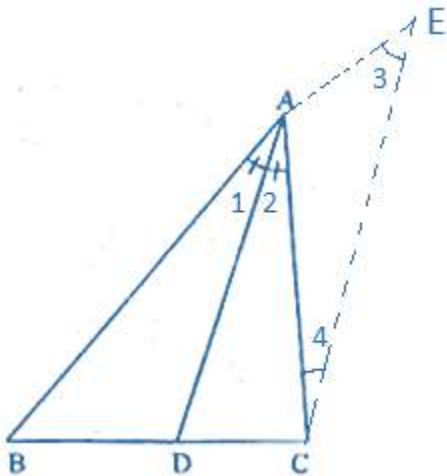
**Solution:-**

From the question it is given that,

AD is bisector of  $\angle BAC$

$AB = 6$  cm,  $AC = 4$  cm and  $BD = 3$  cm

Construction, from C draw a straight line CE parallel to DA and join AE



$$\angle 1 = \angle 2 \quad \dots \text{ [equation (i)]}$$

By construction  $CE \parallel DE$

$$\text{So, } \angle 2 = \angle 4 \quad \dots \text{ [because alternate angles are equal] [equation (ii)]}$$

Again by construction  $CE \parallel DE$

$$\angle 1 = \angle 3 \quad \dots \text{ [because corresponding angles are equal] [equation (iii)]}$$

By comparing equation (i), equation (ii) and equation (iii) we get,

$$\angle 3 = \angle 4$$

$$\text{So, } AC = AE \quad \dots \text{ [equation (iv)]}$$

Now, consider the  $\triangle BCE$ ,

$CE \parallel DE$

$$BD/DC = AB/AE$$

$$BD/DC = AB/AC$$

$$3/DC = 6/4$$

By cross multiplication we get,

$$3 \times 4 = 6 \times DC$$

$$DC = (3 \times 4)/6$$

$$DC = 12/6$$

$$DC = 2$$

Therefore,  $BC = BD + DC$

$$= 3 + 2$$

$$= 5 \text{ cm}$$

### EXERCISE 13.3

1. Given that  $\Delta s$  ABC and PQR are similar.

Find:

(i) The ratio of the area of  $\Delta ABC$  to the area of  $\Delta PQR$  if their corresponding sides are in the ratio 1 : 3.

(ii) the ratio of their corresponding sides if area of  $\Delta ABC$  : area of  $\Delta PQR = 25 : 36$ .

**Solution:-**

From the question it is given that,

(i) The area of  $\Delta ABC$  to the area of  $\Delta PQR$  if their corresponding sides are in the ratio 1 : 3

Then,  $\Delta ABC \sim \Delta PQR$

$$\text{area of } \Delta ABC / \text{area of } \Delta PQR = BC^2 / QR^2$$

$$\text{So, } BC : QR = 1 : 3$$

$$\begin{aligned} \text{Therefore, } \Delta ABC / \text{area of } \Delta PQR &= 1^2 / 3^2 \\ &= 1/9 \end{aligned}$$

Hence the ratio of the area of  $\Delta ABC$  to the area of  $\Delta PQR$  is 1: 9

(ii) The area of  $\Delta ABC$  to the area of  $\Delta PQR$  if their corresponding sides are in the ratio 25 : 36

Then,  $\Delta ABC \sim \Delta PQR$

$$\text{area of } \Delta ABC / \text{area of } \Delta PQR = BC^2 / QR^2$$

$$\begin{aligned} \text{area of } \Delta ABC / \text{area of } \Delta PQR &= BC^2 / QR^2 = 25/36 \\ &= (BC/QR)^2 = (5/6)^2 \end{aligned}$$

$$BC/QR = 5/6$$

Hence the ratio of their corresponding sides is 5 : 6

2.  $\Delta ABC \sim \Delta DEF$ . If area of  $\Delta ABC = 9$  sq. cm., area of  $\Delta DEF = 16$  sq. cm and  $BC = 2.1$  cm., find the length of  $EF$ .

**Solution:-**

From the question it is given that,

$$\Delta ABC \sim \Delta DEF$$

$$\text{Area of } \Delta ABC = 9 \text{ sq. cm}$$

$$\text{Area of } \Delta DEF = 16 \text{ sq. cm}$$

We know that,

$$\text{area of } \Delta ABC / \text{area of } \Delta DEF = BC^2 / EF^2$$

$$\text{area of } \Delta ABC / \text{area of } \Delta DEF = BC^2 / EF^2$$

$$9/16 = BC^2 / EF^2$$

$$9/16 = (2.1)^2 / x^2$$

$$2.1/x = \sqrt{9}/\sqrt{16}$$

$$2.1/x = \frac{3}{4}$$

By cross multiplication we get,

$$2.1 \times 4 = 3 \times x$$

$$8.4 = 3x$$

$$x = 8.4/3$$

$$x = 2.8$$

Therefore, EF = 2.8 cm

**3.  $\Delta ABC \sim \Delta DEF$ . If BC = 3 cm, EF = 4 cm and area of  $\Delta ABC = 54$  sq. cm. Determine the area of  $\Delta DEF$ .**

**Solution:-**

From the question it is given that,

$$\Delta ABC \sim \Delta DEF$$

$$BC = 3 \text{ cm, EF} = 4 \text{ cm}$$

$$\text{Area of } \Delta ABC = 54 \text{ sq. cm.}$$

We know that,

$$\text{Area of } \Delta ABC / \text{area of } \Delta DEF = BC^2 / EF^2$$

$$54 / \text{area of } \Delta DEF = 3^2 / 4^2$$

$$54 / \text{area of } \Delta DEF = 9 / 16$$

By cross multiplication we get,

$$\text{Area of } \Delta DEF = (54 \times 16) / 9$$

$$= 6 \times 16$$

$$= 96 \text{ cm}$$

**4. The area of two similar triangles are  $36 \text{ cm}^2$  and  $25 \text{ cm}^2$ . If an altitude of the first triangle is 2.4 cm, find the corresponding altitude of the other triangle.**

**Solution:-**

From the question it is given that,

The area of two similar triangles are  $36 \text{ cm}^2$  and  $25 \text{ cm}^2$ .

Let us assume  $\Delta PQR \sim \Delta XYZ$ , PM and XN are their altitudes.

$$\text{So, area of } \Delta PQR = 36 \text{ cm}^2$$

$$\text{Area of } \Delta XYZ = 25 \text{ cm}^2$$

$$PM = 2.4 \text{ cm}$$

$$\text{Assume } XN = a$$

We know that,

$$\text{area of } \Delta PQR / \text{area of } \Delta XYZ = PM^2 / XN^2$$

$$36 / 25 = (2.4)^2 / a^2$$

By cross multiplication we get,

$$36a^2 = 25 (2.4)^2$$

$$a^2 = 5.76 \times 25/36$$

$$a^2 = 144/36$$

$$a^2 = 4$$

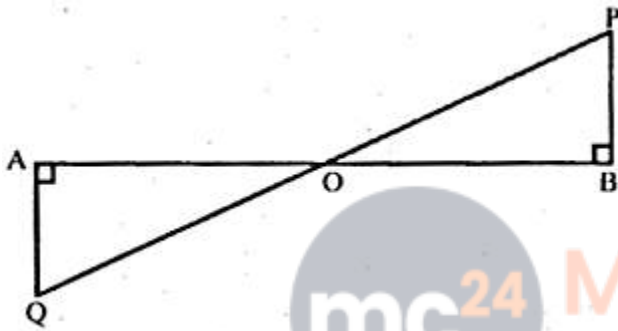
$$a = \sqrt{4}$$

$$a = 2 \text{ cm}$$

Therefore, altitude of the other triangle  $XN = 2 \text{ cm}$ .

5.

(a) In the figure, (i) given below,  $PB$  and  $QA$  are perpendiculars to the line segment  $AB$ . If  $PO = 6 \text{ cm}$ ,  $QO = 9 \text{ cm}$  and the area of  $\Delta POB = 120 \text{ cm}^2$ , find the area of  $\Delta QOA$ .



**Solution:-**

From the question it is given that,  $PO = 6 \text{ cm}$ ,  $QO = 9 \text{ cm}$  and the area of  $\Delta POB = 120 \text{ cm}^2$

From the figure,

Consider the  $\Delta AOQ$  and  $\Delta BOP$ ,

$$\angle OAQ = \angle OBP$$

... [both angles are equal to  $90^\circ$ ]

$$\angle AOQ = \angle BOP$$

... [because vertically opposite angles are equal]

Therefore,  $\Delta AOQ \sim \Delta BOP$

Then, area of  $\Delta AOQ$ /area of  $\Delta BOP = OQ^2/PO^2$

$$\text{Area of } \Delta AOQ/120 = 9^2/6^2$$

$$\text{Area of } \Delta AOQ/120 = 81/36$$

$$\text{Area of } \Delta AOQ = (81 \times 120)/36$$

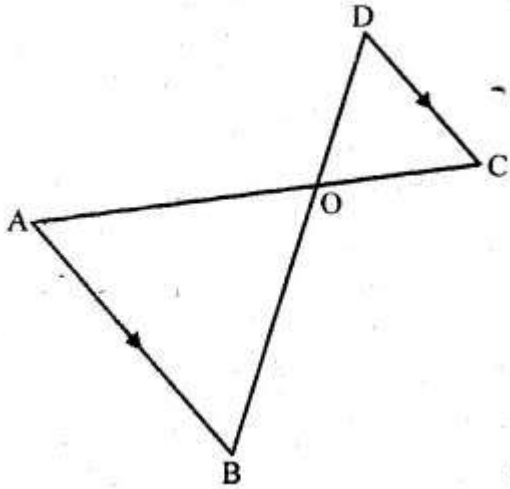
$$\text{Area of } \Delta AOQ = 270 \text{ cm}^2$$

b) In the figure (ii) given below,  $AB \parallel DC$ .  $AO = 10 \text{ cm}$ ,  $OC = 5 \text{ cm}$ ,  $AB = 6.5 \text{ cm}$  and  $OD = 2.8 \text{ cm}$ .

