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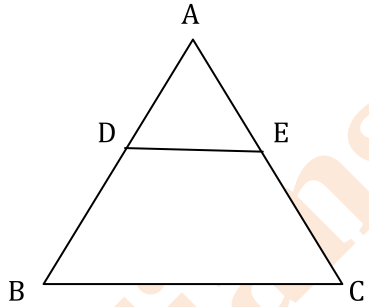
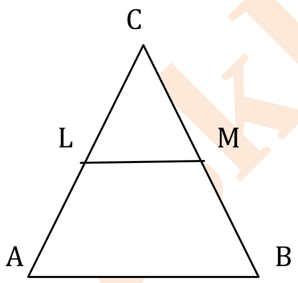
Class: X
Subject: Maths
Topic: Triangles
No. of Questions: 20

Q.1 In a given ΔABC, DE||BC and AD/BD= 3/5. If AC= 5.6, find AE.

Solution 1: In ΔABC,
DE||BC
AD/DB= AE/EC
AD/DB=AE/(AC – AE)
3/5=AE/(5.6 – AE)
16.8 – 3AE= 5AE
8AE=16.8
AE=16.8/8=2.1 cm



Q.2 In the given figure, LM||AB. If AL= x – 3, AC=2x, BM=x – 2 and BC= 2x + 3, find the value of x.



Solution 2: In ΔABC,
LM||AB
AL/LC=BM/MC
AL/(AC – AL)=BM/(BC – BM)
(x – 3)/[2x – (x – 3)]= (x – 2)/[(2x + 3) – (x – 2)]
(x – 3)/(x + 3)=(x – 2)/(x + 5)
(x – 3)(x + 5)=(x – 2)(x + 3)
$x^2 + 2x - 15 = x^2 + x - 6$
x = 9

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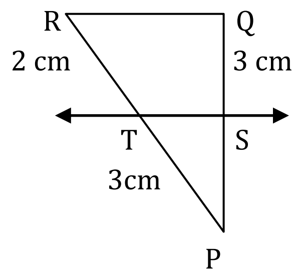
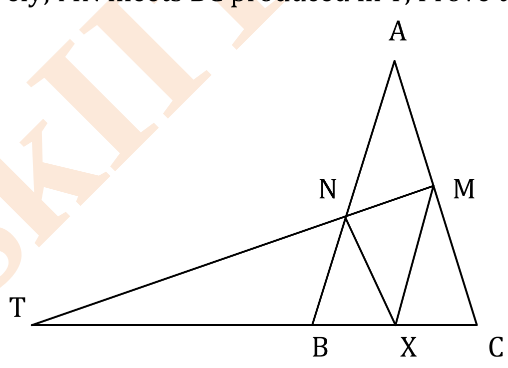
Q.3 In figure, if ST||QR. Find PS.



Solution 3: In ΔPRQ,
ST||QR
PS/QS=PT/RT
PS/3=3/2
PS=9/2 cm

Q.4 Let X be any point on the side BC of a triangle ABC. If XM, XN are drawn parallel to BA and CA meeting CA, BA in M, N respectively; MN meets BC produced in T, Prove that TX^2= TB x TC.

Solution 4: In ΔTXM,
XM||BN
TB/TX=TN/TM………(2)
In ΔTMC,
XN||CM
TX/TC=TN/TM……..(1)
From (1) and (2),
TB/TX=TX/TC
TX^2=TB x TC



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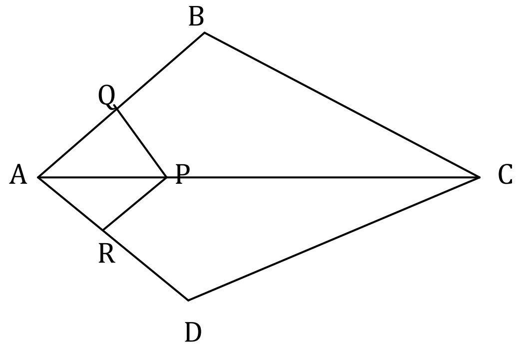
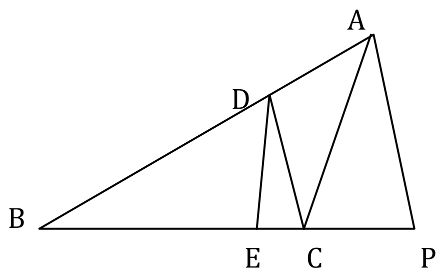
Q.5 In the given figure, if PQ||BC and PR||CD. Prove that i) AR/AD= AQ/AB, ii) QB/AQ= DR/AR. (CBSE- 2010)



