

# Similarity of triangles

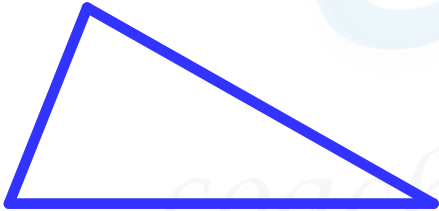
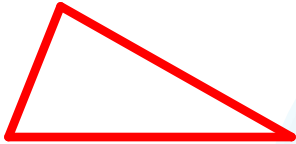
(त्रिभुजों की समरूपता)

Equal shape  
same



coaching center

# Similarity (समरूपता) :



Congruent:

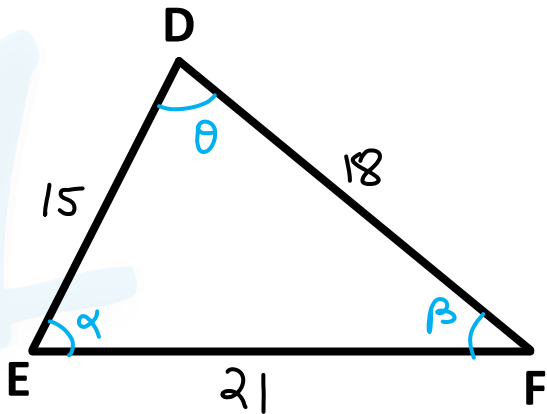
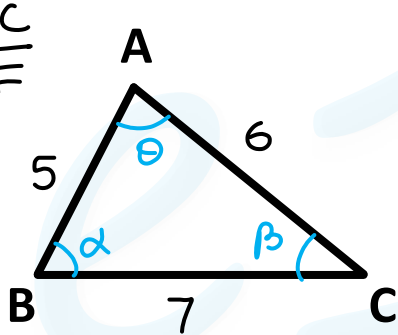


Similar:



## SSS Rule:

$$\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF}$$



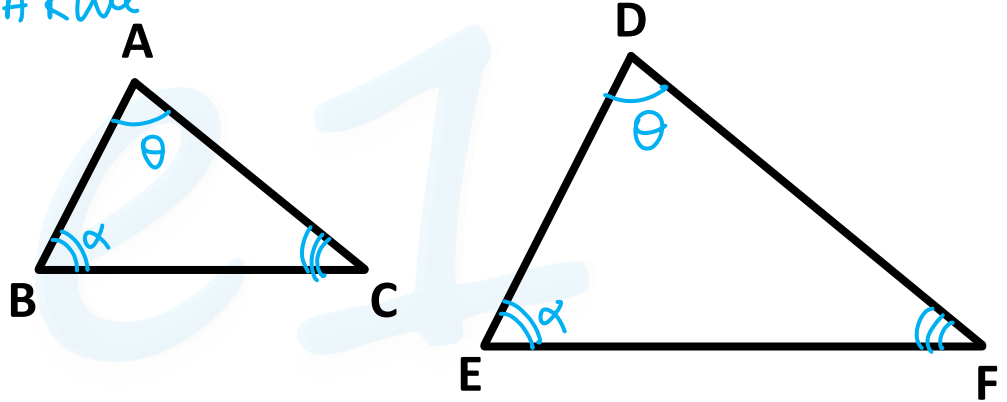
$$AB : AC : BC = DE : DF : EF$$

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# AAA Rule:

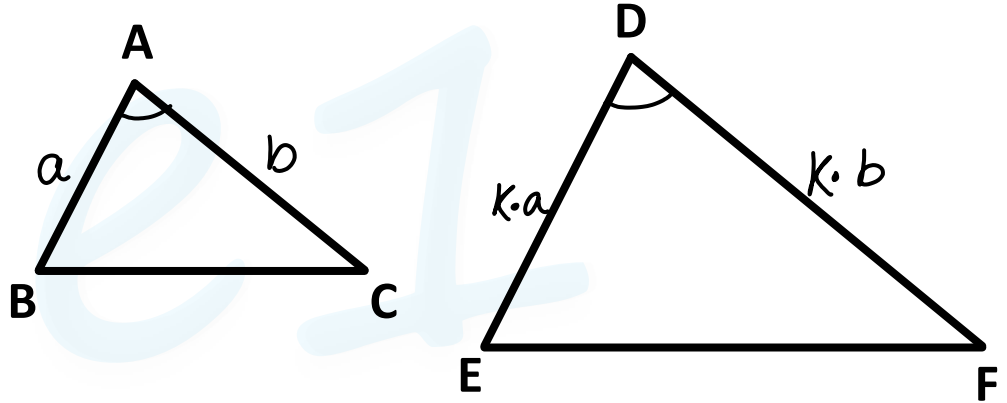
AA Rule'

$$\angle A = \angle D$$
$$\angle B = \angle E$$



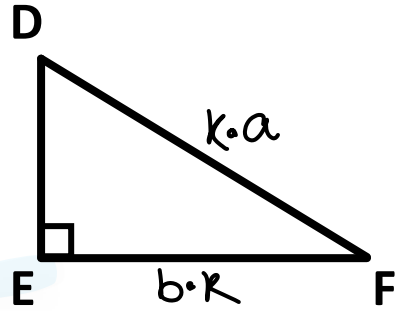
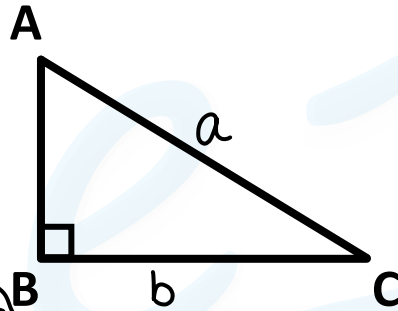
*coaching center*