(i) Prove that  $\Delta OAB \sim \Delta OCD$ .

(ii) Find  $CD$  and  $OB$ .

(iii) Find the ratio of areas of  $\Delta OAB$  and  $\Delta OCD$ .



**Solution:-**

From the question it is given that,  
 $AB \parallel DC$ .  $AO = 10$  cm,  $OC = 5$  cm,  $AB = 6.5$  cm and  $OD = 2.8$  cm

(i) We have to prove that,  $\Delta OAB \sim \Delta OCD$

So, consider the  $\Delta OAB$  and  $\Delta OCD$

$$\angle AOB = \angle COD$$

... [because vertically opposite angles are equal]

$$\angle OBA = \angle OCD$$

... [because alternate angles are equal]

Therefore,  $\Delta OAB \sim \Delta OCD$

... [from AAA axiom]

(ii) Consider the  $\Delta OAB$  and  $\Delta OCD$

$$OA/OC = OB/OD = AB/CD$$

Now consider  $OA/OC = OB/OD$

$$10/5 = OB/2.8$$

$$OB = (10 \times 2.8)/5$$

$$OB = 2 \times 2.8$$

$$OB = 5.6 \text{ cm}$$

Then, consider  $OA/OC = AB/CD$

$$10/5 = 6.5/CD$$

$$CD = (6.5 \times 5)/10$$

$$CD = 32.5/10$$

$$CD = 3.25 \text{ cm}$$

(iii) We have to find the ratio of areas of  $\Delta OAB$  and  $\Delta OCD$ .

From (i) we proved that,  $\Delta OAB \sim \Delta OCD$

Then, area of  $(\Delta OAB)/$ area of  $\Delta OCD$

$$AB^2/CD^2 = (6.5)^2/(3.25)^2$$

$$= (6.5 \times 6.5)/(3.25 \times 3.25)$$

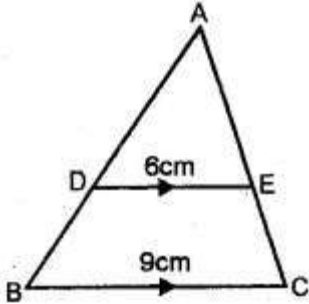
$$= 2 \times 2/1$$

$$= 4/1$$

Therefore, the ratio of areas of  $\Delta OAB$  and  $\Delta OCD = 4: 1$ .

6.

(a) In the figure (i) given below,  $DE \parallel BC$ . If  $DE = 6$  cm,  $BC = 9$  cm and area of  $\Delta ADE = 28$  sq. cm, find the area of  $\Delta ABC$ .



**Solution:-**

From the question it is given that,

$DE \parallel BC$ ,  $DE = 6$  cm,  $BC = 9$  cm and area of  $\Delta ADE = 28$  sq. cm

From the fig,  $\angle D = \angle B$  and  $\angle E = \angle C$  ... [corresponding angles are equal]

Now consider the  $\Delta ADE$  and  $\Delta ABC$ ,

$\angle A = \angle A$

... [common angles for both triangles]

Therefore,  $\Delta ADE \sim \Delta ABC$

Then, area of  $\Delta ADE$ /area of  $\Delta ABC = (DE)^2/(BC)^2$

$$28/\text{area of } \Delta ABC = (6)^2/(9)^2$$

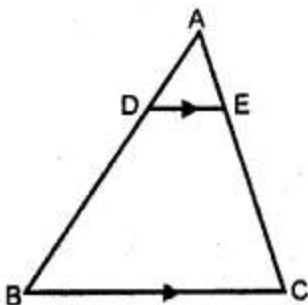
$$28/\text{area of } \Delta ABC = 36/81$$

$$\text{area of } \Delta ABC = (28 \times 81)/36$$

$$\text{area of } \Delta ABC = 2268/36$$

$$\text{area of } \Delta ABC = 63 \text{ cm}^2$$

(b) In the figure (ii) given below,  $DE \parallel BC$  and  $AD : DB = 1 : 2$ , find the ratio of the areas of  $\Delta ADE$  and trapezium  $DBCE$ .



**Solution:-**

From the question it is given that,  $DE \parallel BC$  and  $AD : DB = 1 : 2$ ,

$\angle D = \angle B$ ,  $\angle E = \angle C$  ... [corresponding angles are equal]

Consider the  $\triangle ADE$  and  $\triangle ABC$ ,

$\angle A = \angle A$  ... [common angles for both triangles]

Therefore,  $\triangle ADE \sim \triangle ABC$

But,  $AD/DB = 1/2$

Then,  $DB/AD = 2/1$

Now, adding 1 for both side LHS and RHS,

$$(DB/AD) + 1 = (2/1) + 1$$

$$(DB + AD)/AD = (2 + 1)$$

Therefore,  $\triangle ADE \sim \triangle ABC$

Then, area of  $\triangle ADE$ /area of  $\triangle ABC = AD^2/AB^2$

$$\text{Area of } \triangle ADE/\text{area of } \triangle ABC = (1/3)^2$$

$$\text{Area of } \triangle ADE/\text{area of } \triangle ABC = 1/9$$

$$\text{Area of } \triangle ABC = 9 \text{ area of } \triangle ADE$$

Area of trapezium DBCE

$$\text{Area of } \triangle ABC - \text{area of } \triangle ADE$$

$$9 \text{ area of } \triangle ADE - \text{area of } \triangle ADE$$

$$8 \text{ area of } \triangle ADE$$

$$\text{Therefore, area of } \triangle ADE/\text{area of trapezium} = 1/8$$

$$\text{Then area of } \triangle ADE : \text{area of trapezium DBCE} = 1 : 8$$

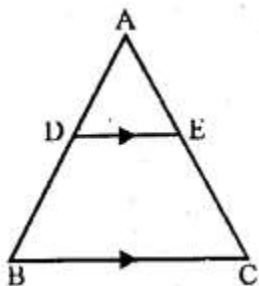
7.

In the given figure,  $DE \parallel BC$ .

(i) Prove that  $\triangle ADE$  and  $\triangle ABC$  are similar.

(ii) Given that  $AD = 1/2 BD$ , calculate  $DE$  if  $BC = 4.5$  cm.

(iii) If area of  $\triangle ABC = 18\text{cm}^2$ , find the area of trapezium DBCE



**Solution:-**

(i) From the question it is given that,  $DE \parallel BC$

We have to prove that,  $\triangle ADE$  and  $\triangle ABC$  are similar

$\angle A = \angle A$  ... [common angle for both triangles]  
 $\angle ADE = \angle ABC$  ... [because corresponding angles are equal]  
 Therefore,  $\triangle ADE \sim \triangle ABC$  ... [AA axiom]

(ii) From (i) we proved that,  $\triangle ADE \sim \triangle ABC$

Then,  $AD/AB = DE/BC$

So,  $AD/(AD + BD) = DE/BC$

$(\frac{1}{2} BD)/((\frac{1}{2}BD) + BD) = DE/4.5$

$(\frac{1}{2} BD)/((\frac{3}{2})BD) = DE/4.5$

$\frac{1}{2} \times (2/3) = DE/4.5$

$1/3 = DE/4.5$

Therefore,  $DE = 4.5/3$

$DE = 1.5 \text{ cm}$

(iii) From the question it is given that, area of  $\triangle ABC = 18 \text{ cm}^2$

Then, area of  $\triangle ADE/\text{area of } \triangle ABC = DE^2/BC^2$

area of  $\triangle ADE/18 = (DE/BC)^2$

area of  $\triangle ADE/18 = (AD/AB)^2$

area of  $\triangle ADE/18 = (1/3)^2 = 1/9$

area of  $\triangle ADE = 18 \times 1/9$

area of  $\triangle ADE = 2$

So, area of trapezium DBCE = area of  $\triangle ABC$  – area of  $\triangle ADE$

$$= 18 - 2$$

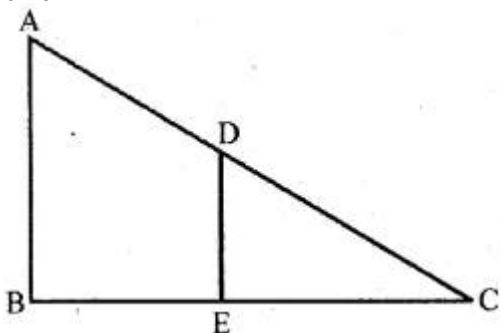
$$= 16 \text{ cm}^2$$

**8. In the given figure, AB and DE are perpendicular to BC.**

**(i) Prove that  $\triangle ABC \sim \triangle DEC$**

**(ii) If  $AB = 6 \text{ cm}$ ,  $DE = 4 \text{ cm}$  and  $AC = 15 \text{ cm}$ , calculate CD.**

**(iii) Find the ratio of the area of  $\triangle ABC$  : area of  $\triangle DEC$ .**



**Solution:-**

(i) Consider the  $\triangle ABC$  and  $\triangle DEC$ ,

$$\angle ABC = \angle DEC$$

... [both angles are equal to  $90^\circ$ ]

$$\angle C = \angle C$$

... [common angle for both triangles]

Therefore,  $\triangle ABC \sim \triangle DEC$

... [by AA axiom]

(ii)  $AC/CD = AB/DE$

Corresponding sides of similar triangles are proportional

$$15/CD = 6/4$$

$$CD = (15 \times 4)/6$$

$$CD = 60/6$$

$$CD = 10 \text{ cm}$$

(iii) we know that, area of  $\triangle ABC$ /area of  $\triangle DEC = AB^2/DE^2$

$$\text{area of } \triangle ABC/\text{area of } \triangle DEC = 6^2/4^2$$

$$\text{area of } \triangle ABC/\text{area of } \triangle DEC = 36/16$$

$$\text{area of } \triangle ABC/\text{area of } \triangle DEC = 9/4$$

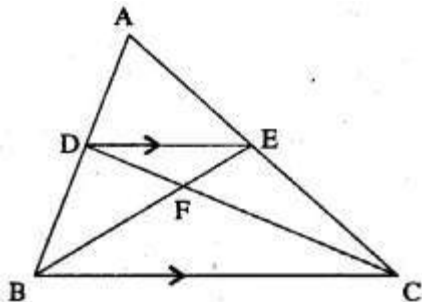
Therefore, the ratio of the area of  $\triangle ABC$  : area of  $\triangle DEC$  is 9 : 4.

