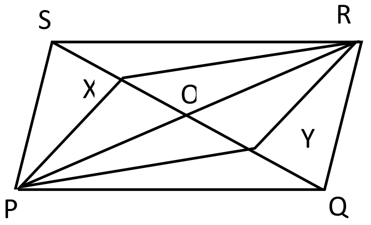
# CBSE Grade $9^{th}$

# Quadrilaterals

Q1) Prove that diagonals of parallelogram bisect each other.

Q2) In figure PQRS is a parallelogram, and X, Y are the points on the diagonal QS such that SX = QY. Prove that




i)RXPY is a parallelogram.

ii) $\Delta PSX \cong \Delta RQY$

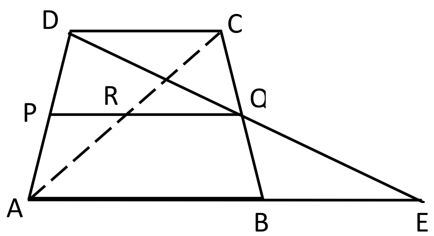
iii)PX = RY and RX = PY

Q3) In figure, ABCD is a trapezium in which AB∥ $DC$ and P, Q are the mid points of AD and BC respectively. DQ and AB when produced meet at E. Also AC and PQ intersect at R. Prove that

(i) DQ = QE

(ii) AB∥ $PR$

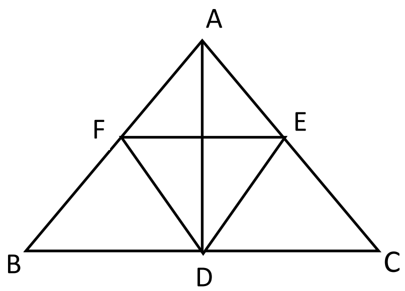
(iii) AR = RC




Q4) E is the mid point of a median AD of $\Delta ABC$ *and BE is produced to meet* AC at F. Show that AF = $\frac{1}{3}AC$.

Q5)Prove that quadrilateral formed by internal angle bisector of a parallelogram is a rectangle.

Q6)In figure,$\Delta ABC$ *is isoceles* with AB = AC. D, E, F are the mid points of sides BC, CA, and AB respectively. Show that the line segment EF is bisected by AD.



# Solutions

## CBSE Grade 9th

## Quadrilaterals

Sol.1)

In $\Delta AOB$ and $\Delta COD$, we have

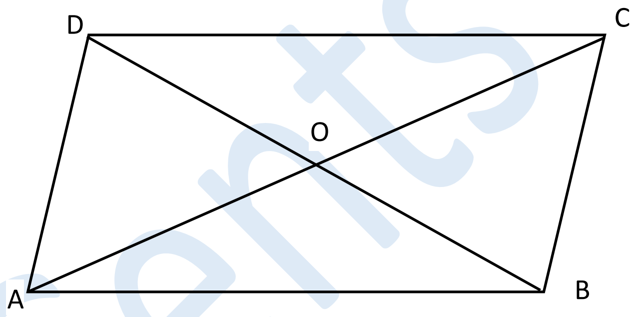
AB = CD

$\angle OAB = \angle OCD$

and $\angle OBA = \angle ODC$

$\therefore \Delta AOB \cong \Delta COD$

Hence, OD = OB and OA = OC (c.p.c.t)




Sol.2)

i) Join RQ, meeting SQ at O.

Since diagonals of quadrilateral bisect each other OS = OQ and OP = OR

Given SX = QY,

$\therefore OX = OY$

OP = OR

Diagonals of quadrilateral PXRY, XY and PR bisect each other hence, PXRY is a parallelogram.

ii) In $\Delta PSX$ and $\Delta RQY$

PS = RQ (opposite sides of parallelogram PQRS)

PX = RY (opposite sides of parallelogram PXRY)

SX = QY (Given)

Hence $\Delta PSX \cong \Delta RQY$ By SSS

iii) PX = RY (opposite sides of parallelogram PXRY)

PY = RX (opposite sides of parallelogram PXRY)

Sol.3) Given AB$\parallel DC$ and P, Q are the mid points of AD and BC respectively.