## SAS Rule:



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# RHS Rule:



RHS

✓ ✓

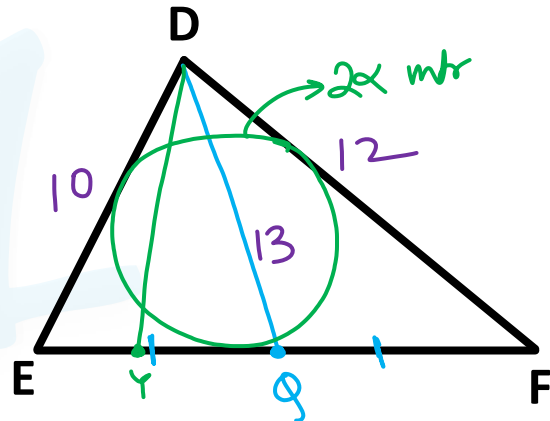
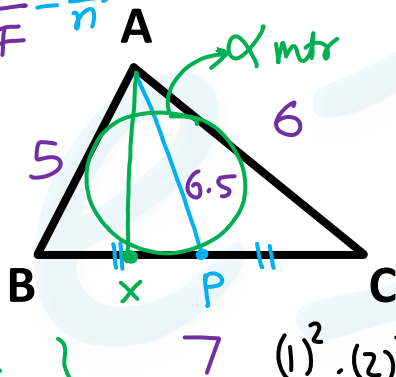
$$\frac{AC}{DF} = \frac{BC}{EF}$$

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# Relations between 1D and 2D measures:

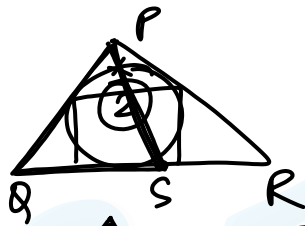
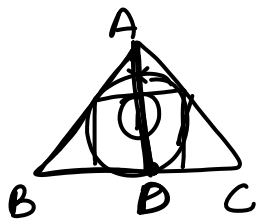
$$\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF} = \frac{m}{n}$$

$$\begin{aligned} \angle A &= \angle D \\ \angle B &= \angle E \\ \angle C &= \angle F \end{aligned}$$



$$\frac{m}{n} \frac{AP}{DQ} = \frac{Ax}{Dy} = \frac{Bx}{Ey} = \frac{XP}{YQ} \quad x(=1) \cdot 3 \quad (1)^2 \cdot (2)^2$$

$$Ey \cdot YF = 1 \cdot 3 = 14$$



length

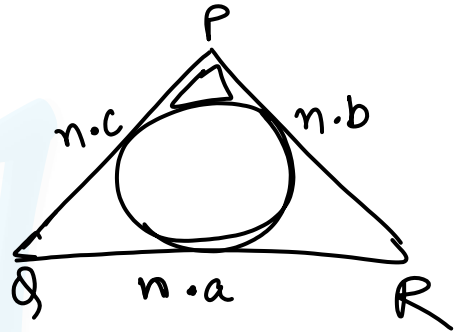
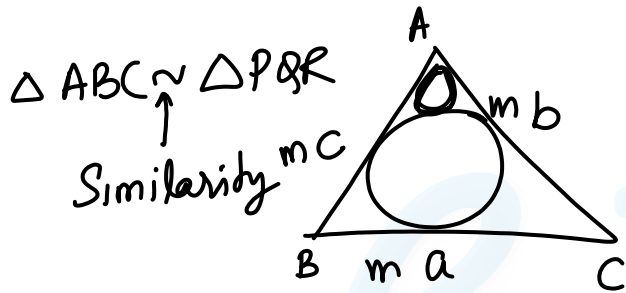
Side  $\rightarrow$  1 dimension

Area  $\rightarrow$  2 "

$$\frac{m}{n} = \frac{\Delta ①}{\Delta ②} = \frac{AB}{PQ} = \frac{AC}{PR} = \frac{BC}{QR} = \frac{m_1}{m_2} = \frac{AB_1}{AB_2} =$$

$$\frac{\text{ar } ①}{\text{ar } ②} = \frac{m^2}{h^2} = \frac{\text{ar } ABD}{\text{ar } PQS} = \frac{\text{ar } ADC}{\text{ar } PSR} = \frac{\text{ar } C_1}{\text{ar } C_2} =$$