9. In the adjoining figure,  $ABC$  is a triangle.  $DE$  is parallel to  $BC$  and  $AD/DB = 3/2$ ,

(i) Determine the ratios  $AD/AB$ ,  $DE/BC$

(ii) Prove that  $\triangle DEF$  is similar to  $\triangle CBF$ . Hence, find  $EF/FB$ .

(iii) What is the ratio of the areas of  $\triangle DEF$  and  $\triangle CBF$ ?



**Solution:-**

(i) We have to find the ratios  $AD/AB$ ,  $DE/BC$ ,

From the question it is given that,  $AD/DB = 3/2$

$$\text{Then, } DB/AD = 2/3$$

Now add 1 for both LHS and RHS we get,

$$(DB/AD) + 1 = (2/3) + 1$$

$$(DB + AD)/AD = (2 + 3)/3$$

From the figure  $(DB + AD) = AB$

So,  $AB/AD = 5/3$

Now, consider the  $\triangle ADE$  and  $\triangle ABC$ ,

$\angle ADE = \angle B$

... [corresponding angles are equal]

$\angle AED = \angle C$

... [corresponding angles are equal]

Therefore,  $\triangle ADE \sim \triangle ABC$

... [by AA similarity]

Then,  $AD/AB = DE/BC = 3/5$

(ii) Now consider the  $\triangle DEF$  and  $\triangle CBF$

$\angle EDF = \angle BCF$

... [because alternate angles are equal]

$\angle DEF = \angle BCF$

... [because alternate angles are equal]

$\angle DFE = \angle BFC$

... [because vertically opposite angles are equal]

Therefore,  $\triangle DEF \sim \triangle CBF$

So,  $EF/FB = DE/BC = 3/5$

(iii) we have to find the ratio of the areas of  $\triangle DEF$  and  $\triangle CBF$ ,

We know that,  $\text{Area of } \triangle DFE / \text{Area of } \triangle BFC = DE^2/BC^2$

$\text{Area of } \triangle DFE / \text{Area of } \triangle BFC = (DE/BC)^2$

$\text{Area of } \triangle DFE / \text{Area of } \triangle BFC = (3/5)^2$

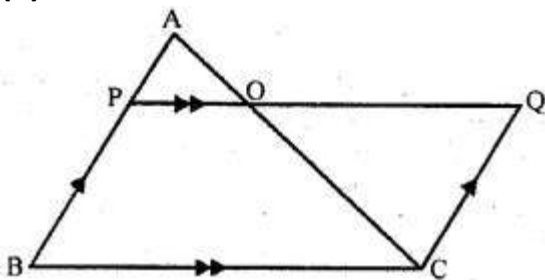
$\text{Area of } \triangle DFE / \text{Area of } \triangle BFC = 9/25$

Therefore, the ratio of the areas of  $\triangle DEF$  and  $\triangle CBF$  is 9: 25.

**10. In  $\triangle ABC$ ,  $AP : PB = 2 : 3$ .  $PO$  is parallel to  $BC$  and is extended to  $Q$  so that  $CQ$  is parallel to  $BA$ . Find:**

**(i) area  $\triangle APO$  : area  $\triangle ABC$ .**

**(ii) area  $\triangle APO$  : area  $\triangle CQO$ .**



**Solution:-**

From the question it is given that,

$PB = 2: 3$

$PO$  is parallel to  $BC$  and is extended to  $Q$  so that  $CQ$  is parallel to  $BA$ .

(i) we have to find the area  $\triangle APO$ : area  $\triangle ABC$ ,

Then,

$$\angle A = \angle A \quad \dots \text{ [common angles for both triangles]}$$

$$\angle APO = \angle ABC \quad \dots \text{ [because corresponding angles are equal]}$$

$$\text{Then, } \Delta APO \sim \Delta ABC \quad \dots \text{ [AA axiom]}$$

$$\begin{aligned} \text{We know that, area of } \Delta APO / \text{area of } \Delta ABC &= AP^2 / AB^2 \\ &= AP^2 / (AP + PB)^2 \\ &= 2^2 / (2 + 3)^2 \\ &= 4 / 5^2 \\ &= 4 / 25 \end{aligned}$$

Therefore, area  $\Delta APO$ : area  $\Delta ABC$  is 4: 25

(ii) we have to find the area  $\Delta APO$ : area  $\Delta CQO$

$$\text{Then, } \angle AOP = \angle COQ \quad \dots \text{ [because vertically opposite angles are equal]}$$

$$\angle APQ = \angle OQC \quad \dots \text{ [because alternate angles are equal]}$$

$$\text{Therefore, area of } \Delta APO / \text{area of } \Delta CQO = AP^2 / CQ^2$$

$$\text{area of } \Delta APO / \text{area of } \Delta CQO = AP^2 / PB^2$$

$$\text{area of } \Delta APO / \text{area of } \Delta CQO = 2^2 / 3^2$$

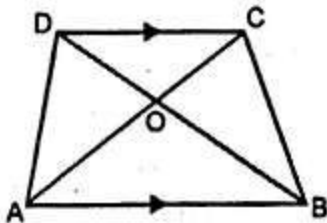
$$\text{area of } \Delta APO / \text{area of } \Delta CQO = 4 / 9$$

Therefore, area  $\Delta APO$ : area  $\Delta CQO$  is 4: 9



11 .

(a) In the figure (i) given below, ABCD is a trapezium in which  $AB \parallel DC$  and  $AB = 2 CD$ . Determine the ratio of the areas of  $\Delta AOB$  and  $\Delta COD$ .



**Solution:-**

From the question it is given that,

ABCD is a trapezium in which  $AB \parallel DC$  and  $AB = 2 CD$ ,

$$\text{Then, } \angle OAB = \angle OCD \quad \dots \text{ [because alternate angles are equal]}$$

$$\angle OBA = \angle ODC$$

$$\text{Then, } \Delta AOB \sim \Delta COD$$

$$\begin{aligned} \text{So, area of } \Delta AOB / \text{area of } \Delta COD &= AB^2 / CD^2 \\ &= (2CD)^2 / CD^2 && \dots \text{ [because } AB = 2 CD\text{]} \\ &= 4CD^2 / CD^2 \end{aligned}$$

$$= 4/1$$

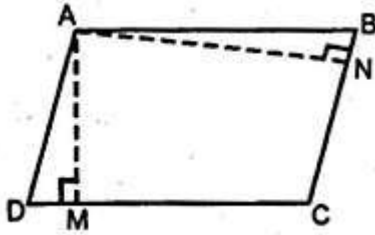
Therefore, the ratio of the areas of  $\Delta AOB$  and  $\Delta COD$  is 4: 1.

**(b) In the figure (ii) given below, ABCD is a parallelogram.  $AM \perp DC$  and  $AN \perp CB$ . If  $AM = 6$  cm,  $AN = 10$  cm and the area of parallelogram ABCD is  $45 \text{ cm}^2$ , find**

**(i) AB**

**(ii) BC**

**(iii) area of  $\Delta ADM$  : area of  $\Delta ANB$ .**



**Solution:-**

From the question it is given that,  
ABCD is a parallelogram,  $AM \perp DC$  and  $AN \perp CB$

$$AM = 6 \text{ cm}$$

$$AN = 10 \text{ cm}$$

The area of parallelogram ABCD is  $45 \text{ cm}^2$

Then, area of parallelogram ABCD =  $DC \times AM = BC \times AN$

$$45 = DC \times 6 = BC \times 10$$

$$(i) DC = 45/6$$

Divide both numerator and denominator by 3 we get,

$$= 15/2$$

$$= 7.5 \text{ cm}$$

Therefore,  $AB = DC = 7.5 \text{ cm}$

$$(ii) BC \times 10 = 45$$

$$BC = 45/10$$

$$BC = 4.5 \text{ cm}$$

(iii) Now, consider  $\Delta ADM$  and  $\Delta ANB$

$$\angle D = \angle B$$

... [because opposite angles of a parallelogram]

$$\angle M = \angle N$$

... [both angles are equal to  $90^\circ$ ]

Therefore,  $\Delta ADM \sim \Delta ANB$

Therefore, area of  $\Delta ADM$ /area of  $\Delta ANB = AD^2/AB^2$

$$= BC^2/AB^2$$

$$\begin{aligned}
 &= 4.5^2/7.5^2 \\
 &= 20.25/56.25 \\
 &= 2025/5625 \\
 &= 81/225 \\
 &= 9/25
 \end{aligned}$$

Therefore, area of  $\triangle ADM$  : area of  $\triangle ANB$  is 9: 25

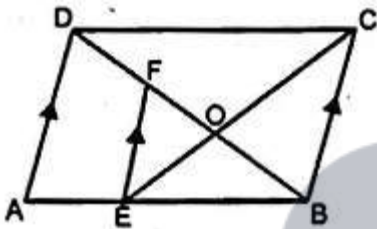
(c) In the figure (iii) given below, ABCD is a parallelogram. E is a point on AB, CE intersects the diagonal BD at O and  $EF \parallel BC$ . If  $AE : EB = 2 : 3$ , find

(i)  $EF : AD$

(ii) area of  $\triangle BEF$  : area of  $\triangle ABD$

(iii) area of  $\triangle ABD$  : area of trapezium AFED

(iv) area of  $\triangle FEO$  : area of  $\triangle OBC$ .