Solution 5: In ΔABC,
PQ||BC
Therefore, by basic proportionality theorem,
AQ/AB=AP/AC…………(1)
In ΔACD,
PR||CD
By basic proportionality theorem,
AP/AC=AR/AD…………(2)
From (1) and (2)
AQ/AD=AR/AD or AR/AD=AQ/AB
AB/AQ=AD/AR
(AQ+QB)/AQ=(AR + RD)/AR= 1 + QB/AQ
=1 + RD/AR
QB/AQ=DR/AR

Q.6 In the given figure, DE||AC and DC||AP. Prove that BE/EC= BC/CP (CBSE-2005)



Solution 6: In ΔBPA,
DC||AP
By basic proportionality theorem,

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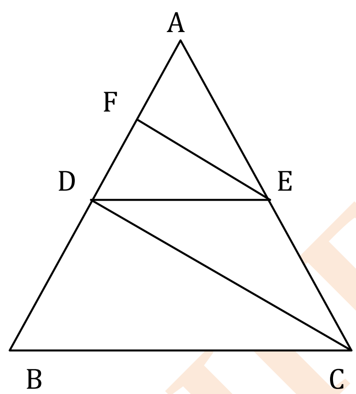
BC/CP=BD/DA
In ΔBCA,
DE||AC…………(1)
By basic proportionality theorem,
BE/EC=BD/DA………..(2)
From (1) and (2),
BC/CP=BE/EC or BE/EC=BC/CP

Q.7 In the given figure, DE||BC and CD||EF. Prove that AD^2= AB x AF (CBSE-2007)



Solution 7: In ΔABC,
DE||BC
AB/DE=AC/AE………..(1)
In ΔADC,
FE||DC
AD/AF=AC/AE………(2)
From (1) and (2),
AB/AD=AD/AF
AD^2=AB

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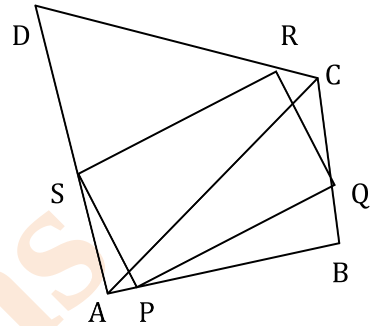
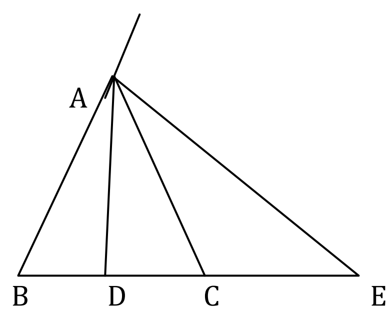
Q.8 ABCD is a quadrilateral; P, Q, R and S are the points of trisection of sides AB, BC, CD and DA respectively and are adjacent to A and C; Prove that PQRS is a parallelogram.

Solution 8: Construction: Join AC.
Proof: Since P,Q,R and S are the points of trisection of AB,BC,CD and DA respectively.
BP=2PA, BQ=2QC, DR=2RC and DS=2SA.



In ΔADC,
DS/SA=DR/RC
S and R divide the sides DA and DC respectively in the same ratio.
SR||AC……………(1)
In ΔABC,
BP/PA=2PA/PA=2 and BQ/QC=2QC/QC=2
BP/PA=BQ/QC
P and Q divide the sides BA and BC respectively in the same ratio.
PQ||AC…….(2)
From equations (1) and (2),
SR||AC and PQ||AC
SR||PQ
Similarly, by joining BD, we can prove that
QR||PS
Hence, PQRS is a parallelogram.

Q.9 The bisector of interior angle A of triangle ABC meets BC in D, and the bisector of exterior angle A meets BC produced in E. prove that BD/BE=CD/CE.



Solution 9: Since AD is the bisector of ∠A meeting BC at D.
AB/AC=BD/DC…….(1)
Since AE is the external bisector of ∠A meeting BC produced in E.
AB/AC=BE/DC………(2)
From (1) and (2),
BD/DC=BE/CE
BD/BE=CD/CE

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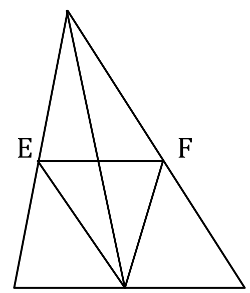
Q.10 AD is a median of ΔABC. The bisector of ∠ADB and ∠ADC meet AB and AC in E and F respectively. Prove that EF||BC.



