AREA

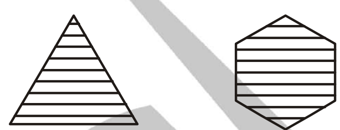
INTRODUCTION

In Previous classes, we have learn to find areas of plane figures, for example, area of triangle, rectangle, square, parallelogram, rhombus etc. In the present chapter, we shall study the relationship between the areas of these geometrical figures particularly when the two figures lie on same base and between same parallel lines.

Let us first understand the meaning of area of planar region and some axioms related to it.

Area of plane region. The part of a plane enclosed by a simple closed figure is called a planar region corresponding to that figure. The measure of this planar region in some unit is called the area of that planar region. Thus area of a figure is a number, associated with the part of the plane enclosed by the figure for example-

1. The part of the plane enclosed by a triangle is called the area of triangular region.



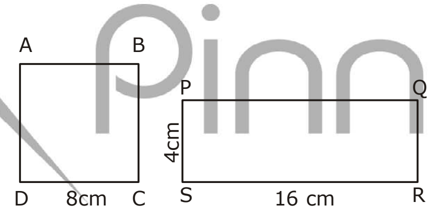
2. The part of the plane enclosed by a polygon is called area of the polygonal region.

Area axioms for plane figures. Following are the axioms related to area of plane figures.

1. Area Axiom of Congruent Figures.

We know that- "two plane figures are congruent' means they have same shape and size. If we place one figure on other, the two figures cover each other exactly. In other words, they have same area. Thus, we can say if R_1 and R_2 are two plane regions such that $R_1 \cong R_2$ then ar (R_1) = ar (R_2) e.g., if $\Delta ABC \cong \Delta PQR$ then ar (ΔABC) = ar (ΔPQR) if quad. ABCD $\cong$ quad. PQRS then ar (ABCD) = ar (PQRS).

But converse of above is not true i.e., if areas of two plane regions are same then they need not be congruent. For example, a square ABCD of side 8 cm has area 64 cm^2 and a rectangle of sides 16 cm and 4 cm also has area 64cm^2 and a rectangle of sides 16 cm and 4 cm also has area 64 cm^2. But , clearly, square ABCD is not congruent to rectangle PQRS.



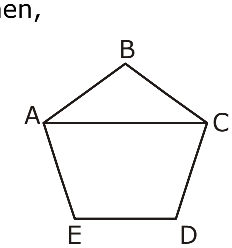
2. Axiom for Area of Union of Two Regions.

If R is a planar region, which is a union of two non- overlapping planar regions R_1 and R_2, then ar (R) = ar (R_1) + ar (R_2)

e.g., if R is a polygonal region ABCDE which is the union of two regions.

R_1 : the triangular region ABC.

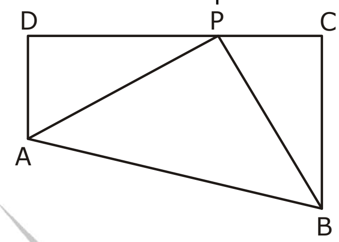
R_2 : the quadrilateral region CEDA. then,



ar (Polygon ABCDE) = ar (ΔABC) + ar (quad. CDEA).

3. Axiom for Area of Included Region.

If R_1 be a plane region included in any other planar region R_2, then ar $(R_1) \leq$ ar (R_2) e.g., in the adjacent figure, triangular region ABP is included inside the quadrilateral region ABCD, therefore



ar (ΔABP) $\leq$ ar (quad. ABCD).

4. Axiom for Area of a Rectangle.

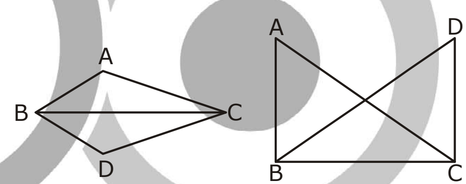
If a rectangle ABCD has length l and breadth b then ar (rect. ABCD) = l × b.

Using above axioms, we can derive the formulae for area of parallelogram, triangle, trapezium and rhombus. It also needs the study of relationship between the areas of these geometric figures under the condition when they lie on the same base and between the same parallels.

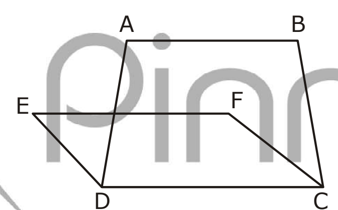
GEOMETRIC FIGURES ON THE SAME BASE AND BETWEEN THE SAME PARALLELS

Let us first understand the meaning of 'same base'. Two geometric figures are said to have same base if they have one side common. For example, in the following cases figures are on same base.

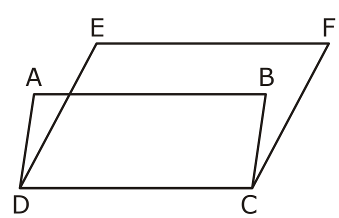
(i) ΔABC and ΔDBC are on the same base BC in each of the two figures given here.



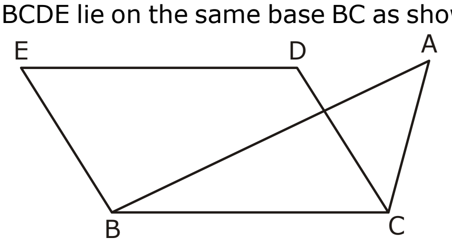
(ii) In the adjacent figure trapezium ABCD and parallelogram CDEF are on the same base CD.



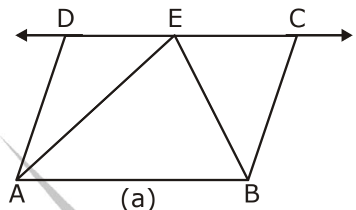
(iii) Two parallelograms ABCD and CDEF are on the same base CD in the figure given below-



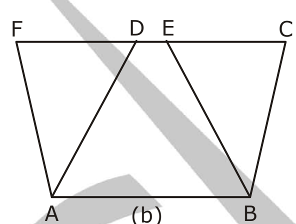
(iv) ΔABC and parallelogram BCDE lie on the same base BC as shown in the given figure.



Now two plane geometric figures are said to be on the same base and between the same parallels if each of these have one side common and their opposite sides or vertex lie along or on a line parallel to the base and on the same side of base. For example, in fig. (a) parallelogram ABCD and ΔABE lie on the same base AB and between the same parallels AB and DC.

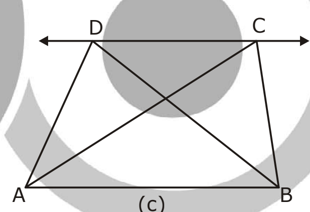


(a)



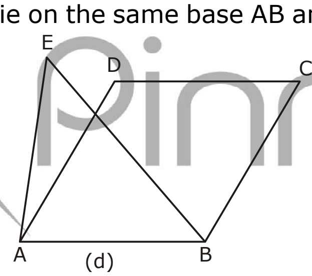
(b)

In fig. (b) parallelograms ABCD and ABEF lie on the same base AB and between the same parallels AB and FC.



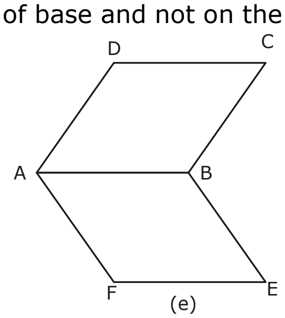
(c)

In fig. (c) triangles ABC adn ABD lie on the same base AB and between the same parallels AB and DC.



(d)

It should be noted that the figures (d) and (e) lie on the same but not between the same base parallels. In fig. (d) vertex E of ΔABE and opposite side of parallelogram ABCD do not lie on the same line parallel to base AB while in Fig. (e) parallelogram ABCD and parallelogram ABEF have their sides opposite to base on different sides of base and not on the same side of base.

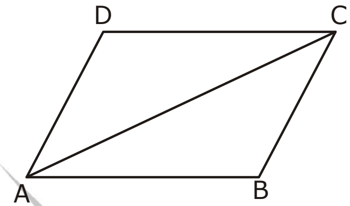


(e)

So figures (d) and (e) cannot be considered as the figures on same base and between the same parallels.

SOLVED PROBLEMS

Ex.1 Diagonal of a parallelogram divides it into two triangles of equal area.



Sol. **Given.** ABCD is a ||gm and AC is diagonal.

To prove : ar (ABC) = ar (ADC).

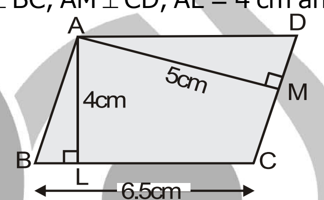
Proof. We know that diagonal of a parallelogram divides it into two congruent triangles.

$\because$ $\Delta ABC \cong \Delta CDA$

$\therefore$ ar (ΔABC) = ar (ΔCDA)

(by area axiom of congruent figures)

Ex.2 In fig, ABCD is a parallelogram, AL $\perp$ BC, AM $\perp$ CD, AL = 4 cm and AM = 5 cm. If BC = 6.5 cm, then find CD.

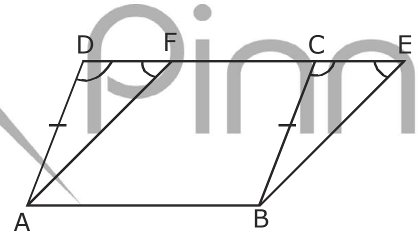


Sol. We have, BC × AL = CD × AM (Each equal to area of the parallelogram ABCD)

$\Rightarrow$ 6.5 × 4 = CD × 5

$\Rightarrow$ CD = $\frac{6.5 \times 4}{5}$ cm $\Rightarrow$ CD = 5.2 cm.