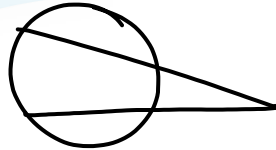
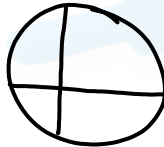
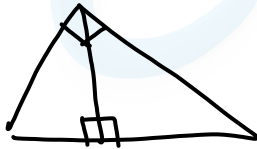
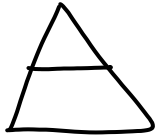




$$\frac{\Delta ABC \text{ 1D}}{\Delta PQR \text{ 1D}} = \frac{m}{n} \quad \begin{array}{l} \text{1D} \quad 1 \cdot 2 \\ \text{2D} \quad 1 \quad 4 \end{array}$$

$$\frac{\Delta ABC \text{ 2D}}{\Delta PQR \text{ 2D}} = \frac{m^2}{n^2}$$

Frequently asked  
Special **situations** creating  
similar triangles:



*coaching center*

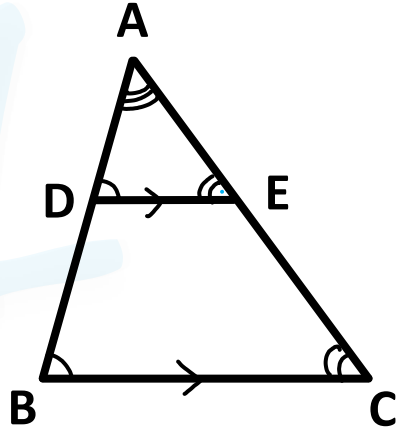
## Line parallel to base (आधार के समानांतर रेखा):

$$\triangle ADE \sim \triangle ABC$$

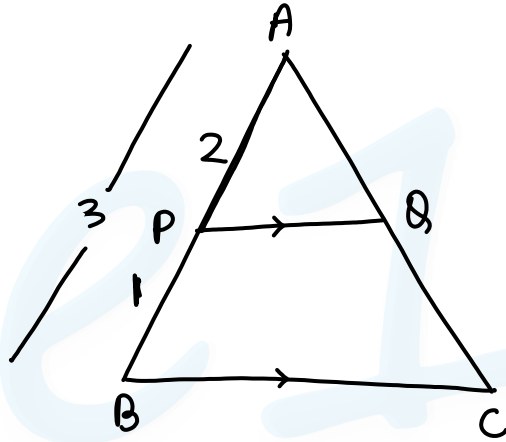
$$\frac{\text{Small}}{\text{big}} = \frac{AD}{AB} = \frac{AE}{AC} = \frac{DE}{BC}$$

$$\frac{\text{Small}}{\text{Rem}} = \frac{AD}{DB} = \frac{AE}{EC} \neq \frac{DE}{BC}$$

$$\frac{\text{big}}{\text{Rem}} = \frac{AB}{DB} = \frac{AC}{EC}$$



$$\frac{PQ}{BC} = \frac{2}{3}$$



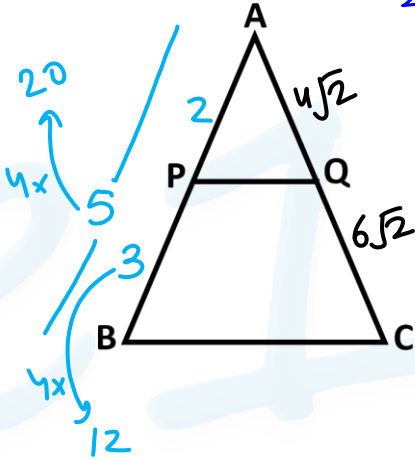
1. Inside  $\triangle ABC$ , a straight line parallel to BC intersect AB and AC at points P and Q respectively. If  $\overline{AB} = 3\overline{PB}$ , then  $\overline{PQ} : \overline{BC}$  is:

$\triangle ABC$  में, BC के समान्तर एक रेखा भुजाओं AB और AC को क्रमशः बिन्दुओं P व Q पर काटती है। अगर  $AB = 3PB$  है तो  $PQ : BC = ?$

- ~~a) 2:3~~      b) 1:3  
c) 3:2      d) 1:2

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$$\frac{AP}{QC} = \frac{4\sqrt{2}}{6\sqrt{2}} = \frac{2}{3}$$



2. In the given figure,  $AQ = 4\sqrt{2}$  cm,  $QC = 6\sqrt{2}$  cm and  $AB = 20$  cm. If  $PQ$  is parallel to  $BC$ , then what is the value (in cm) of  $PB$ ?

दी गई आकृति में  $AQ = 4\sqrt{2}$  cm,  $QC = 6\sqrt{2}$  cm तथा  $AB = 20$  cm है। यदि  $PQ$ ,  $BC$  के समानांतर है, तो  $PB$  का मान (cm में) क्या है?

