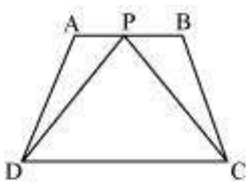
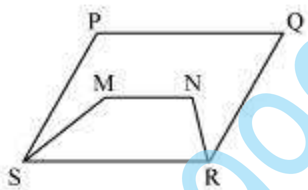
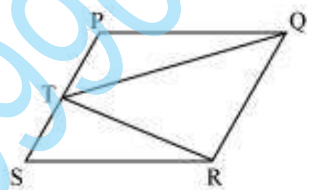
MATHEMATICS CLASS IX CHAPTER – 9 AREAS OF PARALLELOGRAMS

Q.1. Which of the following figures lie on the same base and between the same parallels.

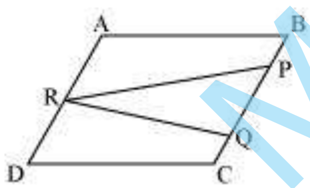
In such a case, write the common base and the two parallels.

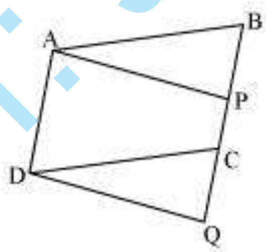


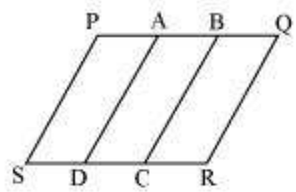




(i) **(ii)** **(iii)**







(iv) **(v)** **(vi)**

Q.2. In the given figure, ABCD is parallelogram, AE ⊥ DC and CF ⊥ AD. If AB = 16 cm, AE = 8 cm and CF = 10 cm, find AD.

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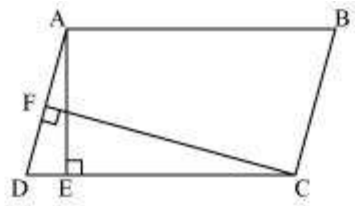

Q.3. **If E, F, G and H are respectively the mid-points of the sides of a parallelogram ABCD show that**

ar (EFGH) $= \frac{1}{2}$ ar (ABCD)

Q.4. **P and Q are any two points lying on the sides DC and AD respectively of a parallelogram ABCD. Show that ar (APB) = ar (BQC).**

Q.5. In the given figure, P is a point in the interior of a parallelogram ABCD. Show that

(i) ar (APB) + ar (PCD) = $\frac{1}{2}$ ar (ABCD)

(ii) ar (APD) + ar (PBC) = ar (APB) + ar (PCD)

[Hint: Through. P, draw a line parallel to AB]

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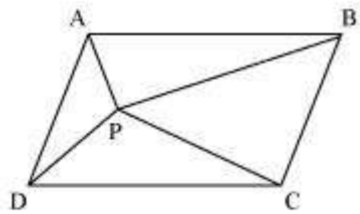
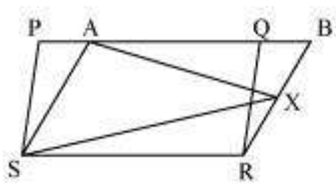


Q.6. **In the given figure, PQRS and ABRS are parallelograms and X is any point on side BR. Show that**

(i) ar (PQRS) = ar (ABRS)

(ii) ar (AXS) = $\frac{1}{2}$ **ar (PQRS)**



Q.7. **A farmer was having a field in the form of a parallelogram PQRS. She took any point A on RS and joined it to points P and Q. In how many parts the field is divided? What are the shapes of these parts? The farmer wants to sow wheat and pulses in equal portions of the field separately. How should she do it?**

Q.8. **In the given figure, E is any point on median AD of a ΔABC. Show that**

ar (ABE) = ar (ACE)

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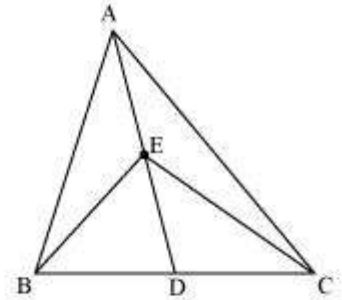
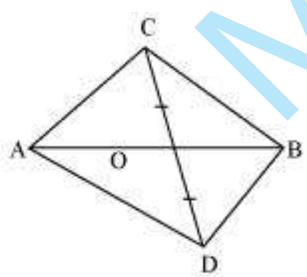


Q.9. **In a triangle ABC, E is the mid-point of median AD. Show that ar (BED) = $\frac{1}{4}$ ar (ABC)**

Q.10. **Show that the diagonals of a parallelogram divide it into four triangles of equal area.**

Q.11. **In the given figure, ABC and ABD are two triangles on the same base AB. If line-segment CD is bisected by AB at O, show that ar (ABC) = ar (ABD).**



Q.12. **D, E and F are respectively the mid-points of the sides BC, CA and AB of a ΔABC. Show that**

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(i) BDEF is a parallelogram.