**Solution:-**

From the question it is given that, ABCD is a parallelogram.

E is a point on AB, CE intersects the diagonal BD at O.

$$AE : EB = 2 : 3$$

(i) We have to find  $EF : AD$

$$\text{So, } AB/BE = AD/EF$$

$$EF/AD = BE/AB$$

$$AE/EB = 2/3 \quad \dots \text{ [given]}$$

Now add 1 to both LHS and RHS we get,

$$(AE/EB) + 1 = (2/3) + 1$$

$$(AE + EB)/EB = (2 + 3)/3$$

$$AB/EB = 5/3$$

$$EB/AB = 3/5$$

Therefore,  $EF : AD$  is 3: 5

(ii) we have to find area of  $\triangle BEF$ : area of  $\triangle ABD$ ,

Then, area of  $\triangle BEF$ /area of  $\triangle ABD = (EF)^2/(AD)^2$

$$\text{area of } \triangle BEF/\text{area of } \triangle ABD = 3^2/5^2$$

$$= 9/25$$

Therefore, area of  $\triangle BEF$ : area of  $\triangle ABD$  is 9: 25

(iii) From (ii) area of  $\triangle ABD$ /area of  $\triangle BEF = 25/9$

$25 \text{ area of } \triangle BEF = 9 \text{ area of } \triangle ABD$

$25(\text{area of } \triangle ABD - \text{area of trapezium AEFD}) = 9 \text{ area of } \triangle ABD$

$25 \text{ area of } \triangle ABD - 25 \text{ area of trapezium AEFD} = 9 \text{ area of } \triangle ABD$

$25 \text{ area of trapezium AEFD} = 25 \text{ area of } \triangle ABD - 9 \text{ area of } \triangle ABD$

$25 \text{ area of trapezium AEFD} = 16 \text{ area of } \triangle ABD$

area of  $\triangle ABD$ /area of trapezium AEFD = 25/16

Therefore, area of  $\triangle ABD$  : area of trapezium AFED = 25: 16

(iv) Now we have to find area of  $\triangle FEO$  : area of  $\triangle OBC$

So, consider  $\triangle FEO$  and  $\triangle OBC$ ,

$\angle EOF = \angle BOC$

... [because vertically opposite angles are equal]

$\angle F = \angle OBC$

... [because alternate angles are equal]

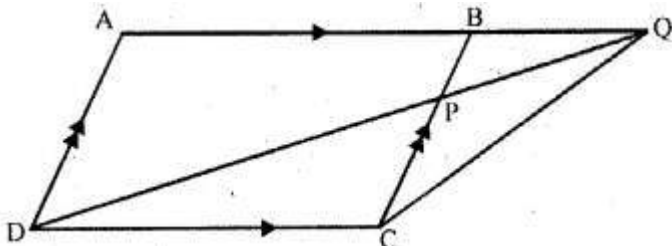
$\triangle FEO \sim \triangle OBC$

Then, area of  $FEO$ /area of  $\triangle OBC = EF^2/BC^2$

$EF^2/AD^2 = 9/25$

Therefore, area of  $\triangle FEO$ : area of  $\triangle OBC = 9: 25$ .

**12. In the adjoining figure, ABCD is a parallelogram. P is a point on BC such that BP : PC = 1 : 2 and DP produced meets AB produced at Q. If area of  $\triangle CPQ = 20 \text{ cm}^2$ , find**



(i) area of  $\triangle BPQ$ .

(ii) area  $\triangle CDP$ .

(iii) area of parallelogram ABCD.

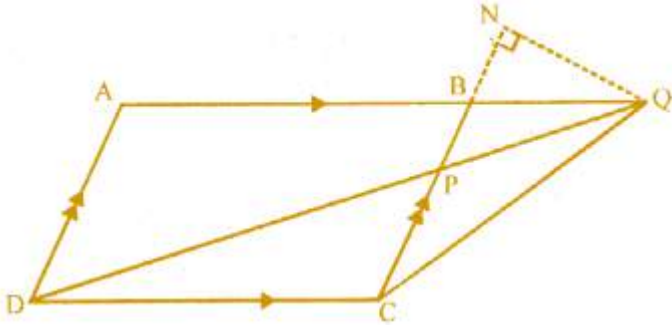
**Solution:-**

From the question it is given that, ABCD is a parallelogram.

BP: PC = 1: 2

area of  $\triangle CPQ = 20 \text{ cm}^2$

Construction: draw QN perpendicular CB and Join BN.



$$\begin{aligned} \text{Then, area of } \triangle BPQ / \text{area of } \triangle CPQ &= ((\frac{1}{2}BP) \times QN) / ((\frac{1}{2}PC) \times QN) \\ &= BP/PC = \frac{1}{2} \end{aligned}$$

$$\begin{aligned} \text{(i) So, area } \triangle BPQ &= \frac{1}{2} \text{ area of } \triangle CPQ \\ &= \frac{1}{2} \times 20 \end{aligned}$$

$$\text{Therefore, area of } \triangle BPQ = 10 \text{ cm}^2$$

(ii) Now we have to find area of  $\triangle CDP$ ,  
Consider the  $\triangle CDP$  and  $\triangle BQP$ ,

$$\text{Then, } \angle CPD = \angle QPD$$

... [because vertically opposite angles are equal]

$$\angle PDC = \angle PQB$$

... [because alternate angles are equal]

$$\text{Therefore, } \triangle CDP \sim \triangle BQP$$

... [AA axiom]

$$\text{area of } \triangle CDP / \text{area of } \triangle BQP = PC^2 / BP^2$$

$$\text{area of } \triangle CDP / \text{area of } \triangle BQP = 2^2 / 1^2$$

$$\text{area of } \triangle CDP / \text{area of } \triangle BQP = 4/1$$

$$\text{area of } \triangle CDP = 4 \times \text{area } \triangle BQP$$

$$\text{Therefore, area of } \triangle CDP = 4 \times 10$$

$$= 40 \text{ cm}^2$$

(iii) We have to find the area of parallelogram ABCD,

$$\text{Area of parallelogram ABCD} = 2 \text{ area of } \triangle DCQ$$

$$= 2 \text{ area } (\triangle DCP + \triangle CPQ)$$

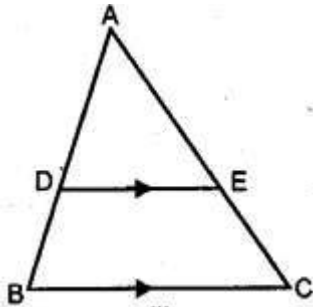
$$= 2 (40 + 20) \text{ cm}^2$$

$$= 2 \times 60 \text{ cm}^2$$

$$= 120 \text{ cm}^2$$

Therefore, the area of parallelogram ABCD is  $120 \text{ cm}^2$ .

**13. (a) In the figure (i) given below,  $DE \parallel BC$  and the ratio of the areas of  $\triangle ADE$  and trapezium DBCE is  $4 : 5$ . Find the ratio of  $DE : BC$ .**



**Solution:-**

From the question it is given that,

$$DE \parallel BC$$

The ratio of the areas of  $\triangle ADE$  and trapezium DBCE is 4 : 5

Now, consider the  $\triangle ABC$  and  $\triangle ADE$

$$\angle A = \angle A \quad \dots \text{ [common angle for both triangles]}$$

$$\angle D = \angle B \text{ and}$$

$$\angle E = \angle C \quad \dots \text{ [because corresponding angles are equal]}$$

Therefore,  $\triangle ADE \sim \triangle ABC$

$$\text{So, area of } \triangle ADE / \text{area of } \triangle ABC = (DE)^2 / (BC)^2 \quad \dots \text{ [equation (i)]}$$

$$\text{Then, area of } \triangle ADE / \text{area of trapezium DBCE} = 4/5$$

$$\text{area of trapezium DBCE} / \text{area of } \triangle ADE = 5/4$$

Add 1 for both LHS and RHS we get,

$$(\text{area of trapezium DBCE} / \text{area of } \triangle ADE) + 1 = (5/4) + 1$$

$$(\text{area of trapezium DBCE} + \text{area of } \triangle ADE) / \text{area of } \triangle ADE = (5 + 4)/4$$

$$\text{area of } \triangle ABC / \text{area of } \triangle ADE = 9/4$$

$$\text{area of } \triangle ADE / \text{area of } \triangle ABC = 4/9$$

From equation (i),

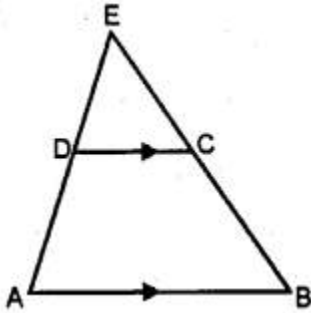
$$\text{area of } \triangle ADE / \text{area of } \triangle ABC = (DE)^2 / (BC)^2$$

$$\text{area of } \triangle ADE / \text{area of } \triangle ABC = (DE)^2 / (BC)^2 = 4^2 / 9^2$$

$$\text{area of } \triangle ADE / \text{area of } \triangle ABC = (DE)^2 / (BC)^2 = 2/3$$

Therefore, DE: BC = 2: 3

**(b) In the figure (ii) given below,  $AB \parallel DC$  and  $AB = 2 DC$ . If  $AD = 3$  cm,  $BC = 4$  cm and  $AD, BC$  produced meet at  $E$ , find (i)  $ED$  (ii)  $BE$  (iii) area of  $\triangle EDC$  : area of trapezium  $ABCD$ .**