- a) 8
- b) 12
- c) 6
- d) 15

coaching center

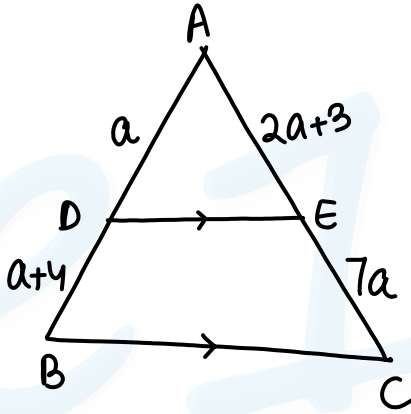
$$\frac{AD}{AB} = \frac{AE}{AC}$$

$$\frac{AD}{DB} = \frac{AE}{EC} \checkmark$$

$$\frac{a}{a+4} = \frac{2a+3}{7a}$$

$$\Rightarrow 7a^2 = 2a^2 + 11a + 12$$

$$\Rightarrow 5a^2 - 11a - 12 = 0 \quad ||$$



3. In a triangle  $ABC$ ,  $DE$  is parallel to  $BC$ ,  $AD = a$ ,  $DB = a + 4$ ,  $AE = 2a + 3$ ,  $EC = 7a$ . What is the value of 'a', if  $a > 0$ ?

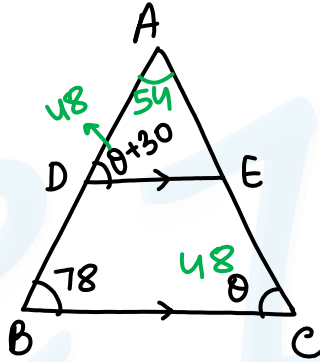
त्रिभुज  $ABC$  में  $DE$ ,  $BC$  के समांतर हैं; ,  $AD = a$ ,  $DB = a + 4$ ,  $AE = 2a + 3$ ,  $EC = 7a$  | 'a' का मान क्या होगा, यदि  $a > 0$ ?

- ~~a) 3~~                      b) 5                      c) 6  
 6                              d) 4

$\frac{3}{7} \frac{9^3}{7 \times 3}$   
 $3 \frac{3}{7} \frac{60}{7}$

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

$$\Rightarrow \frac{AD}{AB} = \frac{AE}{AC}$$



4. In  $\triangle ABC$ , D and E are the points on AB and AC respectively such that  $AD \times AC = AB \times AE$ . If  $\angle ADE = \angle ACB + 30^\circ$  and  $\angle ABC = 78^\circ$ , then  $\angle A = ?$

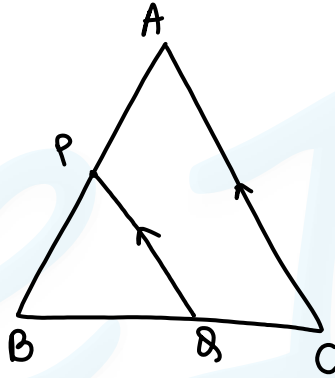
$\triangle ABC$  में AB और AC पर क्रमशः बिंदु D और E इस प्रकार स्थित है कि  $AD \times AC = AB \times AE$  है। यदि  $\angle ADE = \angle ACB + 30^\circ$  और  $\angle ABC = 78^\circ$  है, तो  $\angle A = ?$

- a)  $56^\circ$       ~~b)  $54^\circ$~~   
 c)  $68^\circ$       d)  $48^\circ$

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$$\frac{BC}{QC} = \frac{BA}{PA}$$

$$\Rightarrow PA \checkmark BC = \underline{QC BA}$$



5. In  $\triangle ABC$ , A line  $PQ \parallel AC$  meets  $AB$ ,  $BC$  at  $P$ ,  $Q$  respectively, then  $\underline{AB} \times \underline{CQ} = ?$

त्रिभुज  $\triangle ABC$  में एक रेखा  $PQ \parallel AC$  भुजाओं  $AB$ ,  $BC$  को क्रमशः बिन्दुओं  $P$ ,  $Q$  पर मिलती है तो

$\underline{AB} \times \underline{CQ} = ?$

~~a)  $AP \times BC$~~

b)  $BC \times AB$

c)  $CQ \times AB$

d)  $RQ \times BA$

coaching center



6. In the given figure, two squares of sides 8 cm and 20 cm are given. What is the area (in  $cm^2$ ) of the shaded part?