(ii) ar (DEF) = $\frac{1}{4}$ **ar (ABC)**

(iii) ar (BDEF) = $\frac{1}{2}$ **ar (ABC)**

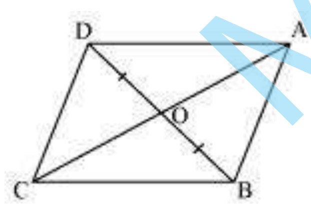
Q.13. In the given figure, diagonals AC and BD of quadrilateral ABCD intersect at O such that OB = OD. If AB = CD, then show that:

(i) ar (DOC) = ar (AOB)

(ii) ar (DCB) = ar (ACB)

(iii) DA || CB or ABCD is a parallelogram.

[Hint: From D and B, draw perpendiculars to AC.]



Q.14. D and E are points on sides AB and AC respectively of ΔABC such that

ar (DBC) = ar (EBC). Prove that DE || BC.

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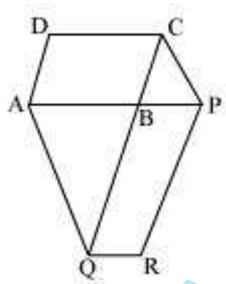
Q.15. **XY is a line parallel to side BC of a triangle ABC. If BE || AC and CF || AB meet XY at E and E respectively, show that**

ar (ABE) = ar (ACF)

Q.16. **The side AB of a parallelogram ABCD is produced to any point P. A line through A and parallel to CP meets CB produced at Q and then parallelogram PBQR is completed (see the following figure). Show that**

ar (ABCD) = ar (PBQR).

[Hint: Join AC and PQ. Now compare area (ACQ) and area (APQ)]



Q.17. **Diagonals AC and BD of a trapezium ABCD with AB || DC intersect each other at O. Prove that ar (AOD) = ar (BOC).**

Q.18. **In the given figure, ABCDE is a pentagon. A line through B parallel to AC meets DC produced at F. Show that**

(i) ar (ACB) = ar (ACF)

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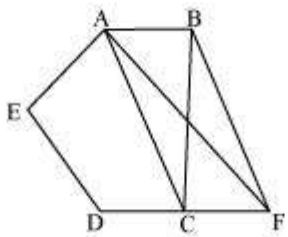
(ii) ar (AEDF) = ar (ABCDE)



Q.19. A villager Itwaari has a plot of land of the shape of a quadrilateral. The Gram Panchayat of the village decided to take over some portion of his plot from one of the corners to construct a Health Centre. Itwaari agrees to the above proposal with the condition that he should be given equal amount of land in lieu of his land adjoining his plot so as to form a triangular plot. Explain how this proposal will be implemented.

Q.20. ABCD is a trapezium with AB || DC. A line parallel to AC intersects AB at X and BC at Y. Prove that ar (ADX) = ar (ACY).

[Hint: Join CX.]

Q.21. In the given figure, AP || BQ || CR. Prove that ar (AQC) = ar (PBR).

Q.22. Diagonals AC and BD of a quadrilateral ABCD intersect at O in such a way that ar (AOD) = ar (BOC). Prove that ABCD is a trapezium.

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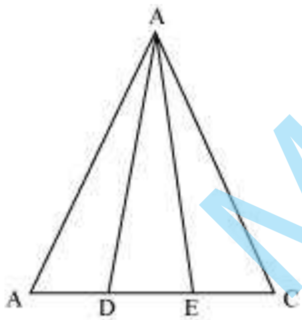
Q.23. **In the given figure, ar (DRC) = ar (DPC) and ar (BDP) = ar (ARC). Show that both the quadrilaterals ABCD and DCPR are trapeziums.**

Q.24. Parallelogram ABCD and rectangle ABEF are on the same base AB and have equal areas. Show that the perimeter of the parallelogram is greater than that of the rectangle.

Q.25. In the following figure, D and E are two points on BC such that BD = DE = EC. Show that ar (ABD) = ar (ADE) = ar (AEC).

Can you answer the question that you have left in the 'Introduction' of this chapter, whether the field of *Budhia* has been actually divided into three parts of equal area?



[Remark: Note that by taking BD = DE = EC, the triangle ABC is divided into three triangles ABD, ADE and AEC of equal areas. In the same way, by dividing BC into *n* equal parts and joining the points of division so obtained to the opposite vertex of BC, you can divide ΔABC into *n* triangles of equal areas.]

