MATHS

BOOKS - RD SHARMA MATHS (ENGLISH)

AREA OF PARALLELOGRAMS AND TRIANGLES

Others

1. In ABC, D is the mid-point of AB, P is any point of $BC, CQ || PD$ meets AB in Q . Show that $ar(BPQ)=\frac{1}{2}ar(ABC)\cdot$ TO PROVE : $ar(BPQ)=\frac{1}{2}ar(ABC)$ CONSTRUCTION : Join CD.

2. $ABCD$ is a parallelogram, G is the point on AB such that $AG = 2\,GB,\; E$ is a point of DC such that $CE = 2DE \text{ and } F$ is the point on BC such that $BF = 2FC$. Prove that: $ar(\triangle EGB) = \frac{1}{6} ar\,(ABCD)$

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3. The side AB of a parallelogram $ABCD$ is produced to any point P. A line through A parallel to CP meets CB produced in Q and the parallelogram $PBQR$ completed. Show that $ar(llgmABCD) = ar(llgmBPRQ)$. CONSTRUCTION : Join AC and PQ. TO PROVE : $ar(llgmABCD) = ar(llgmBPRQ)$

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4. In a $\triangle ABC$, If $L \text{ and } M$ are points on $AB \text{ and } AC$ respectively such that $LM \mid\mid BC$. Prove that: $ar\,(\triangle LOB) = ar\,(\triangle MOC)$

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5. D is the mid-point of side BC of $\triangle ABC$ and E is the mid-point of BD. If O is the mid-point of AE, prove that $ar(\triangle BOE) = \frac{1}{8} ar(\triangle ABC)$.

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6. In Fig. 9.30, D and E are two points on BC such that $BD = DE = EC. Show t\hat{}$a r(A B D)=a r(A D E)=a r(A E C)` . Can you now answer the question that you have left in the Introduction of this chapter, whether the field of Budha has been actually divided into three parts of equal area ?

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7. A villager Itwari has a plot of land of the shape of a quadrilateral. The Gram Panchayat of the village decided to take over some portion of plot from one of the corners to construct a health centre. Itwari 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 his proposal will be implemented.

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8. In parallelogram $ABCD, AB = 10cm.$ The altitudes corresponding to the sides AB and AD are respectively $7cm$ and $8cm.$ Find $AD.$

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9. D, E, F are the mid points of side AB, BC, AC prove that BDEF is a parallelogram whose area is half that of Δ ABC

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10. If the medians of a $\triangle ABC$ intersect at G, show that $ar(\triangle AGB) = ar(\triangle AGC) = ar(\triangle BGC) = \frac{1}{3} ar(\triangle ABC)$. GIVEN : $\triangle ABC$ such that its medians AD, BE and CF intersect at G. TO PROVE : $ar(\triangle AGB) = ar(\triangle BGC) = ar(\triangle AGC) = \frac{1}{3} ar(\triangle ABC)$

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11. 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. GIVEN : An equilateral triangle

ABC such that $AB = BC = CA = a$. TO PROVE : $ar(\triangle ABC) = \frac{\sqrt{3}}{4}a^2$. CONSTRUCTION : Draw $AD \perp BC$.

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12. In a parallelogram $ABCD, E, F$ are any two points on the sides AB and BC respectively. Show that $ar(\triangle ADF) = ar(\triangle DCE)$.

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13. The diagonals of a parallelogram $ABCD$ intersect at O. A line through O meets AB in X and CD in Y. Show that $ar(AXYD) = \frac{1}{2}(AR^{gm}ABCD)$

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14. Show that the segment joining the mid-points of a pair of opposite sides of a parallelogram, divides it into two equal parallelograms. GIVEN : A parallelogram $ABCD, E$ and F are the mid-points of opposite sides AB and CD respectively. TO PROVE : $ar(\mid\ \mid^{gm}\ AEFD) = ar(\mid\ \mid^{gm}\ EBCF)$ CONSTRCUTION : Join EF.

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15. Diagonals AC and BD of a trapezium $ABCD$ with $AB \mid \ \mid CD$ intersect each other at O. Prove that ar $(\triangle\ AOD) = ar(\triangle\ BOC)$.

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16. In Figure, $ABCD$ is a quadrilateral and $BE \mid \ \mid AC$ and also BE meets DC produced at E . Show that area of $\triangle\ ADE$ is equal to the area of the quadrilateral $ABCD$.