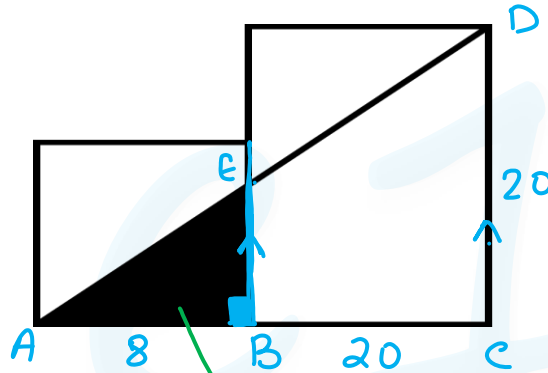
दी गई आकृति में, 8cm तथा 20cm भजा वाले दो वर्ग दिए गए हैं। छायांकित भाग का क्षेत्रफल ( $cm^2$  में) क्या है?

a)  $\frac{120}{7}$

b)  $\frac{160}{7}$

c)  $\frac{180}{7}$

d)  $\frac{240}{13}$



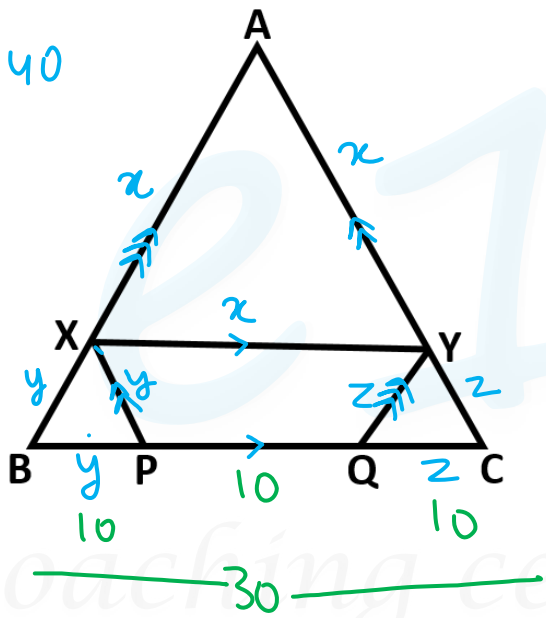
$$\frac{8}{28} = \frac{BE}{20}$$

$$\frac{40}{7} = BE$$

$$\frac{1}{2} \times 8 \times \frac{40}{7}$$

$$20 \quad 10 \quad 10$$

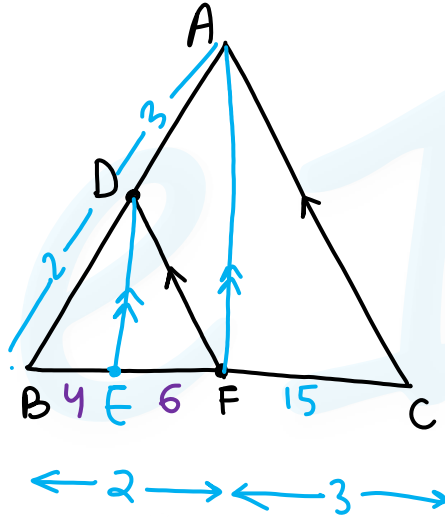
$$x + y + z = 40$$



7. In the figure given below,  $ABC$  is an equilateral triangle with each side of length 30 cm.  $XY$  is parallel to  $BC$ ,  $XP$  is parallel to  $AC$  and  $YQ$  is parallel to  $AB$ . If  $XY + XP + YQ$  is 40cm, then the value of  $PQ$  is:

निम्न दी गई आकृति में  $ABC$  एक समभुजी त्रिभुज है जिसकी प्रत्येक भुजा 30cm लम्बी है।  $XY$  भुजा  $BC$  के समान्तर है,  $XP$  भुजा  $AC$  के समान्तर है,  $YQ$  भुजा  $AB$  के समान्तर है। अगर  $XY + XP + YQ$  का मान 40cm है तो  $PQ$  का मान क्या होगा?

- a) 5 cm
- b) 12 cm
- c) 15 cm
- ~~d) 10 cm~~



8. In a triangle ABC, a point D lies on AB and points E and F lie on BC such that DF is parallel to AC and DE is parallel to AF. If  $BE = 4 \text{ cm}$ ,  $EF = 6 \text{ cm}$ , then find the length (in cm) of BC.

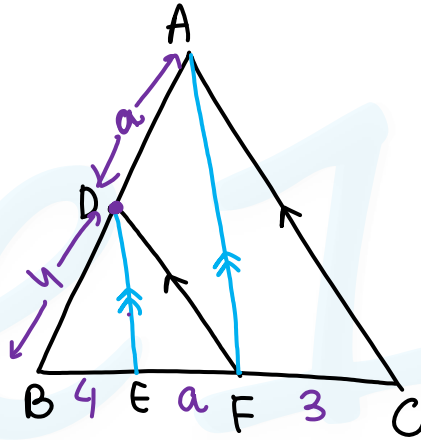
त्रिभुज ABC में, बिंदु D, AB पर तथा बिंदु E और F इस प्रकार BC पर स्थित हैं कि DF, AC के समानांतर हैं और DE, AF के समानांतर हैं। यदि  $BE = 4 \text{ cm}$  और  $EF = 6 \text{ cm}$  है, तो BC की लम्बाई (cm में) ज्ञात करें।

- a) 30      b) 20  
c) 25      d) 15

$$\frac{y}{a} = \frac{y+a}{3}$$

$$a^2 + 4a - 12 = 0$$

-6      2



9. In a triangle ABC, point D lies on AB, and points E and F lie on BC such that DF is parallel to AC and DE is parallel to AF. If  $BE = 4 \text{ cm}$ ,  $CF = 3 \text{ cm}$ , then find the length (in cm) of EF.