Ex.3 Parallelogram on the same base and between the same parallels are equal in area. **[NCERT]** **(CBSE 2010)**



Sol. **Given.** Two parallelograms ABCD and ABEF on the same base AB and between the same parallels AB and DE.

To Prove : ar (||gm ABCD) = ar (||gm ABEF).

Proof. In ΔADF and ΔBCE.

$\because$ AD||BC being opposite sides of a parallelogram and DC a transversal,

$\therefore$ $\angle ADF = \angle BCE$ (corresponding angles)

Also since AF ||BE being opposite sides of a parallelogram and DE a transversal,

$\therefore$ $\angle AFD = \angle BEC$ (corresponding angles)

$\therefore$ $\angle DAF = \angle CBE$ ($\because$ if two angles of two triangles are equal, third will also be equal)

and, AD = BC (opp. sides of a||gm)

$\therefore$ $\Delta ADF \cong \Delta BCE$ (ASA congruence condition)

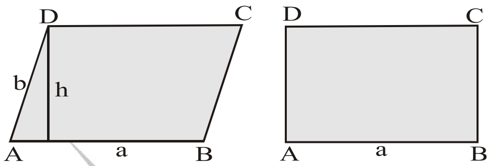
$\therefore$ ar (ΔADF) = ar (ΔBCE)

$\Rightarrow$ ar (ΔADF) + ar (||gm ABCF) = ar (ΔBCE) + ar (||gm ABCF)

$\Rightarrow$ ar (||gm ABCD) = ar (||gm ABEF)

Ex.4 Prove that of all parallelograms of which the sides are given, the parallelogram which is rectangle has the greatest area.

Sol. Let ABCD be a parallelogram in which AB = a and AD = b. Let h be the altitude corresponding to the base AB. Then,



ar (||gm ABCD) = AB × h = ah

Since the sides a and b are given. Therefore, with the same sides a and b we can construct infinitely many parallelograms with different heights.

Now, ar (||gm ABCD) = ah

$\Rightarrow$ ar (||gm ABCD) is maximum or greatest when h is maximum. [$\because$ a is given i.e., a is constant]

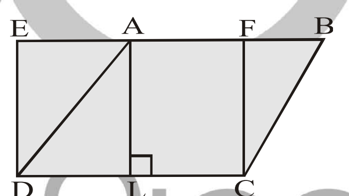
But, the maximum value which h can attain is AD = b and this is possible when AD is perpendicular to AB i.e. the ||gm ABCD becomes a rectangle.

Thus, (ar ||gm ABCD) is greatest when AD $\perp$ AB i.e. when (||gm ABCD) is a rectangle.

Ex.5 In fig, ABCD is a parallelogram and EFCD is a rectangle. Also AL $\perp$ DC. Prove that

(i) ar (ABCD) = (EFCD) (ii) ar (ABCD) = DC × AL

Sol. (i) We know that a rectangle is also a parallelogram.



Thus, parallelogram ABCD and rectangle EFCD are on the same base CD and between the same parallels CD and BE.

$\therefore$ ar (||gm ABCD) = ar (EFCD)

(ii) From (i), we have ar (ABCD) = ar (EFCD)

$\Rightarrow$ ar (ABCD) = CD × FC

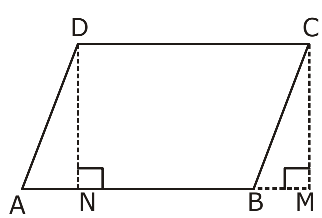
[$\because$ Area of a rectangle = Base × Height]

$\Rightarrow$ ar (ABCD) = CD × AL

[$\because$ AL = FC as ALCF is a rectangle]

$\Rightarrow$ ar (ABCD) = DC × AL

Ex.6 Area of a parallelogram is equal to the product of its base and corresponding altitude. **[NCERT]**



Sol. **Given.** A parallelogram ABCD in which DN is altitude corresponding to base AB.

To Prove : ar (||gm ABCD) = AB × DN.

Construction. Draw CM perpendicular to AB which meets AB produced at M.

Proof. DN and CM are both perpendicular to same line AB,

$\therefore$ DN ||CM

Also DN = CM

($\because$ each is distance between two parallel lines AB and DC)

$\therefore$ DCMN is a parallelogram. ($\because$ A quad. is a parallelogram if one pair of opp. side is equal and parallel)

Also $\angle$DNM = 90º, So DCMN is a rectangle.

$\therefore$ ar (||gm DCMN) = DC × DN

($\because$ Area of rect. = length × breadth)

But, AB = DC

($\because$ opp. sides of a parallelogram are equal)

$\therefore$ ar (||gm DCMN) = AB × DN ...(1)

Also as both the parallelograms (DCMN and ABCD) lie on the same base DC and between the same parallels DC and AM.

$\therefore$ ar (|| gm DCMN) = ar (||gm ABCD)...(2)

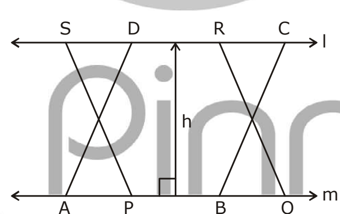
($\because$ parallelograms on same base and between same parallels are equal in area)

From equations (1) and (2), we get

ar (ABCD) = AB × DN = base

× corresponding altitude.

corollary. Parallelograms on equal base and between the same parallels are equal in area.



Proof. If ABCD adn PQRS be two parallelograms on equal base AB and PQ ann between same parallel lines l and m, and h be the perpendicular distance between l and m, then

ar (||gm ABCD) = AB × h ...(1)

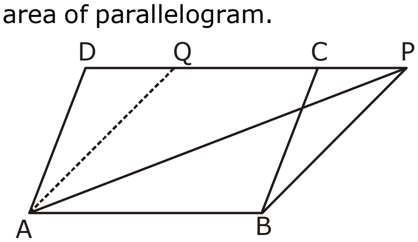
and ar (||gm PQRS) = PQ× h ...(2)

But AB = PQ (given) ...(3)

From equations (1), (2) and (3), we get

ar (ABCD) = ar (||gm PQRS)

Ex.7 If a triangle and a parallelogram lie on the same base and between the same parallel then area of triangle is equal to half of the area of parallelogram. **[NCERT]**



Sol. **Given.** ΔABP and a ||gm ABCD on same base AB and between the same parallels AB and DP.

To prove : ar (ΔABP) = $\frac{1}{2}$ar (||gm ABCD).

Construction. Through A , draw a line AQ parallel to BP intersecting DP at Q.

Proof. AB||DC ($\because$ opp. sides of a parallelogram are parallel).

$\therefore$ AB || QP

Also, AQ || BP (by construction)

$\therefore$ ABPQ is a parallelogram.

Thus ABCD and ABPQ are two parallelograms on the same base AB and between the same parallels AB and DP.

$\therefore$ ar (||gm ABCD) = are (||gm ABPQ) ...(1)

Also in parallelogram ABPQ, AP is the diagonal

$\therefore$ ar (Δ ABP) = ar (Δ AQP)

($\because$ diagonal of a parallelogram divides it into two triangles of equal area).

But ar (ABP) + ar (AQP) = ar (ABPQ)

$\Rightarrow$ ar (ABP) + ar (ABP) = ar (ABPQ)

$\Rightarrow$ 2ar (ABP) = ar (ABPQ) ...(2)

From equations (1) and (2), we get

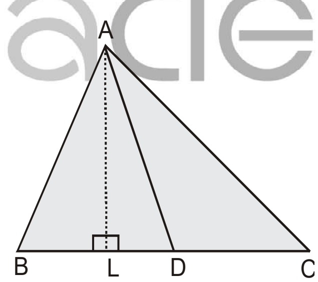
2ar (Δ ABP) = ar (||gm ABCD)

$\Rightarrow$ ar (Δ ABP) = $\frac{1}{2}$ ar (||gm ABCD)

Hence area of triangle is half the area of parallelogram.

Ex.8 Show that a median of a triangle divides it into two triangles of equal area. **[NCERT]**

Sol. **Given :** ΔABC in which AD is a median.



To prove : ar(ΔABD) = ar (ΔADC).

Construction : Draw AL $\perp$ BC.

Proof : Since AD is the median ΔABC.

Therefore, D is the mid-point of BC.

$\Rightarrow$ BD = DC

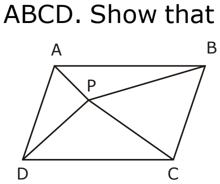
$\Rightarrow$ BD × AL = DC × AL [Multiplying both sides by AL]

$\Rightarrow$ $\frac{1}{2}$(BD × AL) = $\frac{1}{2}$(DC × AL) [Multiplying both sides by $\frac{1}{2}$]

$\Rightarrow$ ar (ΔABD) = ar (ΔADC)

Hence, proved.

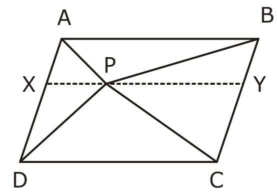
Ex.9 In the given figure, P is a point in the interior of a parallelogram ABCD. Show that **[NCERT]**



(i) ar (ΔAPB) + ar (Δ PCD) = $\frac{1}{2}$ ar (||gm ABCD)

(ii) ar (ΔAPD) + ar (ΔPBC) = ar (ΔAPB) ar (ΔPCD).

Sol. Let us draw a line through P parallel to AB which meet AD at X and BC at Y.



$\because$ AD || BC (opp. sides of a parallelogram)

$\therefore$ AX || BY

Also AB || XY (by construction)

$\therefore$ ABYX is a parallelogram.

Similarly CDXY is a parallelogram.