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17. If a triangle and a parallelogram are on the same base and between the same parallels lines, then the area of the triangle is equal to half that of the parallelogram. GIVEN : A $\triangle ABC$ and $| \ |^{gm} BCDE$ on the same base BC and between the same parallels BC and AD. TO PROVE : ar($\triangle ABC$)=1/2 ar ($| \ |^{gm} BCDE$) CONSTRUCTION : Draw AL $\perp$ BC and DM $\perp$ BC, produced at M.

18. In Figure, $ABCDE$ is a pentagon. A line through B parallel to AC meets DC produced at F. Show that: (i) $ar(\triangle ACB) = ar(\triangle ACF)$ (ii) $ar($quadrilateral $AEDF) = ar(ABCDE)$

19. Prove that The area of a parallelogram is the product of its base and the corresponding altitude.

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20. Prove that Parallelograms on the same base and between the same parallels are equal in area.

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21. Prove that A diagonal of a parallelogram divides it into two triangles of equal area.

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22. If each diagonal of a quadrilateral separates it into two triangles of equal area then show that the quadrilateral is a parallelogram. GIVEN : A quadrilateral $ABCD$ such that its diagonals AC and BD are such that $ar(ABD) = ar(CDB)$ and $ar(ABC) = ar(ACD)$. TO PROVE: Quadrilateral $ABCD$ is a parallelogram.

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23. The area of a triangle is half the product of any of its sides and the corresponding altitude. GIVEN : A ABC in which AL is the altitude to the side BC. TO PROVE : $ar(ABC) = \frac{1}{2}(BC \cdot AL)$ CONSTRUCTION : Through C and A draw $CDBA$ and $ADBC$ respectively, intersecting each other at D.

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24. Triangles ABC and DBC are on the same base BC with A, D on opposite side of line BC, such that $ar(\perp ABC) = ar(DBC)$. Show that BC bisects AD.

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25. If the diagonals AC, BD of a quadrilateral $ABCD$, intersect at O, and seqarate the quadrilateral into four triangles of equal area, show that quadrilateral $ABCD$ is a parallelogram. GIVEN : A quadrilateral $ABCD$ such that its diagonals AC and BD intersect at O and separate it into four parts such that $ar(AOB) = ar(BOC) = ar(COD) = ar(AOD)$ TO PROVE : Quadrilateral $ABCD$ is a parallelogram.

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26. If P is any point in the interior of a parallelogram $ABCD$, then prove that area of the triangle APB is less than half the are of parallelogram.

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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. GIVEN : A quadrilateral $ABCD$ in which its diagonals AC and BD intersect at O such that BO = OD. TO PROVE : $ar(ABC) = ar(ADC)$

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28. XY is a line parallel to side BC of triangle ABC. $BEllAC$ and CF ll AB$meet$XY $\in$ E and F$respectively. Show t^$a r(A B E)=a r(A C F)dot`

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29. In Figure, $ABCD$ is a trapezium in which $ABDC$ and $DC = 40cm$ and $AB = 60cm\cdot$ If X and Y are, respectively, the mid-points of AD and BC , prove that : $XY = 50cm$ $DCYX$ is a trapezium $ar\left(trap\dot{D}CYX\right) = \frac{9}{11}ar\left(trapXY\dot{B}A\right.$

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30. Show that the diagonals of a parallelogram divide it into four triangles of equal area. GIVEN : A parallelogram $ABCD$. The diagonals AC and BD intersect at $O\cdot$ TO PROVE : $ar(OAB) = ar(OBC) = ar(OCD) = ar(AOD)$

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31. Show that the area of a rhombus is half the product of the lengths of its diagonals. GIVEN : A rhombus $ABCD$ whose diagonals AC and BD intersect at O. TO PROVE : $ar(rhombus ABCD) = \frac{1}{2}(AC \cdot BD)$

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32. $ABCD$ is a parallelogram whose diagonals AC and BD intersect at O. A Line through O intersects AB at P and DC at Q. Prove that $ar(POA) = ar(QOC)$.

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33. A point D is taken on the side BC of a ABC such that $BD = 2dC$. Prove that $ar(ABD) = 2ar(ADC)$.