**Solution:-**

From the question it is given that,

$$AB \parallel DC$$

$$AB = 2 DC, AD = 3 \text{ cm}, BC = 4 \text{ cm}$$

Now consider  $\triangle EAB$ ,

$$EA/DA = EB/CB = AB/DC = 2DC/DC = 2/1$$

$$(i) EA = 2, DA = 2 \times 3 = 6 \text{ cm}$$

$$\text{Then, } ED = EA - DA$$

$$= 6 - 3$$

$$= 3 \text{ cm}$$

$$(ii) EB/CB = 2/1$$

$$EB = 2 CB$$

$$EB = 2 \times 4$$

$$EB = 8 \text{ cm}$$



(iii) Now, consider the  $\triangle EAB$ ,  $DC \parallel AB$

So,  $\triangle EDC \sim \triangle EAB$

$$\text{Therefore, area of } \triangle EDC / \text{area of } \triangle ABE = DC^2 / AB^2$$

$$\text{area of } \triangle EDC / \text{area of } \triangle ABE = DC^2 / (2DC)^2$$

$$\text{area of } \triangle EDC / \text{area of } \triangle ABE = DC^2 / 4DC^2$$

$$\text{area of } \triangle EDC / \text{area of } \triangle ABE = \frac{1}{4}$$

$$\text{Therefore, area of } ABE = 4 \text{ area of } \triangle EDC$$

$$\text{Then, area of } \triangle EDC + \text{area of trapezium } ABCD = 4 \text{ area of } \triangle EDC$$

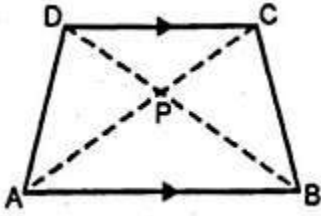
$$\text{Area of trapezium } ABCD = 3 \text{ area of } \triangle EDC$$

$$\text{So, area of } \triangle EDC / \text{area of trapezium } ABCD = 1/3$$

$$\text{Therefore, area of } \triangle EDC : \text{area of trapezium } ABCD = 1 : 3$$

**14. (a)** In the figure given below, ABCD is a trapezium in which DC is parallel to AB. If  $AB = 9 \text{ cm}$ ,  $DC = 6 \text{ cm}$  and  $BB = 12 \text{ cm}$ ., find (i) BP (ii) the ratio of areas of  $\triangle APB$  and

$\Delta DPC$ .



**Solution:-**

From the question it is given that,

DC is parallel to AB

AB = 9 cm, DC = 6 cm and BB = 12 cm

(i) Consider the  $\Delta APB$  and  $\Delta CPD$

$$\angle APB = \angle CPD$$

... [because vertically opposite angles are equal]

$$\angle PAB = \angle PCD$$

... [because alternate angles are equal]

So,  $\Delta APB \sim \Delta CPD$

Then,  $BP/PD = AB/CD$

$$BP/(12 - BP) = 9/6$$

$$6BP = 108 - 9BP$$

$$6BP + 9BP = 108$$

$$15BP = 108$$

$$BP = 108/15$$

Therefore,  $BP = 7.2$  cm

(ii) We know that, area of  $\Delta APB$ /area of  $\Delta CPD = AB^2/CD^2$

$$\text{area of } \Delta APB/\text{area of } \Delta CPD = 9^2/6^2$$

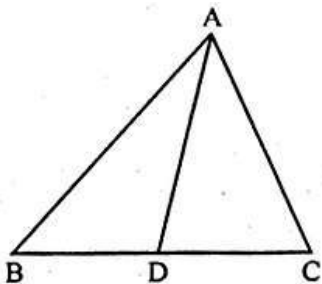
$$\text{area of } \Delta APB/\text{area of } \Delta CPD = 81/36$$

By dividing both numerator and denominator by 9, we get,

$$\text{area of } \Delta APB/\text{area of } \Delta CPD = 9/4$$

Therefore, the ratio of areas of  $\Delta APB$  and  $\Delta DPC$  is 9: 4

**(b) In the figure given below,  $\angle ABC = \angle DAC$  and AB = 8 cm, AC = 4 cm, AD = 5 cm. (i) Prove that  $\Delta ACD$  is similar to  $\Delta BCA$  (ii) Find BC and CD (iii) Find the area of  $\Delta ACD$  : area of  $\Delta ABC$ .**



**Solution:-**

From the question it is given that,

$$\angle ABC = \angle DAC$$

$$AB = 8 \text{ cm}, AC = 4 \text{ cm}, AD = 5 \text{ cm}$$

(i) Now, consider  $\triangle ACD$  and  $\triangle BCA$

$$\angle C = \angle C \quad \dots \text{ [common angle for both triangles]}$$

$$\angle ABC = \angle CAD \quad \dots \text{ [from the question]}$$

$$\text{So, } \triangle ACD \sim \triangle BCA \quad \dots \text{ [by AA axiom]}$$

(ii)  $AC/BC = CD/CA = AD/AB$

Consider  $AC/BC = AD/AB$

$$4/BC = 5/8$$

$$BC = (4 \times 8)/5$$

$$BC = 32/5$$

$$BC = 6.4 \text{ cm}$$

Then, consider  $CD/CA = AD/AB$

$$CD/4 = 5/8$$

$$CD = (4 \times 5)/8$$

$$CD = 20/8$$

$$CD = 2.5 \text{ cm}$$

(iii) from (i) we proved that,  $\triangle ACD \sim \triangle BCA$

$$\text{area of } \triangle ACD / \text{area of } \triangle BCA = AC^2/AB^2$$

$$= 4^2/8^2$$

$$= 16/64$$

By dividing both numerator and denominator by 16, we get,

$$= \frac{1}{4}$$

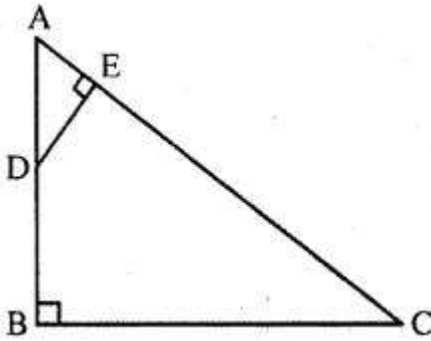
Therefore, the area of  $\triangle ACD$  : area of  $\triangle ABC$  is 1: 4.

**15. ABC is a right angled triangle with  $\angle ABC = 90^\circ$ . D is any point on AB and DE is perpendicular to AC. Prove that:**

**(i)  $\triangle ADE \sim \triangle ACB$ .**

**(ii) If AC = 13 cm, BC = 5 cm and AE = 4 cm. Find DE and AD.**

**(iii) Find, area of  $\triangle ADE$  : area of quadrilateral BCED.**



**Solution:-**

From the question it is given that,  
 $\angle ABC = 90^\circ$

AB and DE is perpendicular to AC

(i) Consider the  $\triangle ADE$  and  $\triangle ACB$ ,

$\angle A = \angle A$  ... [common angle for both triangle]

$\angle B = \angle E$  ... [both angles are equal to  $90^\circ$ ]

Therefore,  $\triangle ADE \sim \triangle ACB$

(ii) from (i) we proved that,  $\triangle ADE \sim \triangle ACB$

So,  $AE/AB = AD/AC = DE/BC$  ... [equation (i)]

Consider the  $\triangle ABC$ , is a right angle triangle

From Pythagoras theorem, we have

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

$$13^2 = AB^2 + 5^2$$

$$169 = AB^2 + 25$$

$$AB^2 = 169 - 25$$

$$AB^2 = 144$$

$$AB = \sqrt{144}$$

$$AB = 12 \text{ cm}$$

Consider the equation (i),

$$AE/AB = AD/AC = DE/BC$$

Take,  $AE/AB = AD/AC$

$$4/12 = AD/13$$

$$1/3 = AD/13$$

$$(1 \times 13)/3 = AD$$

$$AD = 4.33 \text{ cm}$$

Now, take  $AE/AB = DE/BC$

$$4/12 = DE/5$$

$$\begin{aligned}1/3 &= DE/5 \\ DE &= (5 \times 1)/3 \\ DE &= 5/3 \\ DE &= 1.67 \text{ cm}\end{aligned}$$

(iii) Now, we have to find area of  $\triangle ADE$  : area of quadrilateral BCED,

We know that, Area of  $\triangle ADE = \frac{1}{2} \times AE \times DE$   
 $= \frac{1}{2} \times 4 \times (5/3)$   
 $= 10/3 \text{ cm}^2$

Then, area of quadrilateral BCED = area of  $\triangle ABC$  – area of  $\triangle ADE$   
 $= \frac{1}{2} \times BC \times AB - 10/3$   
 $= \frac{1}{2} \times 5 \times 12 - 10/3$   
 $= 1 \times 5 \times 6 - 10/3$   
 $= 30 - 10/3$   
 $= (90 - 10)/3$   
 $= 80/3 \text{ cm}^2$

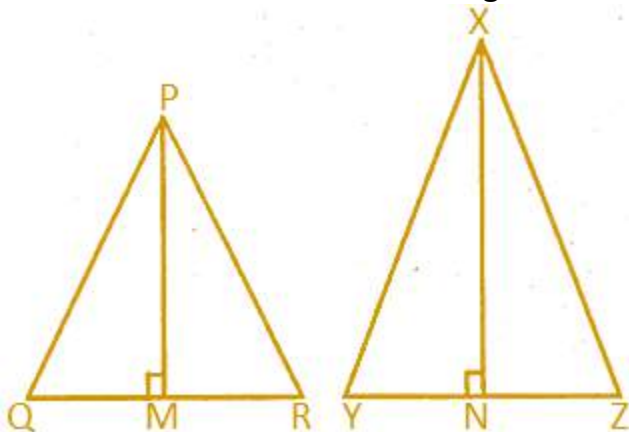
So, the ratio of area of  $\triangle ADE$  : area of quadrilateral BCED =  $(10/3)/(80/3)$   
 $= (10/3) \times (3/80)$   
 $= (10 \times 3)/(3 \times 80)$   
 $= (1 \times 1)/(1 \times 8)$   
 $= 1/8$

Therefore, area of  $\triangle ADE$  : area of quadrilateral BCED is 1: 8.