Now parallelogram ABYX and ΔAPB lie on the same base AB and between the same parallels AB and XY,

$\therefore$ ar (Δ APB) = $\frac{1}{2}$ ar (||gm ABYX) ...(1)

And parallelogram CDXY and ΔPDC lie on the same base DC and between the same parallels DC and XY,

$\therefore$ ar (Δ PCD) = $\frac{1}{2}$ ar (||gm CDYX) ...(2)

Adding equations (1) and (2), we get

ar (ΔAPB) + ar (Δ PCD) = $\frac{1}{2}$ ar (||gm ABYX) + $\frac{1}{2}$ ar (||gm CDXY)

ar (ΔAPB) + ar (Δ PCD) = $\frac{1}{2}$ (ar (||gm ABYX) + ar (||gm CDXY))

ar (ΔAPB) + ar (Δ PCD) = $\frac{1}{2}$ ar (||gm ABCD)

$\therefore$ ar (Δ APB) + ar (Δ PCD) = $\frac{1}{2}$ ar (||gm ABCD) ...(3)

Also, ar (ΔAPB) + ar (ΔPBC) + ar (ΔAPD) + ar (Δ PCD) = ar (||gm ABCD).

$\Rightarrow$ ar (ΔAPD) + ar (ΔPBC) + $\frac{1}{2}$ ar (||gm ABCD) = ar (||gm ABCD) (using (3))

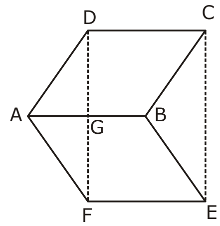
$\Rightarrow$ ar (ΔAPD) + ar (Δ PBC) = ar (||gmABCD) – $\frac{1}{2}$ ar(||gm ABCD)

$\Rightarrow$ ar (ΔAPD) + ar (ΔPBC) = $\frac{1}{2}$ ar (||gm ABCD) ...(4)

From equations (3) and (4), we get

ar (ΔAPD) + ar (ΔPBC) = ar (ΔAPB) + ar (ΔPCD).

Ex.10 ABCD and ABEF are two parallelograms on the opposite sides of AB as shown in the figure. CE and DF are joined. Prove that : (i) ar (Δ ADF) = ar (Δ BCE) (ii) ar (CDFE) = ar (||gm ABCD) + ar (||gm ABEF).



Sol. $\because$ ABCD is a parallelogram,

$\therefore$ AB||DC and AB = DC ...(1)

Also as ABEF is a parallelogram,

$\therefore$ AB||EF and AB = EF ...(2)

From equations (1) and (2), we get

DC||EF and DC = EF.

$\therefore$ DCEF is a parallelogram.

($\because$ one pair of opp. sides of a quad. are equal and parallel)

$\therefore$ DF = CE.

Now in Δ ADF and Δ BCE

AD = BC (opp. sides of a ||gm ABCD)

AF = BE (opp. sides of a ||gm ABEF)

DF = CE (proved earlier)

$\therefore$ ΔADF $\cong$ ΔBCE (SSS congruence condition)

$\therefore$ ar (ΔADF) = ar (ΔBCE) ...(3)

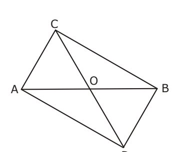
Again ar (||gm ABCD) + ar (||gn ABEF) = ar (ΔADF) + ar (||gm BCDG) + ar (||gm BGFE)

ar (||gm ABCD) + ar (||gn ABEF) = ar (ΔBCE) + ar (||gm BCDG) + ar (||gm BGFE)

ar (||gm ABCD) + ar (||gn ABEF) = = ar (||gm CDFE) (using eqn. (3)

Hence ar (||gm CDFE) = ar (||gm ABCD) + ar (||gm ABEF).

Ex.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 (ΔABC) = ar (ΔABD).



Sol. Given that AB bisects CD, i.e., O is the mid point of CD. Now in ΔADC, AO is the median.

$\therefore$ ar (ΔACO) = ar (ΔADO) .....(1)

($\because$ median of a triangle divides it into two triangles of equal area)

Also in ΔBCD, BO is the median,

$\therefore$ ar (ΔBCO) = ar (ΔBDO) .....(2)

($\because$ median of a triangle divides it into two triangles of equal area)

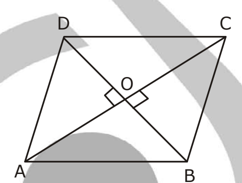
Adding equations (1) and (2) we get

ar (ΔACO) + ar (ΔBCO) = ar (ΔADO) + ar (ΔBDO)

$\Rightarrow$ ar (ΔABC) = ar (ΔABD).

Ex.12 Prove that area of a rhombus is equal to the half of the product of its diagonals.

Sol. Let ABCD be a rhombus. Let its diagonals AC and BD intersect each other at O.



We know that diagonals of a rhombus bisect each other at 90º.

$\therefore$ DO is altitude of ΔADC and BO is the altitude of ΔABC.

Now ar (ΔABC) = $\frac{1}{2}$ × AC × OB ...(1)

and ar (ΔADC) = $\frac{1}{2}$ × AC × OD ...(2)

($\because$ area of triangle = $\frac{1}{2}$ × base×altitude)

Adding equations (1) and (2) we get

ar (ΔABC) + ar (ΔADC) = $\frac{1}{2}$ × AC ×OB + $\frac{1}{2}$ × AC ×OD

$\Rightarrow$ ar (||gm ABCD) = $\frac{1}{2}$ × AC (OB × OD)

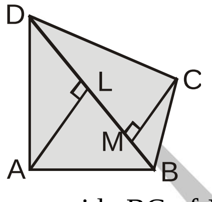
$\Rightarrow$ ar (||gm ABCD) = $\frac{1}{2}$ × AC × BD

or area of rhombus = $\frac{1}{2}$ × (product of diagonals).

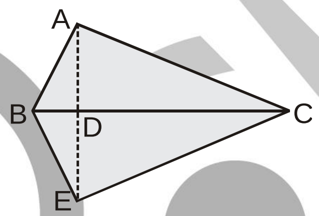
EXERCISE – 1

- **Area of parallelogram and triangle:**

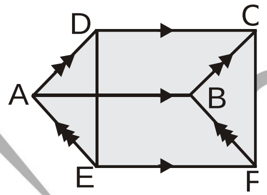
1. ABCD is a parallelogram. Diagonals AC and BD intersect each other at O. A line through O is drawn which meets AB at P and DC at Q. Prove that : ar (OAQ) = ar(OCP).
2. ABCD is a quadrilateral. If AL $\perp$ BD and CM $\perp$ BD, prove that: ar (quad. ABCD) = $\frac{1}{2} \times$ BD $\times$ (AL + CM).



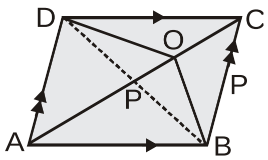
3. In the given figure, a point D is taken on side BC of DABC and AD is produced to E, making DE = AD. Show that : ar (ΔBEC) = ar (ΔABC).



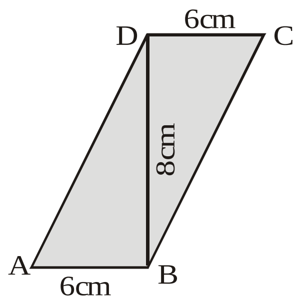
4. The diagonals AC and BD of a parallelogram ABCD intersect each other at a point O. Through O, a line is drawn to intersect AD and BC at points x and y respectively. Show that xy divides the parallelogram into two parts of equal area.
5. Show that the area of rhombus is half the product of the lengths of its diagonals.
6. In the adjoining figure, two parallelograms ABCD and AEFB are drawn on opposite sides of AB. Prove that: ar (|| gm ABCD) + ar (|| gm AEFB) = ar (|| gm EFCD).



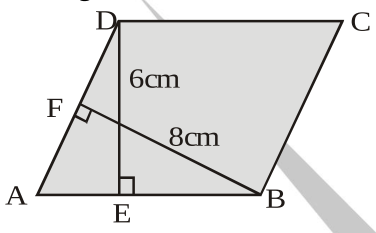
7. In the adjoining figure, ABCD is a parallelogram and O is any point on its diagonal AC. Show that : ar (ΔAOB) = ar (ΔAOD).



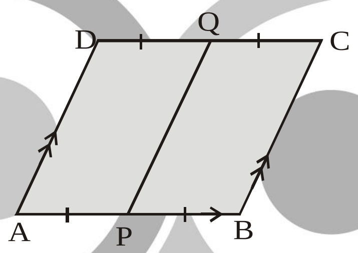
8. In the adjoining figure, BD is a diagonal of quad. ABCD. Show that ABCD is a parallelogram and calculate the area of || gm ABCD.



9. In a || gm ABCD, it is given that AB = 16 cm and the altitudes corresponding to the sides AB and AD are 6 cm and 8 cm respectively. Find the length of AD.



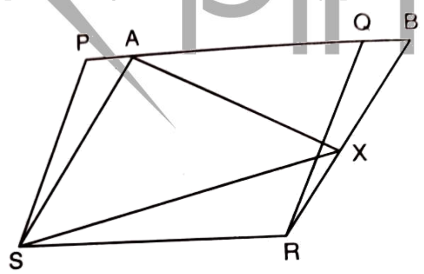
10. Show that the line segment joining the mid-points of a pair of opposite sides of a parallelogram, divides it into two equal parallelograms.



11. Show that the segment joining the mid-points of a pair of opposite sides of a parallelogram divides it into two equal parallelograms.

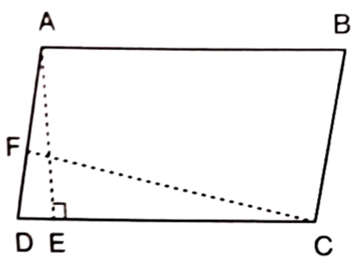
12. If E, F, G and H are respectively the mid-points of the sides of a parallelogram ABCD, show that ar (EFGH) = $\frac{1}{2}$ ar (ABCD).