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34. In Figure, D, E are points on sides AB and AC respectively of ABC, such that $ar(BCE) = ar(BCD)$. Show that `DE ll BC .

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35. ABC is a triangle in which D is the mid-point of BC and E is the mid-point of AD. Prove that area of $BED = \frac{1}{4} area of ABC$.

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36. In Figure, $ABCD$ is a parallelogram. Prove that: $ar(BCP) = ar(DPQ)$ Construction: Join AC

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37. $ABCD$ is a parallelogram X and Y are the mid-points of BC and CD respectively. Prove that $ar(AXY) = \frac{3}{8} ar(\hat{\ } (gm) ABCD)$

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38. The area of a trapezium is half the product of its height and the sum of parallel sides. GIVEN : A trapezium $ABCD$ in which $AB \mid \mid CD; AB = a, DC = b$ and $AL = CM = h,$ where $AL \perp DC$ and $CM \perp AB.$ TO PROVE : $ar(trap.\ ABCD) = \frac{1}{2} h(a + b)$ construction : Join AC

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39. Parallelogram $ABCD$ and rectangle $ABEF$ have the same base AB and also have equal areas. Show that the perimeter of the parallelogram is greater than that of the rectangle.

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40. O is any point on the diagonal BD of the parallelogram $ABCD$. Prove that $ar(\triangle OAB) = ar(\triangle OBC)$

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41. Prove that the area of a rhombus is equal to half the rectangle contained by its diagonals. Given: A rhombus $ABCD$ such that its diagonals $AC \text{ and } BD$ intersect at O. To Prove: $ar\ (rhombus\ ABCD) = \frac{1}{2}$ (area of the rectangle contained by its diagonals $= \frac{1}{2}(AC \times BD)$

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42. A quadrilateral $ABCD$ is such that diagonal BD divides its area in two equal parts. Prove that BD bisects AC. GIVEN : A quadrilateral

$ABCD$ in which diagonal BD bisects it. i.e. $ar(\triangle ABD) = ar(\triangle BDC)$ CONSTRUCTION : Join AC Suppose AC and BD intersect at O . Draw $AM \perp BD$ and $CN \perp BD$. TO PROVE : $AO = OC$.

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43. Prove that two triangles having the same base and equal areas lie between the same parallels.

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44. Show that a median of a triangle divides it into two triangles of equal area. GIVEN : A $\triangle ABC$ in which AD is the median. TO PROVE : $ar(\triangle ABD) = ar(\triangle ADC)$ CONSTRUCTION : Draw $AL \perp BC$

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

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

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

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48. If $ABCD$ is a parallelogram, the prove that $ar(ABD) = ar(BCD) = ar(ABC) = ar(ACD)$=1/2a r(| $|^{gm}$A B C D)

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49. Triangles on the same base and between the same parallels are equal in area.

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50. Triangles having equal areas and having one side of one of the triangles, equal to one side of the other, have their corresponding altitudes equal.

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51. In Figure, $ABCD$ is a parallelogram and $EFCD$ is a rectangle.

Also $AL \perp DC$. Prove that

(i) $ar(ABCD = ar(EFCD)$

(ii) $ar\ (ABCD) = DC$ x AL

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

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53. In Figure, P is a point in the interior of a parallelogram $ABCD$.

Show that $ar(APB) + ar(PCD) = \frac{1}{2}ar(\hat{\ }(gm)ABCD)$

$aR(APD) + ar(PBC) = ar(APB) + ar(PCD)$

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54. In Figure, $PQRS$ and $ABRS$ are parallelograms and X is any point on side BR. Show that : $ar(| \, |^{gm} PQRS) = ar(| \, |^{gm} ABRS)$, $ar(\triangle AXS) = \frac{1}{2} ar(| \, |^{gm} PQRS)$

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55. The diagonals of a parallelogram $ABCD$ intersect at a point O. Through O , a time is drawn to intersect AD at P and BC at Q . Show that PQ divides the parallelogram into two parts of equal area.

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56. E, F, G, H are respectively, the mid-points of the sides of parallelogram $ABCD$. Show that the area of EFGH is half the area of the parallelogram, $ABCD$. GIVEN : A quadrilateral $ABCD$ in which L, F, G, H are respectively the mid-points of the sides AB, BC, CD

and DA. TO PROVE : $ar(\hat{}\ (gm)EFGH) = \frac{1}{2} ar(\hat{}\ (gm)ABCD)$

CONSTRUCTION : Join H and F

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57. 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 as shown in Figure. Show that $ar(\hat{}\ (gm)ABCD) = ar^{gm}PBQR)$.