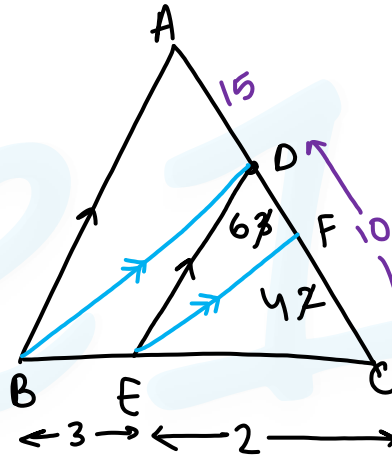
त्रिभुज ABC में, बिंदु D, AB पर स्थित है तथा E और F, BC पर इस प्रकार स्थित हैं कि DF, AC के समानांतर है और DE, AF के समानांतर है। यदि  $BE = 4 \text{ cm}$  और  $CF = 3 \text{ cm}$  है, तो EF की लम्बाई (cm में) ज्ञात करें।

a) 5

b) 3

c) 2

d) 1.5



10. In  $\triangle ABC$ ,  $DE \parallel AB$ , Where D and E are points on sides AC and BC, respectively. F is a point between C and D such that  $EF \parallel BD$ . If  $AD = 15\text{ cm}$ ,  $DC = 10\text{ cm}$ , then the length of CF is:

$\triangle ABC$  में,  $DE \parallel AB$  है, जहाँ D और E क्रमशः भुजा AC और BC पर स्थित बिन्दु हैं। C और D के बीच बिन्दु F इस प्रकार है कि  $EF \parallel BD$  है। यदि  $AD = 15\text{ cm}$ ,  $DC = 10\text{ cm}$  है, तो CF की लंबाई ज्ञात करें।

- a) 3cm
- b) 7.5cm
- c) 5 cm
- ~~d) 4 cm~~

In  $\triangle CEA$ ,  $FD \parallel EA$

$$\therefore \frac{CF}{FE} = \frac{CD}{DA} = \frac{2.5}{3.5} = \frac{5}{7}$$

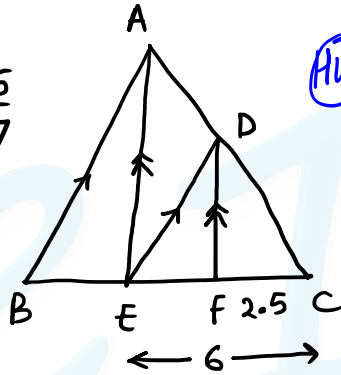
$6 - 2.5$

In  $\triangle CBA$ ,  $ED \parallel BA$ ,

$$\therefore \frac{CD}{DA} = \frac{CE}{EB}$$

$$\Rightarrow \frac{5}{7} = \frac{6}{EB}$$

$$\Rightarrow EB = \frac{6 \times 7 \times 2}{5 \times 2} = 8.4 \quad BC = 8.4 + 6 = 14.4$$

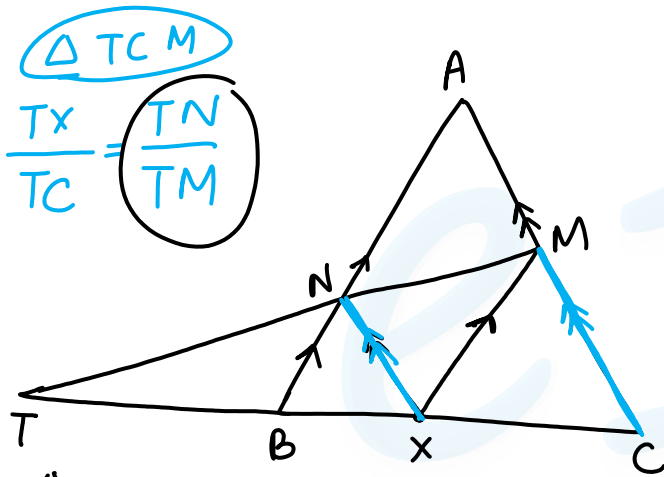


11. In  $\triangle ABC$ , D and E are the points on sides AC and BC respectively such that  $DE \parallel AB$ . F is a point on CE such that  $DF \parallel AE$ . If  $CE = 6 \text{ cm}$  and  $CF = 2.5 \text{ cm}$ , then BC is equal to:

$\triangle ABC$  में बिंदु D और E क्रमशः AC और BC पर इस प्रकार स्थित हैं कि  $DE \parallel AB$  है | बिंदु F, CE पर इस प्रकार स्थित है कि  $DF \parallel AE$  है | यदि  $CE = 6 \text{ cm}$  तथा  $CF = 2.5 \text{ cm}$  है, तो BC की लम्बाई ज्ञात करो?