13. In Fig. PQRS and ABRS are parallelograms and X is any point on side BR. Show that



(i) ar ($||^{gm}$ PQRS) = ar(||gm ABRS) (ii) ar ΔAXS = $\frac{1}{2}$ ar ($||^{gm}$ PQRS)

14. If fig., ABCD is a parallelogram, AE $\perp$ DC and CF $\perp$ AD. If AB = 16 cm, AE = 8 cm and CF = 10 cm, find AD.

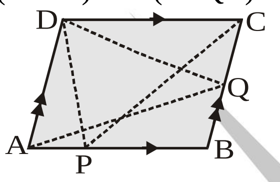


15. Let ABCD be a parallelogram of area 124 cm^2. If E and F are the mid-points of sides AB and CD respectively, then find the area of parallelogram AEFD.
16. If ABCD is a parallelogram, then prove that

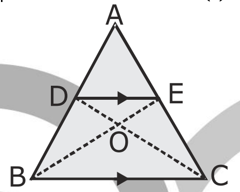
    ar (ΔABD) = ar (ΔBCD) = ar (ΔABC) = ar (ΔACD = $\frac{1}{2}$ ar ($||^{gm}$ ABCD)

- ## **Triangles and parallelograms with the same base and between same parallels:**

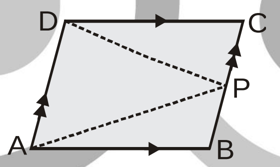
17. In the adjoining figure, ABCD is a parallelogram. P and Q are any two points on the sides AB and BC respectively. Prove that : ar (ΔCPD) = ar (ΔAQD)



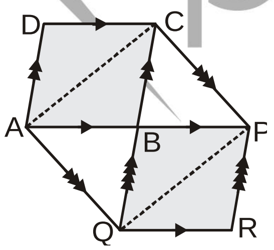
18. In the adjoining figure, DE || BC. Prove that: (i) ar (ΔABE) = ar (ΔACD). (ii) ar (ΔOBD) = ar (ΔOCE).



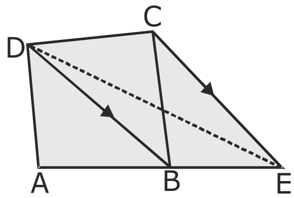
19. In the given figure, ABCD is a parallelogram and P is a point on BC. Prove that : ar (ΔABP) + ar (ΔDPC) = ar (ΔAPD).



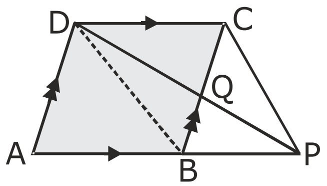
20. ABCD is a quadrilateral. A line through D, parallel to AC meets BC produced in P. Prove that area of ΔABP = area of quadrilateral ABCD.
21. In the given figure, the side AB of ||gm ABCD is produced to a point P. A line through A drawn parallel to CP meets CB produced in Q and the parallelogram PBQR is completed. Prove that: ar (|| gm ABCD) = ar (|| gm BPRQ).



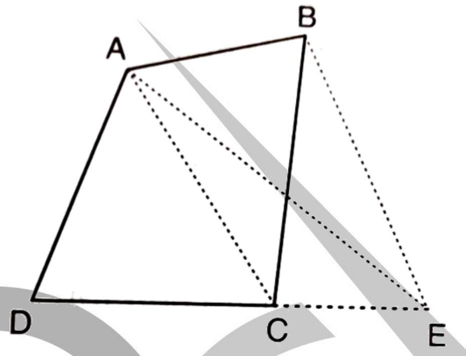
22. In the adjoining figure, CE is drawn parallel to DB to meet AB produced at E. Prove that: ar (quad. ABCD) = ar (ΔDAE).



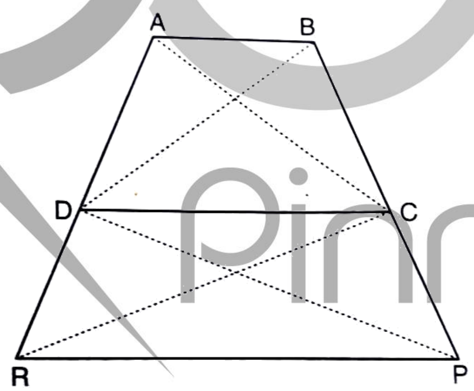
23. In the adjoining figure, ABCD is a parallelogram. AB is produced to a point P and DP intersects BC at Q. Prove that: ar (ΔAPD) = ar (quad. BPCD).



24. P is any point on diagonal BD of parallelogram ABCD, prove that ar(ΔABP) = ar(ΔBCP).
25. AD is one of the medians of a ΔABC. X is any point on AD. Show that ar (ΔABX) = ar (ΔACX).
26. In fig., ABCD is a quadrilateral and BE || AC and also BE meets DC produced at E. show that area of ΔADE is equal to the area of the quadrilateral ABCD.



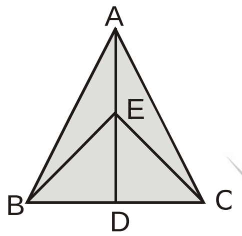
27. The diagonals of quadrilateral ABCD, AC and BD intersect in O. prove that if BO = OD, the triangles ABC and ADC are equal in area.
28. If each diagonal of a quadrilateral separates it into two triangles of equal area than show that the quadrilateral is a parallelogram.
29. In Fig., ar(ΔDRC) = ar (ΔDPC) and ar (ΔBDP) = (ΔARC). Show that both the quadrilaterals ABCD and DCPR are trapeziums.



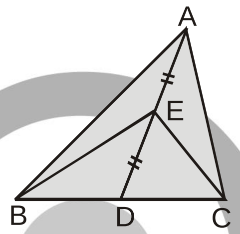
30. A quadrilateral ABCD is such that diagonal BD divides its area in two equal parts. Prove that BD bisects AC.

EXERCISE – 2

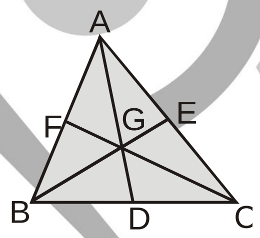
1. In the given figure, D is the mid-point of BC and E is any point on AD. Prove that:
(i) ar (ΔEBD) = ar (ΔEDC), (ii) ar (ΔABE) = ar (ΔACE)



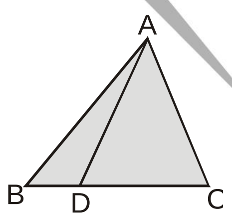
2. In the given figure, D is the mid-point of BC and E is the, mid-point of AD.
Prove that : ar (ΔABE) = $\frac{1}{4}$ ar (ΔABC).



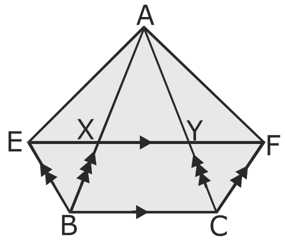
3. If the medians of a ΔABC intersect at G, show that: ar (ΔAGB) = ar (ΔAGC) = ar (ΔBGC) = $\frac{1}{3}$ ar (ΔABC).



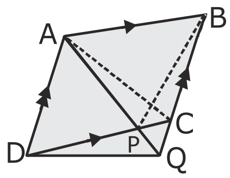
4. D is a point on base BC of a ΔABC such that 2BD = DC. Prove that: ar (ΔABD) = $\frac{1}{3}$ ar (ΔABC).



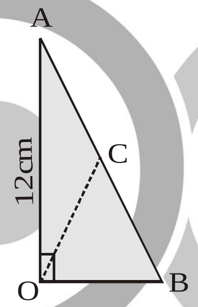
5. D, E, F are respectively the mid points of sides BC, CA and AB of ΔABC. O is any point on AD. Prove that : ar(ΔBOF) = ar(ΔCOE)
6. In the given figure, XY||BC, BE||CA and FC||AB. Prove that : ar (ΔABE) = ar (ΔACF).



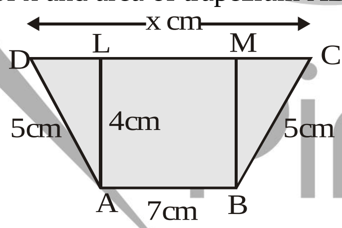
7. In the adjoining figure, ABCD is a parallelogram. Any line through A cuts DC at a point P and BC produced at Q. Prove that: ar (ΔBPC) = ar (ΔDPQ).



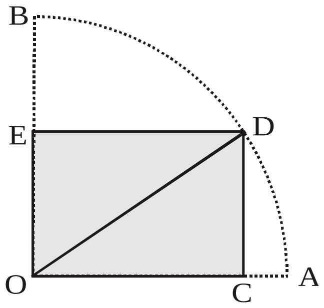
8. Median AD of DABC is produced till E such that AD = DE. Prove that AC || BE.
9. Answer the following questions as per the exact requirement:
   (i) ABCD is a parallelogram in which AB||CD and AB = CD = 10 cm. If the perpendicular distance between AB and CD be 8 cm, find the area of the parallelogram ABCD.
   (ii) ABCD is a parallelogram having area 240 cm^2, BC = AD = 20 cm and BC||AD. Find the distance between the parallel sides BC and AD.
   (iii) ABCD is a parallelogram having area 160 cm^2, BC||AD and the perpendicular distance between BC and AD is 10 cm. Find the length of the side BC.
   (iv) ABCD is a parallelogram having area 200 cm^2. If AB||CD, P is mid-point of AB and Q is mid-point of CD, find the area of the quadrilateral APQD.
   (v) ABCD is a parallelogram having area 450 cm^2. If AB||CD, points P and Q divide AB and DC respectively in the ratio 1 : 2, find the area of the parallelogram APQD and parallelogram PBCQ.
10. In fig, $\angle$ AOB = 90°, AC = BC, OA = 12 cm and OC = 6.5 cm. Find the area of ΔAOB.