In $\Delta DCQ$ $and$ $\Delta BEQ$

CQ = BQ

$\angle DQC = \angle BQE$ $(vertically\ opposite\ angles)$

$\angle DCQ = \angle BEQ$ $(alternate\ interior\ angles)$

$\therefore \Delta DCQ \cong \Delta BEQ$

$\therefore PQ \parallel AB$ (c.p.c.t)

i) In $\Delta ADE$ P is the mid point and $PQ \parallel AB$

$\therefore$ Q is the mid point of DE (converse of mid point theorem)

Hence, DQ = QE

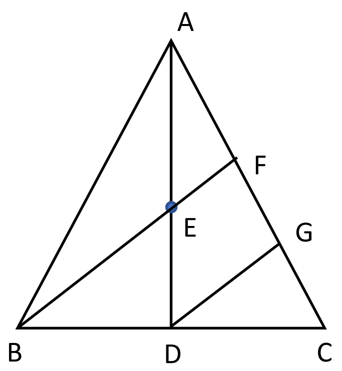
ii) AB$\parallel PR$ $\because AB \parallel PQ$ $and\ R\ lies\ on\ PQ$

iii) In $\Delta ACB$ Q is the mid point and $QR \parallel AB$

$\therefore$ R is the mid point of AC (converse of mid point theorem)

Hence, AR = RC

Sol.4)




Draw DG || EF

In $\Delta ADG, E\ is\ mid\ point\ and$ DG $\parallel$ EF

$\therefore F\ is\ mid\ point\ of\ AG, i.e\ AF = FG$

$In\ \Delta FBC, D\ is\ mid\ point\ of\ BC, and\ DG \parallel$ EF

$\therefore G\ is\ mid\ point\ of\ CF, i.e\ CG = FG$

Thus, $AF = FG = CG$

Hence $AF = \frac{1}{3}AC$

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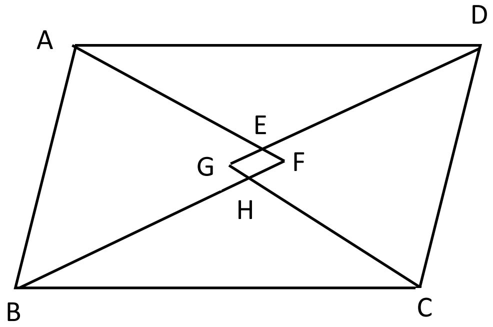
Sol5)




ABCD is a parallelogram. AD∥ $BC$ and AB∥ $DC$

$$\angle DAB + \angle BAD = 180°$$

$\because$ *consicutive angles of parallelogram*

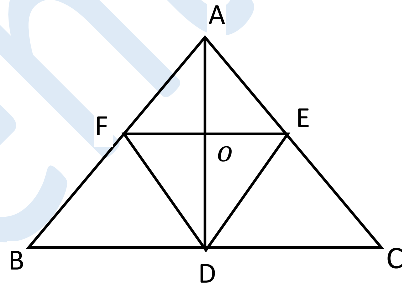
$\therefore \angle DAF + \angle ADG = 90° \because$ *DF and DG are angle bisectors*

$\therefore \angle AED = 90° \because$ *angle sum property.*

$\therefore \angle GEF = 90° \because$ *vertically opposite angles*

Similarly, $\angle GHF = 90°, \angle HFE = 90°, \angle HGE = 90°$

Sol6)




*In* $\Delta ABC, D$ *and* $E$ *are mid points.*

$\therefore DE \parallel BA$ and DE = $\frac{1}{2}BA = FA$

$\because$ *mid point theorm*

*In* $\Delta AFO$ *and* $\Delta DEO$

DE = FA

$\angle DEO = \angle AFO$ (*Alternate angles*)

$\angle EDO = \angle FAO$ (Alternate angles)

Hence, $\Delta AFO \cong \Delta DEO$ *by* ASA rule

Hence AO = DO by CPCT

Hence, AD bisects FE.