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58. In Figure, $BC||XY, BX||CA$ and $AB|\ |YC$ Prove that: $ar(ABX) = ar(ACY)$

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59. The medians BE and CF of a triangle ABC intersect at G . Prove that area of $\triangle GBC$=area of quadrilateral $AGFE$.

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60. ABCD is a parallelogram. E is a point on BA such that $BE = 2EA$ and F is a point on DC such that DF=2 FC. Prove that AECF is a parallelogram whose area is one third area of parallelogram ABCD.

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61. A circular grassy plot of land, 42 m in diameter has a path of 3.5m wide running round it on the outside. Find the cost of gravelling the path at Rs.4 per square metre.

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62. A point O inside a rectangle $ABCD$ is joined to the vertices. Prove that the sum of the areas of a pair of opposite triangles so formed is equal to the sum of the areas of other pair of triangles.

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63. Which of the following figure lie on the same base and between the same parallels? In such a case, write the common base and two parallels: Figure (ii) Figure (iii) Figure Figure

(ii) Figure (iii) Figure

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64. $ABCD$ is a quadrilateral and BD is one of its diagonals as shown in Figure. Show that $ABCD$ is a parallelogram and find its area.

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65. In parallelogram $ABCD, AB = 10cm\cdot$ The altitudes corresponding to the sides AB and AD are respectively $7cm$ and $8cm\cdot$ Find $AD\cdot$

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

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67. The diagonals of a parallelogram $ABCD$ intersect at O. A line through O meets AB in $X \, and \, CD$ in Y. Show that $ar \; (quadrilateral AXYD) = \frac{1}{2} ar (parallelogram \;\; ABCD)$

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

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69. In Figure, $ABCD$ is a parallelogram and $EFCD$ is a rectangle. Also $AL \perp DC$. Prove that

(i) $ar(ABCD = ar(EFCD)$

(ii) $ar\ (ABCD) = DC$ x AL

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

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71. $p\,AND\,q$ are any two points lying on the sides $DC\ and\ AD$ respectively of a parallelogram $ABCD$. Show that $ar(APB) = ar\ (BQC)$.

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72. In Figure, P is a point in the interior of a parallelogram $ABCD$. Show that $ar(APB) + ar(PCD) = \frac{1}{2} ar\ (||^{gm} ABCD)$ $ar\ (APD) + ar\ (PBC) = ar\ (APB) + ar(PCD)$

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73. In Figure, $ABCD$ is a parallelogram, $AE\ \perp DC\ and\ \mathbb{C}F\ \perp\ AD$. If $AB = 16CM,\ AE = 8cm\ and\ CF = 10cm,$ find AD

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74. In above question number, if $AD = 6cm, \ CF = 10cm, \ and \ AE = 8cm,$ find AB.

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75. 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 $AEFD$

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76. If $ABCD$ is a parallelogram, then prove that $ar(\triangle \ ABD) = ar(\triangle \ BCD) = ar(\triangle \ ABC) = ar(\triangle \ ACD)$ = $\frac{1}{2} ar \, (parallelogram ABCD)$

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77. Show that a median of a triangle divides it into two triangles of equal area.

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78. AD is one of the medians of a $ABC \cdot X$ is any point on AD . Show that $ar(ABX) = ar\ (ACX)$

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

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80. In Figure, $ABCD$ is a quadrilateral and $BE \mid AC$ and also BE meets DC produced at $E \cdot$ Show that area of ADE is equal to the area of the quadrilateral $ABCD$

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81. Diagonals $AC \text{ and } BD$ of a trapezium $ABCD$ with $AB \mid \mid DC$ intersect each other at O. Prove that $ar(AOD) = ar(BOC)$.

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82. In Figure, $ABCDE$ is a pentagon. A line through B parallel to AC meets DC produced at F. Show that:

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

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

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83. Show that the diagonals of a parallelogram divide it into four triangles of equal area.

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84. The diagonals of quadrilateral $ABCD$, $AC \text{ and } BD$ intersect in O. Prove that if $BO = OD$, the triangles $ABC \text{ and } ADC$ are equal in area.