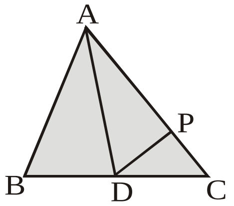
11. In fig, ABCD is a trapezium in which AB = 7 cm, AD = BC = 5 cm, DC = x cm, and distance between AB and DC is 4 cm. Find the value of x and area of trapezium ABCD.



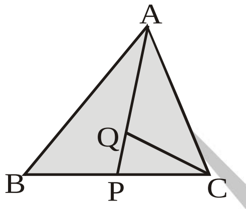
12. In fig, OCDE is a rectangle inscribed in a quadrant of a circle of radius 10 cm. If OE = $2\sqrt{5}$, find the area of the rectangle.



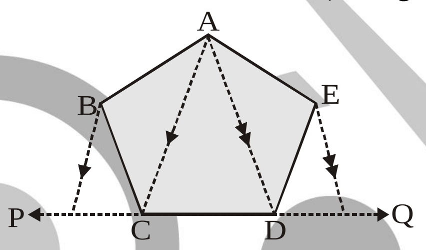
13. In the given figure, AD is a median of ΔABC and P is a point on AC such that :
    ar (ΔADP) : ar (ΔABD) = 2 : 3.
    Find: (i) AP : PC (ii) ar (ΔPDC) : ar (ΔABC).



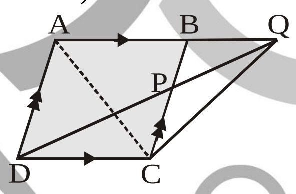
14. In the given figure, P is a point on side BC of ΔABC such that BP : PC = 1 : 2 and Q is a point on AP such that PQ : QA = 2 : 3. Show that ar (ΔAQC) : ar (ΔABC) = 2 : 5.



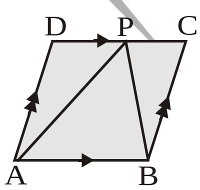
15. In the adjoining figure, ABCDE is a pentagon. BP drawn parallel to AC meets DC produced at P and EQ drawn parallel to AD meets CD produced at Q. Prove that : ar (Pentagon ABCDE) = ar (ΔAPQ).



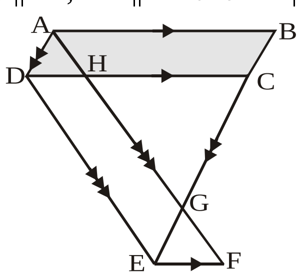
16. In the adjoining figure, ABCD is a parallelogram. P is a point on BC such that BP : PC = 1 : 2. DP produced meets AB produced at Q. Given ar (ΔCPQ) = 20 cm^2. Calculate :
(i) ar (ΔCDP) (ii) ar (|| gm ABCD).



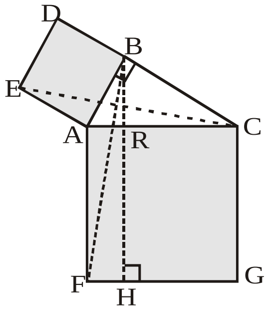
17. In the adjoining figure, ABCD is a parallelogram. P is a point on DC such that ar (ΔAPD) = 25 cm^2 and ar (ΔBPC) = 15 cm^2. Calculate :
(i) ar (|| gm ABCD) (ii) DP : PC.



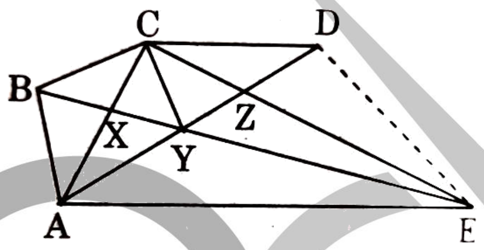
18. In the given figure, AB || DC || EF, AD || BE and DE || AF. Prove that : ar (|| gm DEFH) = ar (|| gm ABCD).



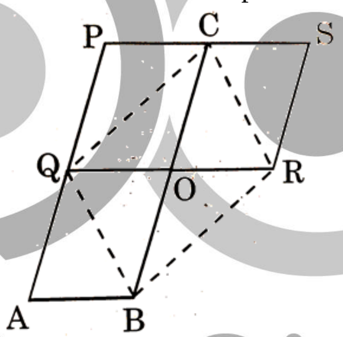
19. In the given figure, squares ABDE and AFGC are drawn on the side AB and hypotenuse AC of right triangle ABC and BH $\perp$ FG. Prove that: (i) $\Delta EAC \cong \Delta BAF$. (ii) ar (sq. ABDE) = ar (rect. ARHF).



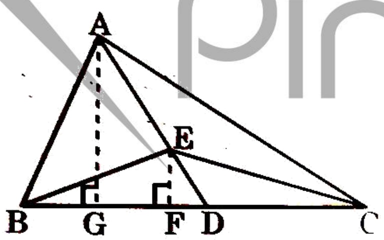
20. In figure CD || AE and CY ||BA.
    (i) name a triangle equal in area of ΔCBX
    (ii) prove that ar(ΔZDE) = ar(ΔCZA)
    (iii) prove that ar (BCZY) = ar(ΔEDZ)



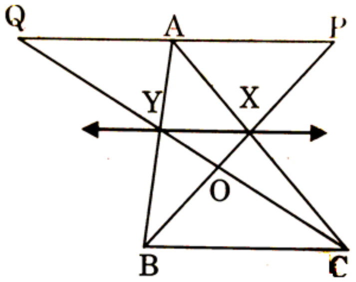
21. In the adjoining figure, PQRS and PABC are two parallelograms of equal area. Prove that QC||BR.



22. In figure, E is any point on median AD of a ΔABC. Show that ar (ΔABE) = ar(ΔACE).

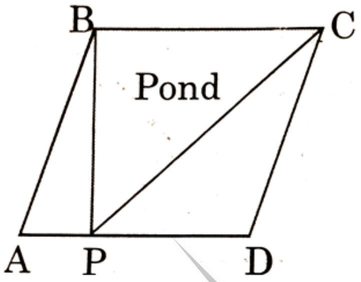


23. In fig., X and Y ar the mid-points of AC and AB respectively, QP||BC and CYQ and BXP are straight lines. Prove that ar(ΔABP) = ar(ΔACQ).



24. Prove that the area of an equilateral triangle is equal to $\frac{\sqrt{3}}{4}a^2$, where a is the side of the triangle.

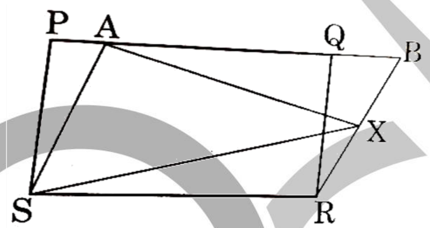
25. There was a deserted land near a colony where people used to throw garbage. Colony people united to develop a pond in triangular shape as shown in the fig. The land is in the shape of || gm ABCD. In rest of the portion medicinal plants were grown. If area of parallelogram ABCD is 200 m^2



(i) Calculate the area where medicinal plants were grown.

(ii) Which value is depicted here?

26. In the fig., PQRS and ABRS are parallelograms and X is any point on side BR. Prove that:

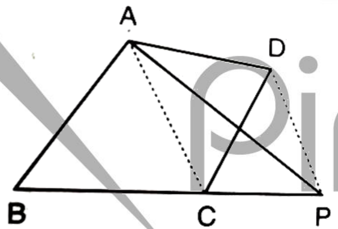


(i) ar(|| gm PQRS) = ar(|| gm ABRS)

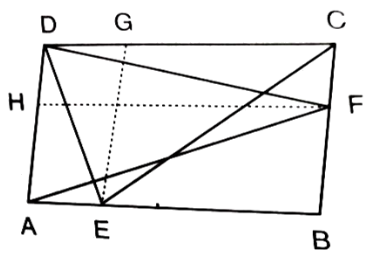
(ii) ar(ΔAXS) = $\frac{1}{2}$ ar(||gmPQRS)

27. Diagonals AC and BD of a quadrilateral ABCD intersect each other at P. show that: ar (ΔAPB) × ar (ΔCPD) = ar (ΔAPD) × ar (ΔBPC)

28. ABCD is a quadrilateral. A line through D, parallel to AC, meets BC produced in P as show in fig., prove that ar (ΔABP) = ar (quad. ABCD).



29. In a parallelogram ABCD, E, F are any two points on the sides AB and BC respectively. Show that ar (ΔADF) = ar (ΔDCE).