- ~~a) 14.4 cm~~  
c) 14 cm

- b) 15.6 cm  
d) 12 cm



$\Delta TCM$

$$\frac{TX}{TC} = \frac{TN}{TM}$$

$\Delta TXM$

$$\frac{TB}{TX} = \frac{TN}{TM}$$

$$\frac{TX}{TC} = \frac{TB}{TX}$$

12. In  $\Delta ABC$ ,  $X$  is a point on  $BC$ . From point  $X$ , two parallel lines respectively  $XM$  and  $XN$  are drawn parallel to  $AB$  and  $AC$ , respectively that joins  $AC$  at  $M$  and  $AB$  at  $N$ . If on extension of  $MN$  and  $CB$  they meet at point  $T$ , then relation between  $TX, TB, TC$ .

एक त्रिभुज  $ABC$  की भुज  $BC$  पर एक बिन्दु  $X$  स्थित है।  $X$  से  $XM$  तथा  $XN$  क्रमशः  $AB$  व  $AC$  के समांतर रेखाएँ खींची गई हैं। जो  $AC$  को  $M$  तथा  $AB$  को  $N$  पर मिलती है। यदि  $MN$  को आगे बढ़ाने पर यह बढ़ी हुई  $CB$  को  $T$  पर मिले तो  $TX$  तथा  $TB$  व  $TC$  में क्या संबंध होगा।

a)  $TB^2 = TX \cdot TC$

b)  $2TX = TB \cdot TC$

~~c)  $TX^2 = TB \cdot TC$~~

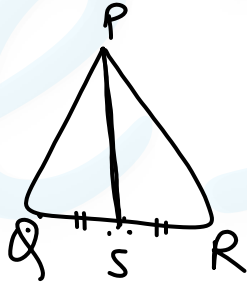
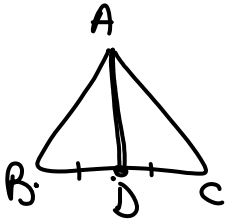
d)  $TC^2 = TX \cdot TB$

ABC

PQR

2 :

3



$$\left(\frac{BD}{QS}\right)^2 = \left(\frac{2}{3}\right)^2$$

13. Triangle ABC is similar to triangle PQR and  $AB:PQ = 2:3$ . AD is the median to the side BC in triangle ABC and PS is the median to the side QR in triangle PQR. What is the value of  $\left(\frac{BD}{QS}\right)^2$ ?

त्रिभुज ABC, त्रिभुज PQR के समरूप है तथा  $AB:PQ = 2:3$  है। AD, त्रिभुज ABC में भुजा BC पर एक माध्यिका है, तथा PS, त्रिभुज PQR में भुजा QR पर एक माध्यिका है।  $\left(\frac{BD}{QS}\right)^2$  का मान क्या है?

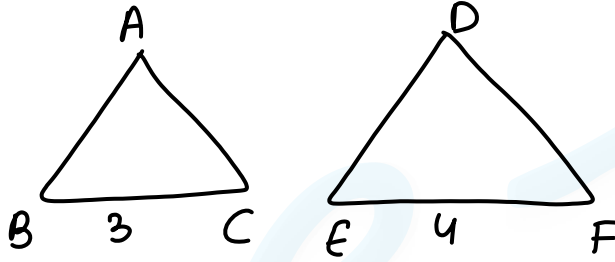
a)  $\frac{3}{5}$

~~b)  $\frac{4}{9}$~~

c)  $\frac{2}{3}$

d)  $\frac{4}{7}$





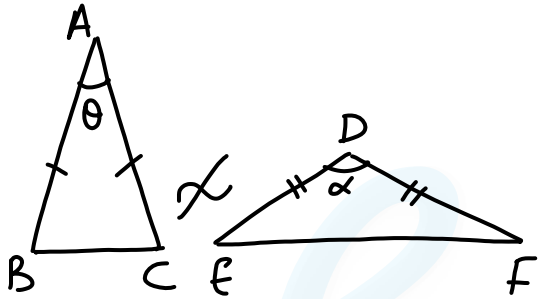
1D      3      4  
 Area    9      16  
           ↓ ×6    ↓ ×6  
           54

14. If  $\Delta ABC$  is similar to  $\Delta DEF$  such that  $BC = 3\text{ cm}$ ,  $EF = 4\text{ cm}$  and area of  $\Delta ABC = 54\text{ cm}^2$ , then the area of  $\Delta DEF$  is

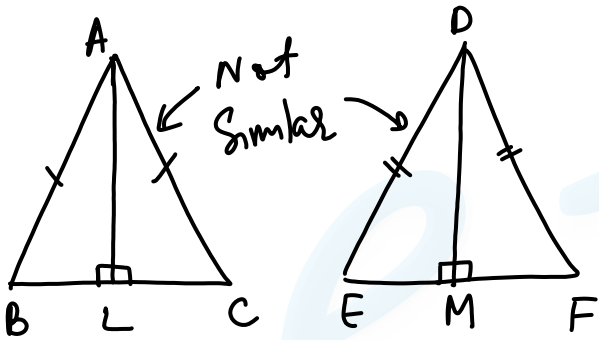
$\Delta ABC$  त्रिभुज  $\Delta DEF$  के समरूप है तथा  $BC = 3\text{ cm}$ ,  $EF = 4\text{ cm}$  और  $\Delta ABC$  का क्षेत्रफल  $= 54\text{ cm}^2$  है तो  $\Delta DEF$  का क्षेत्रफल ज्ञात करें।