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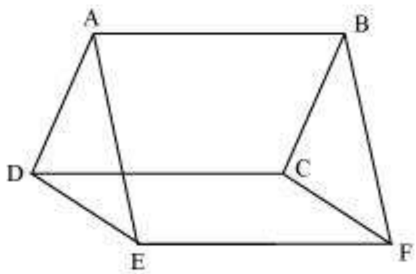
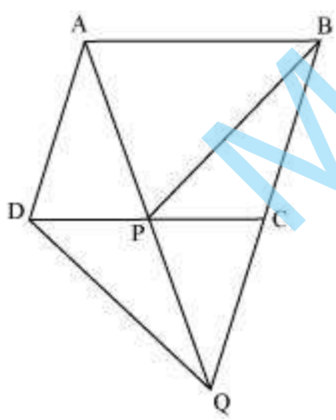
Q.26. **In the following figure, ABCD, DCFE and ABFE are parallelograms. Show that ar (ADE) = ar (BCF).**



Q.27. **In the following figure, ABCD is parallelogram and BC is produced to a point Q such that AD = CQ. If AQ intersect DC at P, show that**

ar (BPC) = ar (DPQ).

[Hint: Join AC.]



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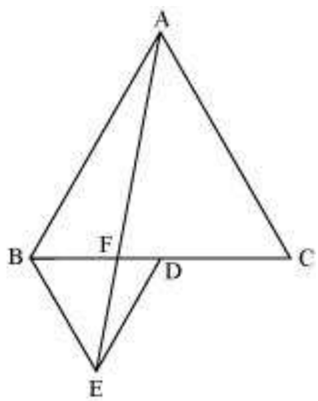
Q.28. In the following figure, ABC and BDE are two equilateral triangles such that D is the mid-point of BC. If AE intersects BC at F, show that



(i) $\text{ar}(\text{BDE}) = \frac{1}{4}\text{ar}(\text{ABC})$

(ii) $\text{ar}(\text{BDE}) = \frac{1}{2}\text{ar}(\text{BAE})$

(iii) $\text{ar}(\text{ABC}) = 2\,\text{ar}(\text{BEC})$

(iv) $\text{ar}(\text{BFE}) = \text{ar}(\text{AFD})$

(v) $\text{ar}(\text{BFE}) = 2\,\text{ar}(\text{FED})$

(vi) $\text{ar}(\text{FED}) = \frac{1}{8}\text{ar}(\text{AFC})$

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[Hint: Join EC and AD. Show that BE || AC and DE || AB, etc.]

Q.29. Diagonals AC and BD of a quadrilateral ABCD intersect each other at P. Show that $ar(APB) \times ar(CPD) = ar(APD) \times ar(BPC)$

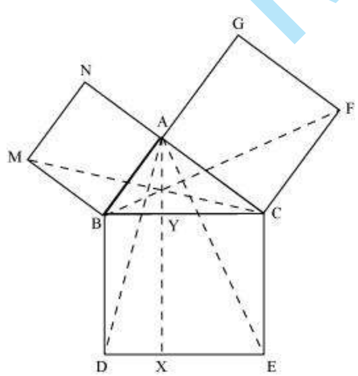
[Hint: From A and C, draw perpendiculars to BD]

Q.30. P and Q are respectively the mid-points of sides AB and BC of a triangle ABC and R is the mid-point of AP, show that

(i) $ar(PRQ) = \frac{1}{2} ar(ARC)$ **(ii)** $ar(RQC) = \frac{3}{8} ar(ABC)$

(iii) $ar(PBQ) = ar(ARC)$

Q.31. In the following figure, ABC is a right triangle right angled at A. BCED, ACFG and ABMN are squares on the sides BC, CA and AB respectively. Line segment AX ⊥ DE meets BC at Y. Show that:



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(i) ΔMBC ≅ ΔABD

(ii) $\text{ar}(\text{BYXD}) = 2\text{ar}(\text{MBC})$

(iii) $\text{ar}(\text{BYXD}) = 2\text{ar}(\text{ABMN})$

(iv) ΔFCB ≅ ΔACE

(v) $\text{ar}(\text{CYXE}) = 2\text{ar}(\text{FCB})$

(vi) $\text{ar}(\text{CYXE}) = \text{ar}(\text{ACFG})$

(vii) $\text{ar}(\text{BCED}) = \text{ar}(\text{ABMN}) + \text{ar}(\text{ACFG})$

Note: Result (vii) is the famous *Theorem of Pythagoras*. You shall learn a simpler proof of this theorem in class X.

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