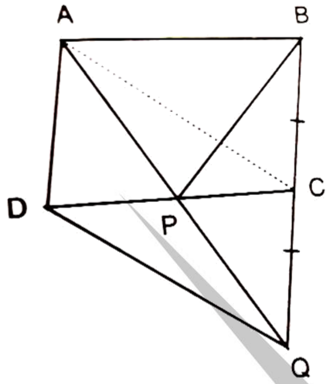
30. ABCD is parallelogram and O is any point in its interior. Prove that:

(i) ar (ΔAOB) + ar (ΔCOD) = ar (ΔBOC) + ar (ΔAOD)

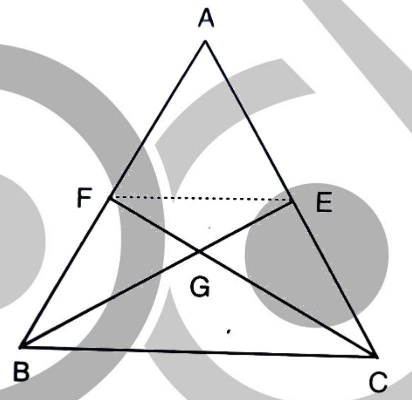
(ii) ar (AOB) + ar Δ(COD) = $\frac{1}{2}$ ar ($||^{gm}$ ABCD)

31. In ΔABC, D is the mid point of AB. P is any point of BC. CQ || PD meets AB in Q. show that ar (ΔBPQ) = $\frac{1}{2}$ ar (ΔABC)

32. In fig., ABCD is parallelogram. Prove that: ar (ΔBCP) = ar (ΔDPQ)



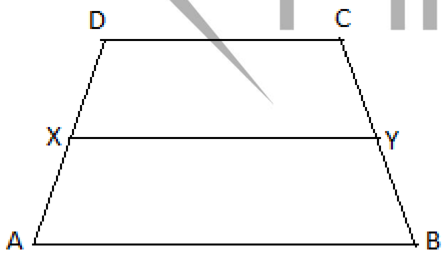
33. The medinas BE and CF of a triangle ABC intersect at G. Prove that area of ΔGBC = area of quadrilateral AFGE.



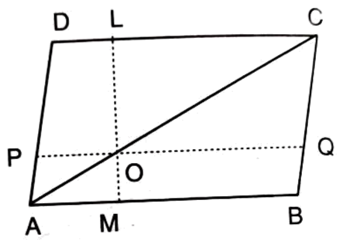
34. In fig., ABCD is a trapezium in which AB||DC and DC = 40 cm and AB = 60 cm. If x and y are, respectively, the mid-points of AD and BC, prove that

(i) XY = 50 cm (ii) DCYX is a trapezium

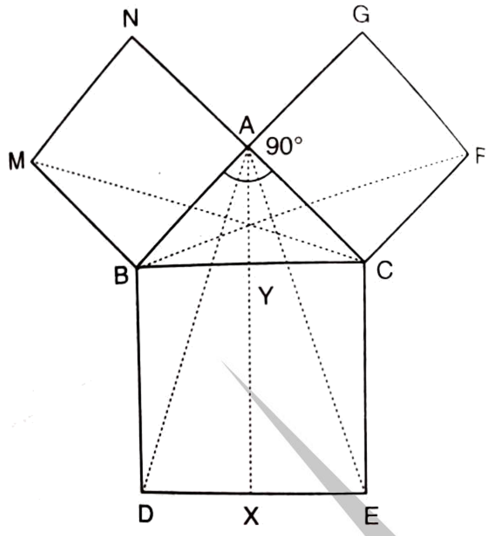
(ii) ar (trap. DCYX) = $\frac{9}{11}$ ar (trap. (XYBA)



35. In fig., ABCD is a $||^{g,m}$, O is any point on AC. PQ || AB and LM || AD. Prove that ar ($||^{gm}$ DLOP) = ar($||^{gm}$ BMOQ)



36. If fig., 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 $\perp$ DE meets BC at Y. show that:

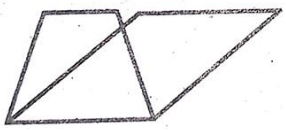


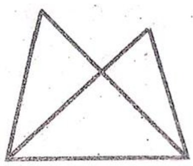
(i) $\Delta MBC \cong \Delta ABD$ (ii) ar (BYXD) = 2 ar (ΔMBC)

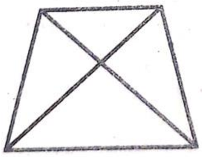
(iii) ar (BYXD) = ar (ABMN) (iv) $\Delta FCB \cong \Delta ACE$

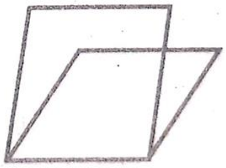
EXERCISE – 3

1. Out of the following given figures, which are on the same base and between the same parallels:

(a) 

(b) 

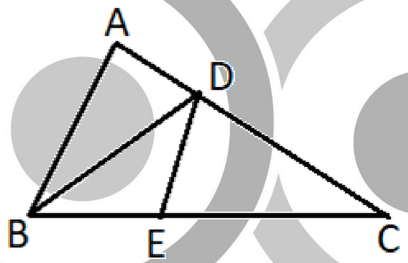
(c) 

(d) 

2. In a triangle ABC, medians AD, BE and CF intersect at G, then ar (ΔACG) is equal to:

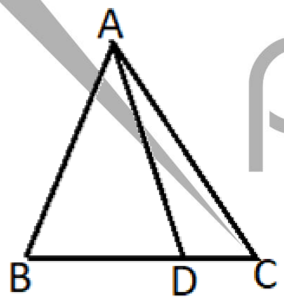
(a) Ar(ΔABG) (b) $\frac{1}{2}$ ar (ΔABC) (c) ar(ΔBCG) (d) Both (a) and (c)

3. In the figure, D and E are the mid – points of sides AC and BC respectively of ΔABC. If ar(ΔBED) = 12 cm², then ar(ΔAEC) =



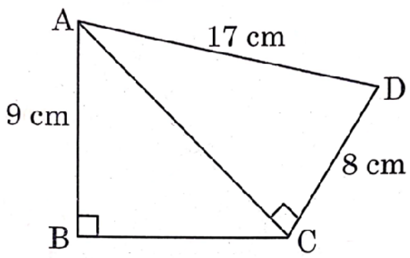
(a) 48 cm² (b) 24 cm² (c) 36 cm² (d) None of these

4. In ΔABC, if AD divides BC in the ratio m : n then area of ΔABD : area of ΔABC is:



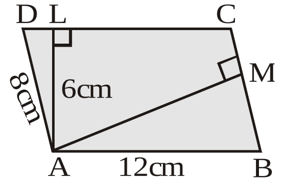
(a) m : n (b) (m + 1) : n (c) m : (n + m) (d) n : m

5. The area of trapezium ABCD in the given figure is:



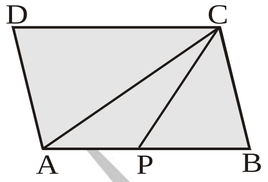
(a) 57 cm² (b) 108 cm² (c) 114 cm² (d) 195 cm²

6. In fig, ABCD is a parallelogram, AL ⊥ CD and AM ⊥ BC. If AB = 12 cm, AD = 8 cm and AL = 6 cm, then AM =



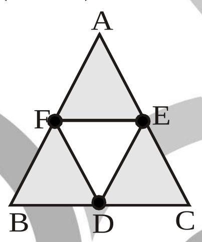
(a) 15 cm (b) 9 cm (c) 10 cm (d) None of these

7. In fig, ABCD is a parallelogram and P is mid-point of AB. If ar (APCD) = 36 cm^2, then ar (DABC) =



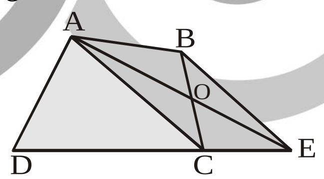
(a) 36 cm^2 (b) 48 cm^2 (c) 24 cm^2 (d) None of these

8. In fig, if (ΔABC) = 28 cm^2, then ar (AEDF) =



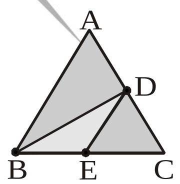
(a) 21 cm^2 (b) 18 cm^2 (c) 16 cm^2 (d) None of these

9. In fig, ABCD is a quadrilateral. BEAC. BE meets DC (produced) at E. AE and BC intersect at O. Which one is the correct answer from the following?



(a) ABEC is a parallelogram (b) ar (ΔAOC) = ar (ΔBOE)
(c) ar (ΔOAB) = ar (ΔOCE) (d) ar (ΔABE) = ar (ΔACE)

10. In fig, D and E are the mid-points of the sides AC and BC respectively of ΔABC. If ar (ΔBED) = 12 cm^2. then ar (ABED) =



(a) 36 cm^2 (b) 48 cm^2 (c) 24 cm^2 (d) None of these

11. Two parallelograms stand on equal bases and between the same parallels. The ratio of their areas is
(a) 1 : 2 (b) 2 : 1 (c) 1 : 1 (d) 1 : 3

12. If a rectangle and a parallelogram are equal in area and have the same base and are situated on the same side, then the quotient : $\frac{Perimeter\ of\ rectangle}{Perimeter\ of\ ||\ gm}$ is
(a) Equal to 1 (b) Greater than 1 (c) Less than 1 (d) Indeterminate

13. If ABCD is a rectangle, E, F are the mid points of BC and AD respectively and G is any point on EF, then ΔGAB equals.