- a)  $72\text{ cm}^2$
- b)  $64\text{ cm}^2$
- ~~c)  $96\text{ cm}^2$~~
- d)  $16\text{ cm}^2$

coaching center



*coaching center*



15. In  $\triangle ABC$ ,  $AB = AC$  and  $AL$  is perpendicular to  $BC$  at  $L$ . In  $\triangle DEF$ ,  $DE = DF$  and  $DM$  is perpendicular to  $EF$  at  $M$ . If (area of  $\triangle ABC$ ) : (area of  $\triangle DEF$ ) = 9:25, then

$\frac{DM+AL}{DM-AL}$  is equal to:

$\triangle ABC$  में,  $AB = AC$  और  $AL$ ,  $BC$  के बिंदु  $L$  पर लम्ब है |  $\triangle DEF$  में  $DE=DF$  और  $DM$ ,  $EF$  के बिंदु  $M$  पर लम्ब है | यदि (area of  $\triangle ABC$ ): (area of  $\triangle DEF$ ) = 9:25 है, तो  $\frac{DM+AL}{DM-AL}$  का मान ज्ञात करें |

- a) 6   b) 4   c) 3   ~~d) 2~~

(2D) area   9 : 25

$\frac{5}{3} = \frac{DM}{AL}$

1D

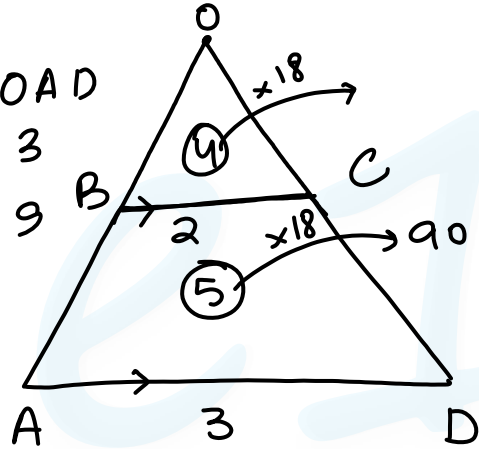
3 : 5

$\frac{8}{2}$

coaching center

1D  
2D

$$\begin{array}{l} OBC \sim OAD \\ 2 : 3 \\ 4 : 9 \end{array}$$



16. ABCD is a trapezium whose parallel sides  $AD$  and  $BC$  are in the ratio of  $3:2$ .  $AB$  and  $DC$  are extended to meet at  $O$ . if the area of  $ABCD$  be  $90 \text{ cm}^2$ , then the area of  $\Delta OBC$  is-

ABCD एक समलम्ब चतुर्भुज है जिसकी भुजाएं  $AD$  और  $BC$  का अनुपात  $3:2$  है।  $AB$  और  $CD$  को बिंदु  $O$  तक आगे बढ़ाया जाता है। अगर  $ABCD$  का क्षेत्रफल  $90 \text{ cm}^2$  है तो त्रिभुज  $OBC$  का क्षेत्रफल पता करो।

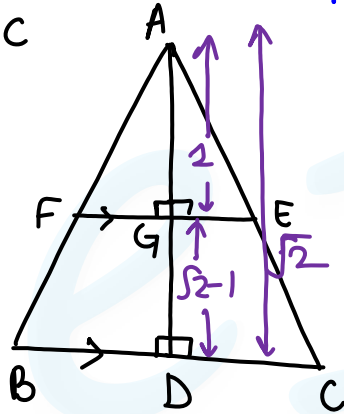
- a)  $40 \text{ cm}^2$     ~~b)  $72 \text{ cm}^2$~~   
c)  $60 \text{ cm}^2$     d)  $90 \text{ cm}^2$

$$AFE \sim ABC$$

$$2D \quad 1 : 2$$

$$1D \quad \sqrt{1} : \sqrt{2}$$

$$! - \sqrt{2}$$



17. In  $\triangle ABC$ , F and E are the point on sides AB and AC, respectively such that  $FE \parallel BC$  and FE divides the triangle in two parts of equal area. If  $AD \perp BC$  and AD intersects FE at G, then  $GD:AG = ?$

$\triangle ABC$  में AB और AC भुजाओ पर क्रमशः बिंदु F और E इस प्रकार है की  $FE \parallel BC$  तथा FE त्रिभुज को समान क्षेत्रफल वाले दो भागों में विभाजित करती है। यदि  $AD \perp BC$  और AD, बिंदु G, पर FE को कटती है तो  $GD:AG = ?$

- a)  $\sqrt{2}:1$       b)  $(\sqrt{2}-1):1$  ✓  
 c)  $(\sqrt{2}+1):1$       d)  $2\sqrt{2}:1$

coaching center