In ΔADB, DE is the bisector of ∠ADB.

AD/DB=AF/FC……..(1)

In ΔADC, DF is the bisector of ∠ADC.

AD/DC=AF/FC

AD/DB=AF/FC……(2)

From (1) and (2),

AE/EB=AF/FC

Thus, in ΔABC, line segment EF divides the sides AB and AC in the same ratio.

Hence, EF is parallel to BC.

Q.11 If the bisector of an angle of a triangle bisect the opposite side, prove that the triangle is isosceles. (CBSE- 2002)

Solution 11: In ΔABC, AD is the angle bisector of ∠A.

AB/BC=BD/DC

AB/AC=1 (D is the mid-point of BC)

AB=AC

Hence, the triangle ABC is isosceles.

Q.12 The bisectors of the angles B and C of a triangle ABC, meet the opposite sides in D and E respectively. If DE||BC, prove that the triangle is isosceles.

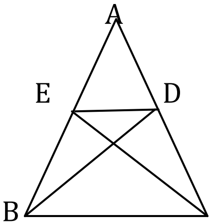
Solution 12: Construction: Join DE

In ΔABC, BD is the bisector of ∠B.

AB/BC=AD/DC……………(1)

In ΔABC, CE is the bisector of ∠C.

AC/BC=AE/BE…………..(2)



Now, DE||BC

AE/BE=AD/DC…………(3)

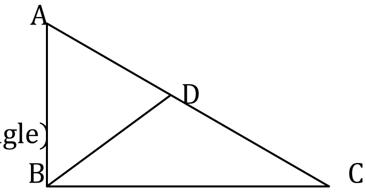
From (3), we find the RHS of (1) and (2) are equal. Therefore, their LHS are also equal ,i.e.,

AB/BC=AC/BC

AB=AC

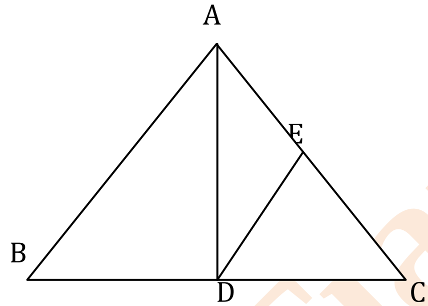
Hence, ΔABC is isosceles.

Q.13 In ΔABC, ∠B=2∠C and the bisector of ∠B intersects AC at D. Prove that BD/DA=BC/BA.



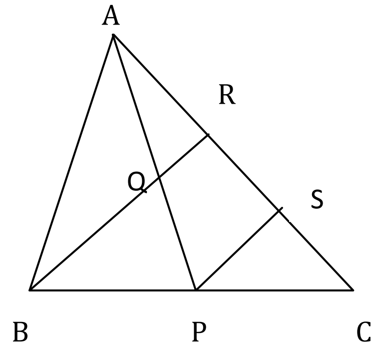
Solution 13: In ΔABC, bisector of ∠B meets AC and D.
CD/AD=BC/BA
BD/AD=BC/BA (CD=BD as BDC will be isosceles triangle)
BD/DA=BC/BA

Q.14 In the figure, ∠BAC= 90^0, AD is the bisector. If DE is perpendicular to AC, prove that DE x (AB + AC)= AB x AC.



Solution 14: It is given that AD is the bisector of ∠A of ΔABC,
AB/AC=BD/DC
AB/AC + 1=BD/BC + 1
(AB + AC)/AC=(BD + DC)/DC
(AB + AC)/AC=BC/DC.........(1)
In ΔCDE and ΔCBA,
∠DCE=∠BCA=∠C (Common)
∠BAC=∠DEC=90^0
So, by AA criterion,
ΔCDE~ΔCBA
CD/CB=DE/BA
AB/DE=BC/DA............(2)
From (1) and (2),
(AB + AC)/AC=AB/DE
DE x (AB + AC)= AB x AC

Q.15 In the figure, P is the mid-point of BC and Q is the mid-point of AP. If BQ when produced meets AC at R, prove that RA= 1/3 CA.



Solution 15: Construction: Draw PS||BR, meeting AC at S.

Proof: In ΔBCR, P is the mid-point of B and PS||BR.

S is the mid-point of CR.

CS=SR……..(1)

In ΔAPS, Q is the mid-point of AP and QR||PS.

R is the mid-point of AS.