(a) $\frac{1}{2}(\square ABCD)$ (b) $\frac{1}{3}(\square ABCD)$ (c) $\frac{1}{4}(\square ABCD)$ (d) $\frac{1}{6}(\square ABCD)$

14. D,E,F are mid points of the sides BC, CA & AB respectively of ΔABC, then area of || gm BDEF is equal to
(a) $\frac{1}{2}$ ar (ΔABC) (b) $\frac{1}{4}$ ar (ΔABC) (c) $\frac{1}{3}$ ar (ΔABC) (d) $\frac{1}{6}$ ar (ΔABC)

15. ABCD is a quadrilateral P,Q,R and S are the mid-points of AB, BC, CD and DA respectively, then PQRS is a
(a) Square (b) Parallelogram (c) Trapezium (d) Kite

16. Two parallelograms are on the same base and between the same parallels. The ratio of their areas is
(a) 2 : 1 (b) 1 : 2 (c) 1 : 1 (d) 3 : 1

17. ABCD is a parallelogram and 'O' is the point of intersection of its diagonals $\overline{AC}$ and $\overline{BD}$. If the area of ΔAOD = 8 cm^2 the area of the parallelogram is
(a) 2 cm^2 (b) 4 cm^2 (c) 16 cm^2 (d) 32 cm^2

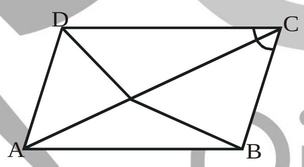
18. A triangle and a rhombus are on the same base and between the same parallels. Then the ratio of the areas of the triangle and the rhombus is
(a) 1 : 1 (b) 1 : 2 (c) 1 : 3 (d) 1 : 4

19. The area of a trapezium is 24 cm^2. The distance between its parallel sides is 4 cm If one of the parallel sides is 7 cm, the other parallel side is
(a) 5 cm (b) 8 cm (c) 12 cm (d) 7 cm

20. The area of a square is 16 cm^2. Its perimeter is
(a) 4 cm (b) 8 cm (c) 112 cm (d) 16 cm

21. The ratio of the areas of two squares is 4 : 9. The ratio of their perimeters in the same order is
(a) 3 : 2 (b) 2 : 3 (c) 9 : 4 (d) 4 : 9

22. In the given figure, P is a point in the interior of parallelogram ABCD. If the area of parallelogram ABCD is 60 cm^2, then area of ΔADP + area of ΔBPC =



(a) 15 cm^2 (b) 30 cm^2 (c) 45 cm^2 (d) 20 cm^2

23. A parallelogram and a rectangle are on the same base and between the same parallel lines. Then the perimeter of the rectangle is
(a) Equal to the perimeter of the parallelogram
(b) Greater than the perimeter of the parallelogram
(c) Less than the perimeter of the parallelogram
(d) None of these

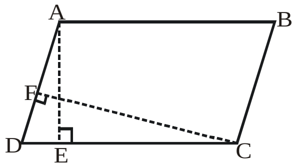
24. The area of a rhombus is 220 cm^2. If one of its diagonals is 5 cm, the other diagonal is
(a) 4 cm (b) 8 cm (c) 10 cm (d) 16 cm

25. If E, F,G and H are respectively the mid-points of the sides of a parallelogram ABCD, then ar(EFGH) is equal to
(a) ar(ABCD) (b) 2 × ar(ABCD) (c) $\frac{1}{2}$ × ar(ABCD) (d) None of these

26. In a ΔABC, E is the mid-point of median AD, then ar(ΔABC) is equal to
(a) 2 × ar(ΔBED) (b) 3 × ar(ΔBED) (c) 4 × ar(ΔBED) (d) None of these

27. In a parallelogram ABCD, AB = 12 cm. The altitudes corresponding to the sides AB and AD are respectively 8 cm and 6 cm, then AD is equal to
(a) 6 cm (b) 12 cm (c) 16 cm (d) 15 cm

28. In figure, AD = 6 cm, CF = 10 cm and AE = 8 cm, then AB is



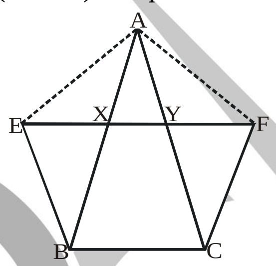
(a) 8 cm (b) 6.5 cm (c) 7.5 cm (d) 9 cm

29. If BD is one of the diagonals of a quadrilateral ABCD. AM and CN are the perpendiculars from A and C respectively on BD, then ar(ABCD) is equal to

(a) BD × (AM + CN) (b) $\frac{1}{2}$ BD × (AM + CN)

(c) 2BD × (AM + CN) (d) None of these

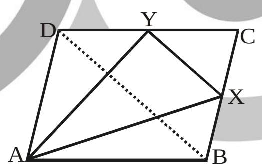
30. In figure, XY is a line parallelogram to the side BC and DABC, BE || AC and CF || AB meet XY in E and F respectively. Also EX = FY, then ar(ΔABE) is equal to



(a) ar(ΔABC) (b) ar(ΔACF)

(c) ar(ΔXEB) + ar(ΔYFC) (d) None of these

31. ABCD is a parallelogram X and Y are the mid points of BC and CD respectively. Then, ar(parallelogram ABCD) is



(a) 4 × ar(ΔAXY) (b) 2 × ar(ΔAXY)

(c) $\frac{8}{3}$ × ar(ΔAXY) (d) None of these

32. Two parallelograms are on the same base and between the same parallels. The ratio of their areas is
(a) 2 : 1 (b) 1 : 2 (c) 1 : 1 (d) 3 : 1

33. ABCD is a parallelogram and 'O' is the point of intersection of its diagonals $\overline{AC}$ and $\overline{BD}$. If the area of ΔAOD = 8 cm^2 the area of the parallelogram is
(a) 2 cm^2 (b) 4 cm^2 (c) 16 cm^2 (d) 32 cm^2

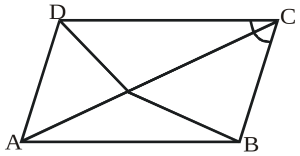
34. A triangle and a rhombus are on the same base and between the same parallels. Then the ratio of the areas of the triangle and the rhombus is
(a) 1 : 1 (b) 1 : 2 (c) 1 : 3 (d) 1 : 4

35. The area of a trepezium is 24 cm^2. The distance between its parallel sides is 4 cm If one of the parallel sides is 7 cm, the other parallel side is
(a) 5 cm (b) 8 cm (c) 12 cm (d) 7 cm

36. The area of a square is 16 cm^2. Its perimeter is
(a) 4 cm (b) 8 cm (c) 112 cm (d) 16 cm

37. The ratio of the areas of two squares is 4 : 9. The ratio of their perimeters in the same order is
(a) 3 : 2 (b) 2 : 3 (c) 9 : 4 (d) 4 : 9

38. In the given figure, P is a point in the interior of parallelogram ABCD. If the area of parallelogram ABCD is 60 cm^2, then area of ΔADP + area of ΔBPC =



(a) 15 cm^2 (b) 30 cm^2 (c) 45 cm^2 (d) 20 cm^2

39. The area of a rhombus is 220 cm^2. If one of its diagonals is 5 cm, the other diagonal is
(a) 4 cm (b) 8 cm (c) 10 cm (d) 16 cm

40. A parallelogram and a rectangle are on the same base and between the same parallel lines. Then the perimeter of the rectangle is
(a) Equal to the perimeter of the parallelogram
(b) Greater than the perimeter of the parallelogram
(c) Less than the perimeter of the parallelogram
(d) None of these

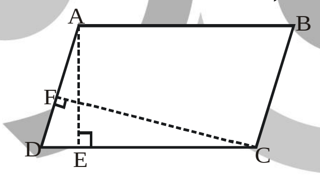
41. The diagonal of a square is 8 cm. Its area is
(a) 4 cm^2 (b) 16 cm^2 (c) 24 cm^2 (d) 32 cm^2

42. If E, F,G and H are respectively the mid-points of the sides of a parallelogram ABCD, then ar(EFGH) is equal to
(a) ar(ABCD) (b) 2 × ar(ABCD) (c) $\frac{1}{2}$ × ar(ABCD) (d) None of these

43. In a ΔABC, E is the mid-point of median AD, then ar(ΔABC) is equal to
(a) 2 × ar(ΔBED) (b) 3 × ar(ΔBED) (c) 4 × ar(ΔBED) (d) None of these

44. In a parallelogram ABCD, AB = 12 cm. The altitudes corresponding to the sides AB and AD are respectively 8 cm and 6 cm, then AD is equal to
(a) 6 cm (B) 12 cm (c) 16 cm (d) 15 cm

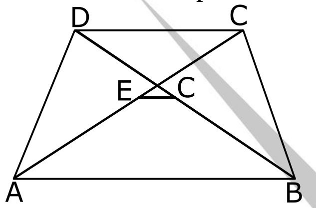
45. In figure, AD = 6 cm, CF = 10 cm and AE = 8 cm, then AB is



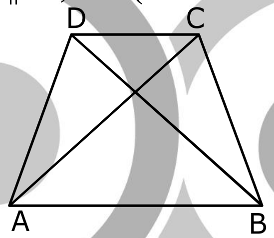
(a) 8 cm (B) 6.5 cm (c) 7.5 cm (d) 9 cm

EXERCISE – 4

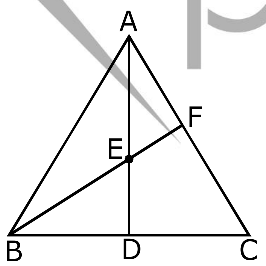
1. If BD is one of the diagonals of a quadrilateral ABCD. AM and CN are the perpendiculars from A and C respectively on BD, then ar(ABCD) is equal to
   (a) BD × (AM + CN)
   (b) $\frac{1}{2}$ BD × (AM + CN)
   (c) 2BD × (AM + CN)
   (d) None of these
2. In a trapezium ABCD, if E and F be the mid-points of the diagonals AC and BD respectively. Then, EF = ?



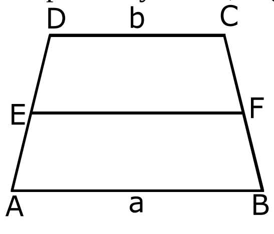
   (a) $\frac{1}{2}$ AB (b) $\frac{1}{2}$ CD (c) $\frac{1}{2}$ (AB + CD) (d) ($\frac{1}{2}$ AB – CD)
3. In a trapezium ABCD, if AB||CD, then ($AC^2 + BD^2$) = ?



   (a) $BC^2 + AD^2 + 2BC.AD$
   (b) $AB^2 + CD^2 + 2AB.CD$
   (c) $AB^2 + CD^2 + 2AD.BC$
   (d) $BC^2 + AD^2 + 2AB.CD$
4. In the given figure, AD is a median of ΔABC and E is the mid-point of AD. If BE is joined and produced to meet AC in F, then AF =?