**16. Two isosceles triangles have equal vertical angles and their areas are in the ratio 7: 16. Find the ratio of their corresponding height.**

**Solution:-**

Consider the two isosceles triangle PQR and XYZ,



$$\angle P = \angle X$$

... [from the question]

$$\text{So, } \angle Q + \angle R = \angle Y + \angle Z$$

$$\angle Q = \angle R \text{ and } \angle Y = \angle Z$$

[because opposite angles of equal sides]

$$\text{Therefore, } \angle Q = \angle Y \text{ and } \angle R = \angle Z$$

$$\Delta PQR \sim \Delta XYZ$$

$$\text{Then, area of } \Delta PQR / \text{area of } \Delta XYZ = PM^2 / XN^2 \quad \dots \text{ [from corollary of theorem]}$$

$$PM^2 / XN^2 = 7/16$$

$$PM / XN = \sqrt{7} / \sqrt{16}$$

$$PM / XN = \sqrt{7} / 4$$

$$\text{Therefore, ratio of PM: DM} = \sqrt{7}: 4$$

**17. On a map drawn to a scale of 1 : 250000, a triangular plot of land has the following measurements : AB = 3 cm, BC = 4 cm and  $\angle ABC = 90^\circ$ . Calculate**

**(i) the actual length of AB in km.**

**(ii) the area of the plot in sq. km:**

**Solution:-**

From the question it is given that,

Map drawn to a scale of 1: 250000

AB = 3 cm, BC = 4 cm and  $\angle ABC = 90^\circ$

(i) We have to find the actual length of AB in km.

Let us assume scale factor  $K = 1: 250000$

$$K = 1/250000$$

Then, length of AB of actual plot =  $1/k \times$  length of AB on the map

$$= (1/(1/250000)) \times 3$$

$$= 250000 \times 3$$

To convert cm into km divide by 100000

$$= (250000 \times 3) / (100 \times 1000)$$

$$= 15/2$$

length of AB of actual plot = 7.5 km

(ii) We have to find the area of the plot in sq. km

Area of plot on the map =  $\frac{1}{2} \times AB \times BC$

$$= \frac{1}{2} \times 3 \times 4$$

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

$$= 1 \times 6$$

$$= 6 \text{ cm}^2$$

Then, area of actual plot =  $1/k^2 \times 6 \text{ cm}^2$

$$= 250000^2 \times 6$$

To convert cm into km divide by  $(100000)^2$

$$\begin{aligned} &= (250000 \times 250000 \times 6) / (100000 \times 100000) \\ &= (25/4) \times 6 \\ &= 75/2 \\ &= 37.5 \text{ km}^2 \end{aligned}$$

**18. On a map drawn to a scale of 1 : 25000, a rectangular plot of land, ABCD has the following measurements AB = 12 cm and BC = 16 cm. Calculate:**

**(i) the distance of a diagonal of the plot in km.**

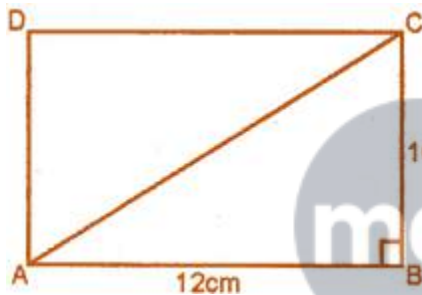
**(ii) the area of the plot in sq. km.**

**Solution:-**

From the question it is given that,

Map drawn to a scale of 1: 25000

AB = 12 cm, BC = 16 cm



Consider the  $\Delta ABC$ ,

From the Pythagoras theorem,

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

$$\begin{aligned} AC &= \sqrt{AB^2 + BC^2} \\ &= \sqrt{(12)^2 + (16)^2} \\ &= \sqrt{144 + 256} \\ &= \sqrt{400} \\ &= 20 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Then, area of rectangular plot } ABCD &= AB \times BC \\ &= 12 \times 16 \\ &= 192 \text{ cm}^2 \end{aligned}$$

(i) We have to find the distance of a diagonal of the plot in km. .

Let us assume scale factor  $K = 1: 25000$

$$K = 1/25000$$

$$\begin{aligned}\text{Then, length of AB of actual plot} &= 1/k \times \text{length of diagonal of rectangular plot} \\ &= (1/(1/25000)) \times 3 \\ &= 25000 \times 20\end{aligned}$$

$$\begin{aligned}\text{To covert cm into km divide by } 100000 & \\ &= (25000 \times 20)/(100 \times 1000) \\ &= 5 \text{ km}\end{aligned}$$

(ii) We have to find the area of the plot in sq. km.

$$\begin{aligned}\text{Then, area of actual plot} &= 1/k^2 \times 192 \text{ cm}^2 \\ &= 25000^2 \times 192\end{aligned}$$

$$\begin{aligned}\text{To covert cm into km divide by } (100000)^2 & \\ &= (25000 \times 25000 \times 192)/(100000 \times 100000) \\ &= 12 \text{ km}^2\end{aligned}$$

**19. The model of a building is constructed with the scale factor 1 : 30.**

**(i) If the height of the model is 80 cm, find the actual height of the building in metres.**

**(ii) If the actual volume of a tank at the top of the building is 27 m<sup>3</sup>, find the volume of the tank on the top of the model.**

**Solution:-**

From the question it is given that,

The model of a building is constructed with the scale factor 1 : 30

So, Height of the model/Height of actual building = 1/30

(i) Given, the height of the model is 80 cm

$$\text{Then, } 80/H = 1/30$$

$$H = (80 \times 30)$$

$$H = 2400 \text{ cm}$$

$$H = 2400/100$$

$$H = 24 \text{ m}$$

(ii) Given, the actual volume of a tank at the top of the building is 27 m<sup>3</sup>

$$\text{Volume of model/Volume of tank} = (1/30)^3$$

$$V/27 = 1/27000$$

$$V = 27/27000$$

$$V = 1/1000 \text{ m}^3$$

$$\text{Therefore, Volume of model} = 1000 \text{ cm}^3$$

**20. A model of a ship is made to a scale of 1 : 200.**

(i) If the length of the model is 4 m, find the length of the ship.

(ii) If the area of the deck of the ship is  $160000 \text{ m}^2$ , find the area of the deck of the model.

(iii) If the volume of the model is 200 liters, find the volume of the ship in  $\text{m}^3$ . (100 liters =  $1 \text{ m}^3$ )

**Solution:-**

From the question it is given that, a model of a ship is made to a scale of 1 : 200

(i) Given, the length of the model is 4 m

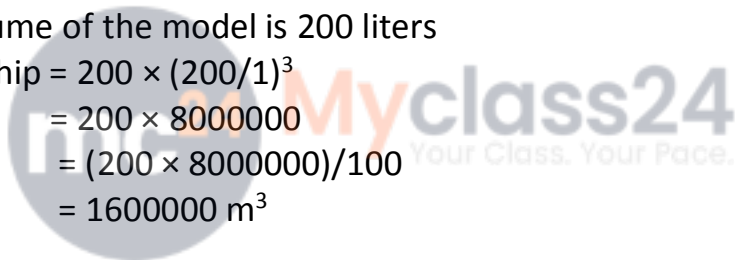
$$\begin{aligned}\text{Then, length of the ship} &= (4 \times 200)/1 \\ &= 800 \text{ m}\end{aligned}$$

(ii) Given, the area of the deck of the ship is  $160000 \text{ m}^2$

$$\begin{aligned}\text{Then, area of deck of the model} &= 160000 \times (1/200)^2 \\ &= 160000 \times (1/40000) \\ &= 4 \text{ m}^2\end{aligned}$$

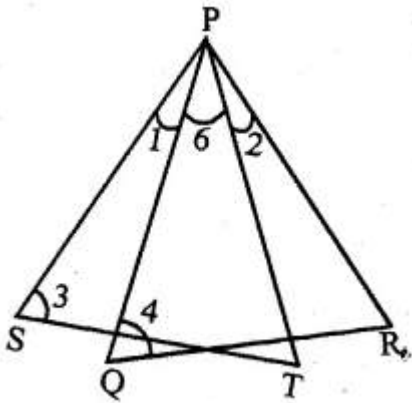
(iii) Given, the volume of the model is 200 liters

$$\begin{aligned}\text{Then, Volume of ship} &= 200 \times (200/1)^3 \\ &= 200 \times 8000000 \\ &= (200 \times 8000000)/100 \\ &= 1600000 \text{ m}^3\end{aligned}$$



## CHAPTER TEST

1. In the adjoining figure,  $\angle 1 = \angle 2$  and  $\angle 3 = \angle 4$ . Show that  $PT \times QR = PR \times ST$ .



**Solution:-**

From the question it is given that,

$$\angle 1 = \angle 2 \text{ and } \angle 3 = \angle 4$$

We have to prove that,  $PT \times QR = PR \times ST$

Given,  $\angle 1 = \angle 2$

Adding  $\angle 6$  to both LHS and RHS we get,

$$\angle 1 + \angle 6 = \angle 2 + \angle 6$$

$$\angle SPT = \angle QPR$$

Consider the  $\Delta PQR$  and  $\Delta PST$ ,

From above  $\angle SPT = \angle QPR$

$$\angle 3 = \angle 4$$

Therefore,  $\Delta PQR \sim \Delta PST$

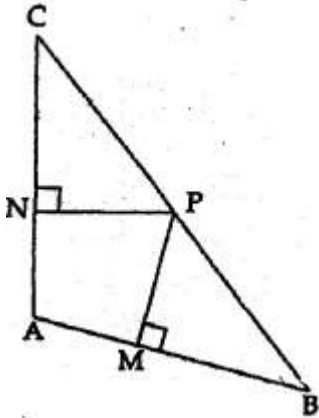
$$\text{So, } PT/PR = ST/QR$$

By cross multiplication we get,

$$PT \times QR = PR \times ST$$

Hence, it is proved that  $PT \times QR = PR \times ST$

2. In the adjoining figure,  $AB = AC$ . If  $PM \perp AB$  and  $PN \perp AC$ , show that  $PM \times PC = PN \times PB$ .