AR=AS…….(2)

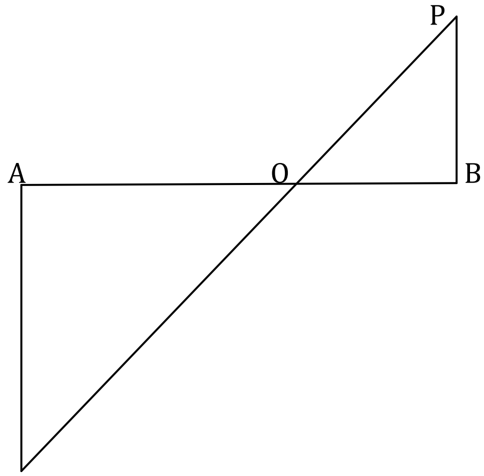
From (1) and (2),

AR=RS=SC

AC=AR + RS + SC=3AR

AR=1/3 AC=1/3 CA

Q.16 In the given figure, QA and PB are perpendiculars to AB. If AO =10 cm, BO=6 cm and PB=9 cm. Find AQ.



Solution 16: Triangle AOQ ~ BOP (Using AA criterion)

AO/BO= AQ/BP

Using this, find AQ.

Q. 17 The perimeters of two similar triangles are 30 cm and 20 cm respectively. If one side of the first triangle is 12 cm, determine the corresponding side of the second triangle.

Let ΔABC and ΔDEF be the two similar triangles of perimeter P1 and P_2 respectively. Also, let AB=12 cm, P_1=30 cm and P_2=20 cm

$AB/DE=BC/EF=AC/DF=P_1/P_2$

$AB/DE=P_1/P_2$

12/DE=30/20

E=12 x 20/30 cm= 8 cm

Q.18 D is a point on the side BC of triangle ABC such that ∠ADC=∠BAC. Prove that CA/CD=CB/CA or CA^2=CB x CD. (CBSE-2004)

Solution 18: In ΔABC and ΔDAC,

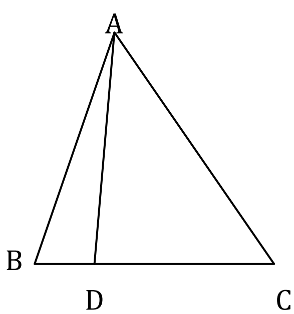
∠ADC=∠BAC and ∠B=∠C

Therefore, by AA~ criterion,

ΔABC~ΔDAC

AB/DA=BC/AC=AC/DC

CB/CA=CA/CD



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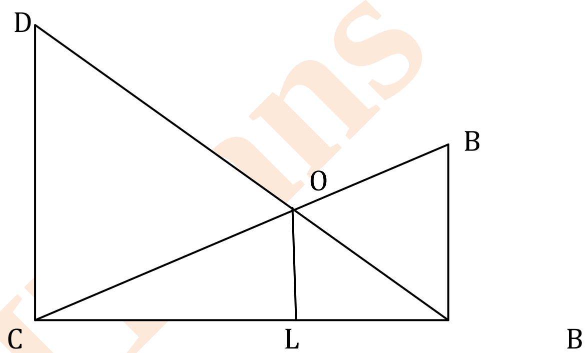
Q.19 Two poles of height a metres and b metres are p metres apart. Prove that the height of the point of intersection of the lines joining the top of each pole to the foot of the opposite pole is given by ab/(a + b) metres.

Solution 19: Let AB and CD be the two poles of heights a and b metres respectively such that the poles are p metres apart, i.e., AC=p metres. Suppose the lines AD and BC meets at O such that OL=h metres.
Let CL=x and LA=y. Then, x + y=p
In ΔABC and ΔLOC,
∠CAB=∠CLO=90⁰
∠C=∠C (Common)
ΔCAB~ΔCLO
CA/CL=AB/LO
x=ph/a…………………(1)
In ΔALO and ΔACD,
∠ALO=∠ACD
∠A=∠A
ΔALO~ΔACD
AL/AC=OL/DC
y/p=h/b
y=ph/b…………………(2)
From (1) and (2),
x+y= ph/a + ph/b
p=ph(1/a +1/b)
1=h(1/a + 1/b)
h= ab/(a + b) metres



Q.20 E is a point on side AD produced of a parallelogram ABCD and BE intersects CD at F. prove that ΔABE ~ΔCFB. (CBSE-2008)

Solution 20: In ΔABE and ΔCFB,
∠AEB=∠CBF (alternate angles)
∠A=∠C (Opposite angles of ||gm)
Thus, by AA ~ criterion,
ΔABE ~ ΔCFB