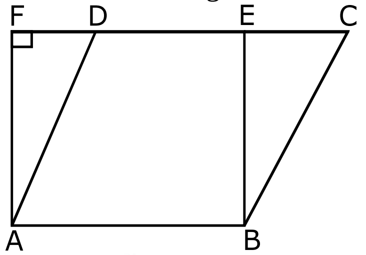
   (a) $\frac{1}{2}$ AC (B) $\frac{1}{3}$ AC (c) $\frac{2}{3}$ AC (d) $\frac{3}{4}$ AC
5. In the given figure ABCD is a trapezium in which AB||DC such that AB = a cm and DC = b cm. If E and F are the midpoints of AD and BC respectively. Then, ar(ABFE) : ar(EFCD) = ?



   (a) a : b
   (b) (a + 3b) : (3a + b)

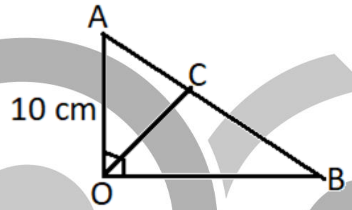
(c) (3a + b) : (a + 3b)
(d) (2a + b) : (3a + b)

6. In the given figure, a ||gm ABCD and a rectangle ABEF are of equal area. Then,



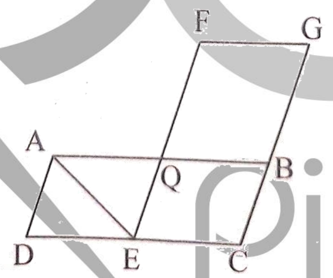
(a) perimeter of ABCD = perimeter of ABEF
(b) perimeter of ABCD < perimeter of ABEF
(c) perimeter of ABCD > perimeter of ABEF
(d) perimeter of ABCD = $\frac{1}{2}$(perimeter of ABEF)

7. In the adjoining figure, <AOB = 90°, AC = BC, OA = 10 cm and OC = 13 cm. The area of ΔAOB is:



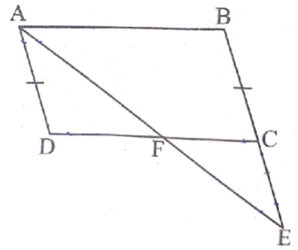
(a) 120 cm² (b) 135 cm² (c) 140 cm² (d) 148 cm²

8. In figure ABCD and FECG are parallelogram equal in area. If ar(ΔAQE) = 12 cm², then ar. ($||^{gm}$FGBQ) is equal to:



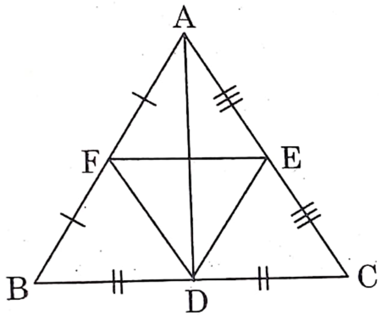
(a) 12 cm² (b) 20 cm² (c) 24 cm² (d) 36 cm²

9. ABCD is a parallelogram in which BC in produced to E such that CE = BC. AE intersects CD at F. If area of ΔDFA id 3 cm², then find the area of paralleogram ABCD.



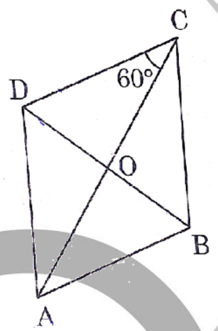
(a) 6 cm² (b) 12 cm² (c) 9 cm² (d) 18 cm²

10. In figure, if ar(ΔABC) = 28 cm², then find ar($||^{gm}$ AEDF).



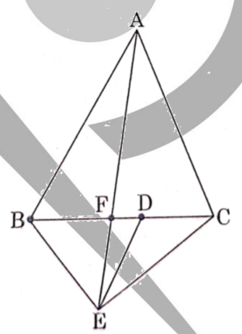
(a) 21 cm² (b) 18 cm² (c) 16 cm² (d) 14 cm²

11. ABCD is a rhombus in which <ACD = 60°. Then, AD : BD = ?



(a) $1 : \sqrt{3}$ (b) $\sqrt{3} : \sqrt{2}$ (c) 3 : 1 (d) 3 : 2

12. In the given figure (nor drawn to scale). ΔABC and ΔBDE are two equilateral triangles such that BD = CD and AE intersects BC at F. Then match the columns.



Column – I	Column – II
(i) Area (ΔBDE) =	(p) 2 × Area (ΔFED)
(ii) Area (ΔFED) =	(q) $\frac{1}{4}$ × Area (ΔABC)
(iii) Area (ΔBFE) =	(r) $\frac{1}{8}$ × Area (ΔAFC)

(a) (i) → (r), (ii) → (p), (iii) → (q) (b) (i) → (r), (ii) → (q), (iii) → (p)
(c) (i) → (q), (ii) → (p), (iii) → (r) (d) (i) → (q), (ii) → (r), (iii) → (p)

13. State True (T) or False (F).

(P) In a ΔABC, if E is the mid – point of median AD, then ar (ΔBED) = $\frac{1}{8}$ ×Area (ΔAFC)

(Q) A parallelogram and a rectangle on the same base and between the same parallels are equal in area

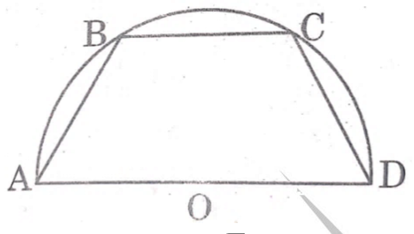
(R) If a triangle and a parallelogram are on the same base and between the same base parallels, then the ratio of the area of parallels, then the ratio of the area of the triangle to the area of the parallelogram is 1: 2

(S) In a trapezium ABCD, it is given the AB || DC and the diagonals AC and BD intersect at O. Then, ar (ΔAOB) ar (ΔCOD)

	(P)	(Q)	(R)	(S)
(a)	F	T	F	T
(b)	T	F	F	T

(c) T F T F
(d) F T T F

14. In the figure, the semicircle centered at Q has a diameter 6 cm. The chord BC parallel to AD and BC = $\frac{1}{3}$ AD. The area of the trapezium ABCD in cm², is –

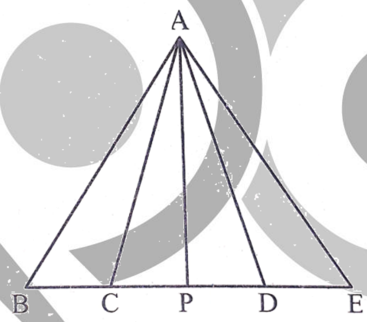


(a) 4 (b) $4\sqrt{2}$ (c) 8 (d) $8\sqrt{2}$

15. In parallelogram ABCD, let AM be the altitude corresponding to the base BC and CN the altitude corresponding to the base AB. If AB = 10 cm, AM = 6 cm and CN = 12 cm, then BC = ______cm,
(a) 20 (b) 10 (c) 12 (d) 5

16. In triangle ABC, segment AD, segment BE and segment CF are altitudes. If AB X AC = 172. 8 cm² and BE X CF = 108.3 cm² then AD X BC = _____.
(a) 136.8 cm² (b) 132. 4 cm² (c) 129. 2 cm² (d) 128. 6 cm²

17. In the figure, BC = CD = DE and P is mid point of CD. The area of ΔAPC is

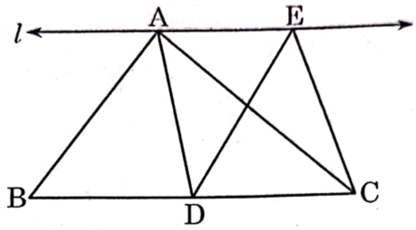


(a) $\frac{1}{3}$ ar (ΔABC) (b) $\frac{1}{2}$ ar (ΔABD) (c) $\frac{1}{6}$ ar (ΔABC) (d) $\frac{1}{4}$ ar (ΔABD)

18. $\overline{AD}$ and $\overline{BE}$ are the altitudes of ΔABC. If AD = 6cm, BC = 16 cm, BE = 8 cm then CA = _____cm.
(a) 12 (b) 18 (c) 24 (d) 10

19. The sides of rectangle are all produced in order, in such a way that the length of each side is increased by 'k' times itself. The area of the new quadilateral formed becomes $2\frac{1}{2}$ times the area of the original rectangle. The value of 'k' is:
(a) $\frac{1}{3}$ (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) $\frac{2}{3}$

20. In the given figure, I || BC and D is the mid point of BC.



If area (ΔABC) X = × area (ΔEDC), then find the value of X.
(a) 1 (b) 2 (c) 3 (d) 4

ANSWER KEY

EXERCISE – 1

14. 12.8 cm
15. 62 cm^2

EXERCISE – 2

21. (i) ΔAXY
25. (i) 100 sq. cm

EXERCISE – 3

Ques.	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**
Ans.	c	d	b	c	c	b	c	d	c	a
Ques.	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**
Ans.	c	c	c	a	b	c	d	b	a	d
Ques.	**21.**	**22.**	**23.**	**24.**	**25.**	**26.**	**27.**	**28.**	**29.**	**30.**
Ans.	b	b	c	b	c	c	c	c	b	b
Ques.	**31.**	**32.**	**33.**	**34.**	**35.**	**36.**	**37.**	**38.**	**39.**	**40.**
Ans.	c	c	d	b	a	d	b	b	b	c
Ques.	**41.**	**42.**	**43.**	**44.**	**45.**					
Ans.	d	c	c	c	c					

EXERCISE – 4

Ques.	**1.**	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**
Ans.	b	d	d	b	c	c	a	c	b	d
Ques.	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**
Ans.	a	d	d	a	a	a	d	a	c	c