**Solution:-**

From the given figure,

$AB = AC$ . If  $PM \perp AB$  and  $PN \perp AC$

We have to show that,  $PM \times PC = PN \times PB$

Consider the  $\Delta ABC$ ,

$AB = AC$  ... [given]

$\angle B = \angle C$

Then, consider  $\Delta CPN$  and  $\Delta BPM$

$\angle N = \angle M$  ... [both angles are equal to  $90^\circ$ ]

$\angle C = \angle B$  ... [from above]

Therefore,  $\Delta CPN \sim \Delta BPM$  ... [from AA axiom]

So,  $PC/PB = PN/PM$

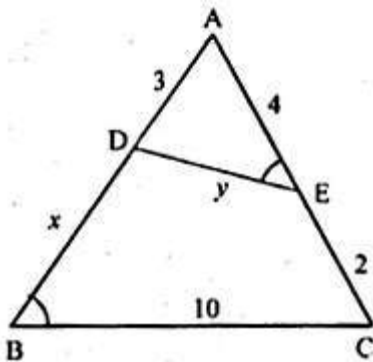
By cross multiplication we get,

$PC \times PM = PN \times PB$

Therefore, it is proved that,  $PM \times PC = PN \times PB$

**3.**

(a) In the figure given below.  $\angle AED = \angle ABC$ . Find the values of  $x$  and  $y$ .



**Solution:-**

From the figure it is given that,

$$\angle AED = \angle ABC$$

Consider the  $\triangle ABC$  and  $\triangle ADE$

$$\angle AED = \angle ABC$$

$$\angle A = \angle A$$

Therefore,  $\triangle ABC \sim \triangle ADE$

Then,  $AD/AC = DE/BC$

$$3/(4 + 2) = y/10$$

$$3/6 = y/10$$

By cross multiplication we get,

$$y = (3 \times 10)/6$$

$$y = 30/6$$

$$y = 5$$

Now, consider  $AB/AE = BC/DE$

$$(3 + x)/4 = 10/y$$

Substitute the value of  $y$ ,

$$(3 + x)/4 = 10/5$$

By cross multiplication,

$$5(3 + x) = 10 \times 4$$

$$15 + 5x = 40$$

$$5x = 40 - 15$$

$$5x = 25$$

$$x = 25/5$$

$$x = 5$$

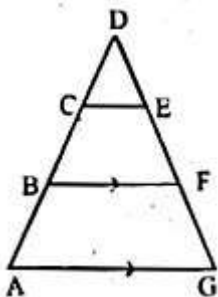
Therefore, the value of  $x = 5$  cm and  $y = 5$  cm

**(b) In the figure given below,  $CD = \frac{1}{2} AC$ , B is mid-point of AC and E is mid-point of DF.**

**If  $BF \parallel AG$ , prove that :**

**(i)  $CE \parallel AG$**

**(ii)  $3 ED = GD$**



**Solution:-**

From the question it is given that,

$$CD = \frac{1}{2} AC$$

$$BF \parallel AG$$

(i) We have to prove that,  $CE \parallel AG$

Consider,  $CD = \frac{1}{2} AC$

$$AC = 2BC$$

... [because from the figure B is mid-point of AC]

$$\text{So, } CD = \frac{1}{2} (2BC)$$

$$CD = BC$$

$$\text{Hence, } CE \parallel BF \quad \dots \text{ [equation (i)]}$$

$$\text{Given, } BF \parallel AG \quad \dots \text{ [equation (ii)]}$$

By comparing the results of equation (i) and equation (ii) we get,

$$CE \parallel AG$$

(ii) We have to prove that,  $3 ED = GD$

Consider the  $\triangle AGD$ ,

$$CE \parallel AG \quad \dots \text{ [above it is proved]}$$

$$\text{So, } ED/GD = DC/AD$$

$$AD = AB + BC + DC$$

$$= DC + DC + DC$$

$$= 3DC$$

$$\text{So, } ED/GD = DC/(3DC)$$

$$ED/GD = 1/(3(1))$$

$$ED/GD = 1/3$$

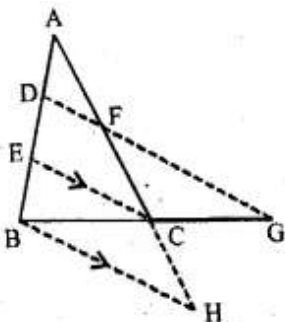
$$3ED = GD$$

Hence it is proved that,  $3ED = GD$

**4. In the adjoining figure,  $2 AD = BD$ , E is mid-point of BD and F is mid-point of AC and  $EC \parallel BH$ . Prove that:**

**(i)  $DF \parallel BH$**

**(ii)  $AH = 3 AF$ .**



**Solution:-**

From the question it is given that,  $2 AD = BD$ ,  $EC \parallel BH$

(i) Given, E is mid-point of BD

$$2DE = BD \quad \dots \text{ [equation (i)]}$$

$$2AD = BD \quad \dots \text{ [equation (ii)]}$$

From equation (i) and equation (ii) we get,

$$2DE = 2AD$$

$$DE = AD$$

Also given that, F is mid-point of AC

$$DF \parallel EC \quad \dots \text{ [equation (iii)]}$$

$$\text{Given, } EC \parallel BH \quad \dots \text{ [equation (iv)]}$$

By comparing equation (iii) and equation (iv) we get,

$$DF \parallel BH$$

(ii) We have to prove that,  $AH = 3 AF$ ,

Given, E is mid-point of BD and  $EC \parallel BH$

And c is midpoint of AH,

$$\text{Then, } FC = CH \quad \dots \text{ [equation (v)]}$$

Also given F is mid-point of AC

$$AF = FC \quad \dots \text{ [equation (vi)]}$$

By comparing both equation (v) and equation (vi) we get,

$$FC = AF = CH$$

$$AF = (1/3)AH$$

By cross multiplication we get,

$$3AF = AH$$

Therefore, it is proved that  $3AF = AH$

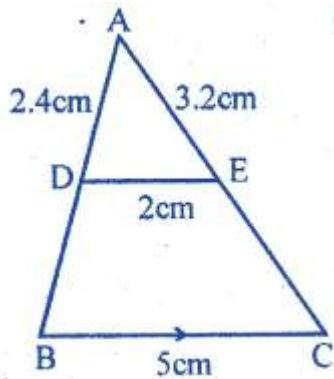
**5. In a  $\Delta ABC$ , D and E are points on the sides AB and AC respectively such that  $DE \parallel BC$ . If  $AD = 2.4$  cm,  $AE = 3.2$  cm,  $DE = 2$  cm and  $BC = 5$  cm, find BD and CE.**

**Solution:-**

From the question it is given that, In a  $\Delta ABC$ , D and E are points on the sides AB and AC respectively.

$$DE \parallel BC$$

$$AD = 2.4 \text{ cm, } AE = 3.2 \text{ cm, } DE = 2 \text{ cm and } BC = 5 \text{ cm}$$



Consider the  $\Delta ABC$ ,

Given,  $DE \parallel BC$

So,  $AD/AB = AE/AC = DE/BC$

Now, consider  $AD/AB = DE/BC$

$$2.4/AB = 2/5$$

$$AB = (2.4 \times 5)/2$$

$$AB = 12/2$$

$$AB = 6 \text{ cm}$$

Then, consider  $AE/AC = DE/BC$

$$3.2/AC = 2/5$$

$$AC = (3.2 \times 5)/2$$

$$AC = 16/2$$

$$AC = 8 \text{ cm}$$

Hence,  $BD = AB - AD$

$$= 6 - 2.4$$

$$= 3.6 \text{ cm}$$

$$CE = AC - AE$$

$$= 8 - 3.2$$

$$= 4.8 \text{ cm}$$

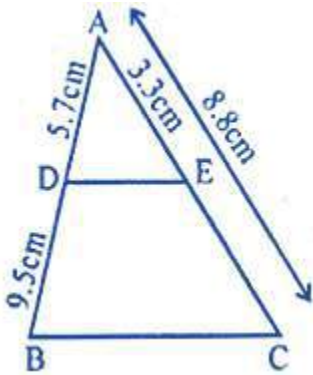
**6. In a  $\Delta ABC$ , D and E are points on the sides AB and AC respectively such that  $AD = 5.7\text{cm}$ ,  $BD = 9.5\text{cm}$ ,  $AE = 3.3\text{cm}$  and  $AC = 8.8\text{cm}$ . Is  $DE \parallel BC$ ? Justify your answer.**

**Solution:-**

From the question it is given that,

In a  $\Delta ABC$ , D and E are points on the sides AB and AC respectively.

$AD = 5.7\text{cm}$ ,  $BD = 9.5\text{cm}$ ,  $AE = 3.3\text{cm}$  and  $AC = 8.8\text{cm}$



Consider the  $\triangle ABC$ ,

$$\begin{aligned} EC &= AC - AE \\ &= 8.8 - 3.3 \\ &= 5.5 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Then, } AD/DB &= 5.7/9.5 \\ &= 57/95 \end{aligned}$$

By dividing both numerator and denominator by 19 we get,  
 $= 3/5$

$$\begin{aligned} AE/EC &= 3.3/5.5 \\ &= 33/55 \end{aligned}$$

By dividing both numerator and denominator by 11 we get,  
 $= 3/5$

$$\text{So, } AD/DB = AE/EC$$

Therefore,  $DE \parallel BC$

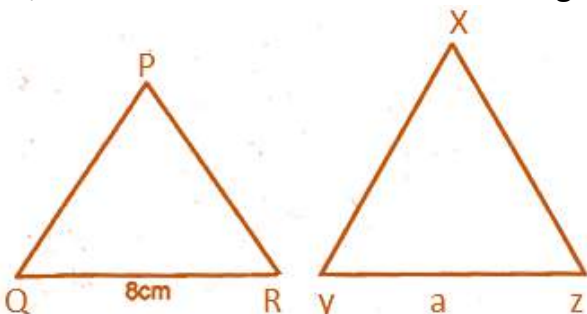
**7. If the areas of two similar triangles are  $360 \text{ cm}^2$  and  $250 \text{ cm}^2$  and if one side of the first triangle is 8 cm, find the length of the corresponding side of the second triangle.**

**Solution:-**

From the question it is given that, the areas of two similar triangles are  $360 \text{ cm}^2$  and  $250 \text{ cm}^2$ .

one side of the first triangle is 8 cm

So, PQR and XYZ are two similar triangles,



So, let us assume area of  $\Delta PQR = 360 \text{ cm}^2$ ,  $QR = 8 \text{ cm}$

And area of  $\Delta XYZ = 250 \text{ cm}^2$

Assume  $YZ = a$

We know that, area of  $\Delta PQR$ /area of  $\Delta XYZ = QR^2/yz^2$

$$360/250 = (8)^2/a^2$$

$$360/250 = 64/a^2$$

By cross multiplication we get,

$$a^2 = (250 \times 64)/360$$

$$a^2 = 400/9$$

$$a = \sqrt{400/9}$$

$$a = 20/3$$

$$a = 6\frac{2}{3}$$

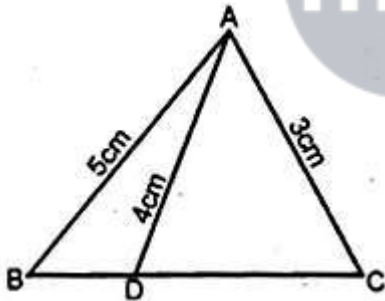
Therefore, the length of the corresponding side of the second triangle  $YZ = 6\frac{2}{3}$

8. In the adjoining figure, D is a point on BC such that  $\angle ABD = \angle CAD$ . If  $AB = 5 \text{ cm}$ ,  $AC = 3 \text{ cm}$  and  $AD = 4 \text{ cm}$ , find

(i) BC

(ii) DC

(iii) area of  $\Delta ACD$  : area of  $\Delta BCA$ .



**Solution:-**

From the question it is given that,

$$\angle ABD = \angle CAD$$

$AB = 5 \text{ cm}$ ,  $AC = 3 \text{ cm}$  and  $AD = 4 \text{ cm}$

Now, consider the  $\Delta ABC$  and  $\Delta ACD$

$$\angle C = \angle C$$

... [common angle for both triangles]

$$\angle ABC = \angle CAD$$

... [from the question]

So,  $\Delta ABC \sim \Delta ACD$

Then,  $AB/AD = BC/AC = AC/DC$

(i) Consider  $AB/AD = BC/AC$

$$5/4 = BC/3$$

$$BC = (5 \times 3)/4$$

$$BC = 15/4$$

$$BC = 3.75 \text{ cm}$$

(ii) Consider  $AB/AD = AC/DC$

$$5/4 = 3/DC$$

$$DC = (3 \times 4)/5$$

$$DC = 12/5$$

$$Dc = 2.4 \text{ cm}$$

(iii) Consider the  $\Delta ABC$  and  $\Delta ACD$

$$\angle CAD = \angle ABC$$

... [from the question]

$$\angle ACD = \angle ACB$$

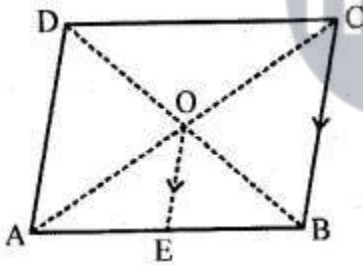
... [common angle for both triangle]

Therefore,  $\Delta ACD \sim \Delta ABC$

$$\begin{aligned} \text{Then, area of } \Delta ACD / \text{area of } \Delta ABC &= AD^2 / AB^2 \\ &= 4^2 / 5^2 \\ &= 16 / 25 \end{aligned}$$

Therefore, area of  $\Delta ACD$  : area of  $\Delta BCA$  is 16: 25.

**9. In the adjoining figure, the diagonals of a parallelogram intersect at O. OE is drawn parallel to CB to meet AB at E, find area of  $\Delta AOE$  : area of parallelogram ABCD.**



**Solution:-**

From the given figure,

The diagonals of a parallelogram intersect at O.

OE is drawn parallel to CB to meet AB at E.

In the figure four triangles have equal area.

So, area of  $\Delta OAB = \frac{1}{4}$  area of parallelogram ABCD

Then, O is midpoint of AC of  $\Delta ABC$  and  $DE \parallel CB$

E is also midpoint of AB

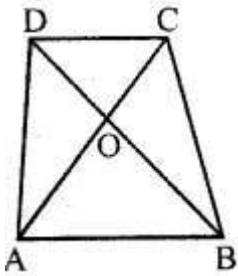
Therefore, OE is the median of  $\Delta AOB$

$$\begin{aligned} \text{Area of } \Delta AOE &= \frac{1}{2} \text{ area of } \Delta AOB \\ &= \frac{1}{2} \times \frac{1}{4} \text{ area of parallelogram ABCD} \\ &= \frac{1}{8} \text{ area of parallelogram ABCD} \end{aligned}$$

So, area of  $\triangle AOE$ /area of parallelogram ABCD =  $1/8$

Therefore, area of  $\triangle AOE$ : area of parallelogram ABCD is 1: 8.

**10. In the given figure, ABCD is a trapezium in which  $AB \parallel DC$ . If  $2AB = 3DC$ , find the ratio of the areas of  $\triangle AOB$  and  $\triangle COD$ .**



**Solution:-**

From the question it is given that, ABCD is a trapezium in which  $AB \parallel DC$ . If  $2AB = 3DC$ .

So,  $2AB = 3DC$

$$AB/DC = 3/2$$

Now, consider  $\triangle AOB$  and  $\triangle COD$

$$\angle AOB = \angle COD$$

... [because vertically opposite angles are equal]

$$\angle OAB = \angle OCD$$

... [because alternate angles are equal]

Therefore,  $\triangle AOB \sim \triangle COD$

... [from AA axiom]

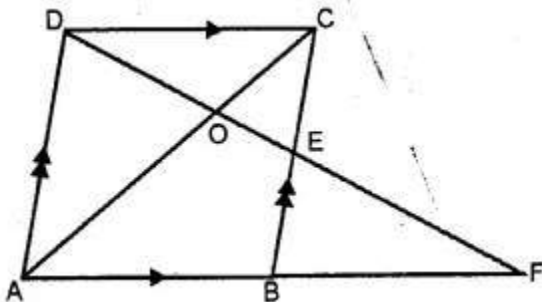
Then, area of  $\triangle AOB$ /area of  $\triangle COD = AB^2/DC^2$

$$= 3^2/2^2$$

$$= 9/4$$

Therefore, the ratio of the areas of  $\triangle AOB$  and  $\triangle COD$  is 9: 4

**11 . In the adjoining figure, ABCD is a parallelogram. E is mid-point of BC. DE meets the diagonal AC at O and meet AB (produced) at F. Prove that**



**Solution:-**

From the question it is given that,

ABCD is a parallelogram. E is mid-point of BC.

DE meets the diagonal AC at O.

(i) Now consider the  $\triangle AOD$  and  $\triangle EDC$ ,

$$\angle AOD = \angle EOC \quad \dots \text{ [because Vertically opposite angles are equal]}$$

$$\angle OAD = \angle OCB \quad \dots \text{ [because alternate angles are equal]}$$

Therefore,  $\triangle AOD \sim \triangle EOC$

$$\text{Then, } OA/OC = DO/OE = AD/EC = 2EC/EC$$

$$OA/OC = DO/OE = 2/1$$

Therefore,  $OA: OC = 2: 1$

(ii) From (i) we proved that,  $\triangle AOD \sim \triangle EOC$

$$\text{So, area of } \triangle OEC/\text{area of } \triangle AOD = OE^2/DO^2$$

$$\text{area of } \triangle OEC/\text{area of } \triangle AOD = 1^2/2^2$$

$$\text{area of } \triangle OEC/\text{area of } \triangle AOD = \frac{1}{4}$$

Therefore, area of  $\triangle OEC$ : area of  $\triangle AOD$  is 1: 4.

**13. A model of a ship is made to a scale of 1: 250 calculate:**

**(i) The length of the ship, if the length of model is 1.6 m.**

**(ii) The area of the deck of the ship, if the area of the deck of model is 2.4 m<sup>2</sup>.**

**(iii) The volume of the model, if the volume of the ship is 1 km<sup>3</sup>.**

**Solution:-**

From the question it is given that, a model of a ship is made to a scale of 1 : 250

(i) Given, the length of the model is 1.6 m

$$\begin{aligned} \text{Then, length of the ship} &= (1.6 \times 250)/1 \\ &= 400 \text{ m} \end{aligned}$$

(ii) Given, the area of the deck of the ship is 2.4 m<sup>2</sup>

$$\begin{aligned} \text{Then, area of deck of the model} &= 2.4 \times (1/250)^2 \\ &= 1,50,000 \text{ m}^2 && = 4 \text{ m}^2 \end{aligned}$$

(iii) Given, the volume of the model is 1 km<sup>3</sup>

$$\begin{aligned} \text{Then, Volume of ship} &= (1/250^3) \times 1 \text{ km}^3 \\ &= 1/(250)^3 \times 1000^3 \\ &= 4^3 \\ &= 64 \text{ m}^3 \end{aligned}$$

Therefore, volume of ship is 64 m<sup>3</sup>.