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85. If the diagonals AC, BD of a quadrilateral $ABCD$, intersect at O, and separate the quadrilateral into four triangles of equal area, show that quadrilateral $ABCD$ is a parallelogram.

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86. If each diagonals of a quadrilateral separates it into two triangles of equal area then show that the quadrilateral is a parallelogram.

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87. Show that the area of a rhombus is half the product of the lengths of its diagonals.

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88. 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 as shown in Figure. Show that $ar(\mid\;\mid^{gm}ABCD)=ar(\mid\;\mid^{gm}PBQR)$

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89. A villager Itwari has a plot of land of the shape of a quadrilateral. The Gram Panchayat of the village decided to take over some portion of plot from one of the corners to construct a Health centre. Itwari 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 his proposal will be implemented.

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90. $ABCD$ is a trapezium with $AB \mid \mid DC$. A line parallel to AC intersects AB at $X \text{ and } BC$ at Y. Prove that $ar(ADX) = ar(ACY)$.

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91. Diagonals $AC \text{ and } BD$ 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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92. In Figure, $AP||BQ\ ||CR.$ Prove that $ar\ (AQC) = \ ar\ (PBR)$

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93. In Fig.9.29, $ar\ (BDP) = ar\ (ARC)$and $ar\ (BDP) = ar\ (ARC)$. Show that both the quadrilaterals ABCD and DCPR are trapeziums.

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94. 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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95. In Figure, diagonals AC and BD of quadrilateral ABCD intersect at O such that OB=OD . If AB=CD , then show that:

(i) $ar \triangle (DOC)$=$ar \triangle (AOB)$

(ii) $ar \triangle (DCB)$=$ar \triangle (ACB)$

(iii) $DA || CB$

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96. A point O inside a rectangle $ABCD$ is joined to the vertices. Prove that the sum of the areas of a pair of opposite triangles so formed is equal to the sum of the other pair of triangles. Given: A rectangle $ABCD \, and \, O$ is a point inside it. $OA, \; OB, \; OC \, and \, OD$ have been joined. To Prove: $ar\,(AOD) + \, ar\,(BOC) = \, ar\,(AOB) + \, ar(COD)$

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97. Show that the area of a rhombus is half the product of the lengths of its diagonals. GIVEN : A rhombus $ABCD$ whose diagonals AC and BD intersect at O. TO PROVE : $ar(rhombus ABCD) = \frac{1}{2}(ACxBD)$

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98. $ABCD$ is a parallelogram and O is any point in its interior. Prove that:

(i) $ar\,(AOB) + ar\,(COD) = \frac{1}{2}\,ar(ABCD)$

(ii) $ar\,(AOB) + \, ar\,(COD) = \, ar\,(BOC) + \, ar(AOD)$

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99. A quadrilateral $ABCD$ is such that diagonal BD divides its area in two equal parts. Prove that BD bisects AC GIVEN : A quadrilateral $ABCD$ in which diagonal BD bisects it. i.e. $ar(\triangle ABD) = ar(\triangle BDC)$ CONSTRUCTION : Join AC Suppose AC and BD intersect at O . Draw $AL \perp BD$. TO PROVE : $AO = OC$

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100. Parallelogram $ABCD$ and rectangle $ABEF$ have the same base AB and also have equal areas. Show that the perimeter of the parallelogram is greater than that of the rectangle. GIVEN : $A | \, |^{gm} ABCD$ and a rectangle $ABEF$ with the same base AB and equal areas. TO PROVE : Perimeter of $| \, |^{gm} ABCD$ > Perimeter of rectangle ABEF i.e. $AB + BC + CD + AD > AB + BE + EF + AF$

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101. O is any point on the diagonal BD of the parallelogram $ABCD$.

Prove that $ar(\triangle OAB) = ar(\triangle OBC)$

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102. Triangles ABC and DBC are on the same base BC with A, D on opposite side of line BC, such that $ar(\triangle ABC) = ar(\triangle DBC)$.

Show that BC bisects AD.

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103. D and E are points on sides AB and AC respectively of ΔABC such that $ar\ (DBC) = ar\ (EBC)$. Prove that $DE \mid \mid BC$.

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104. If the medians of a $\triangle ABC$ intersect at G, show that $ar(\triangle AGB) = ar(\triangle AGC) = ar(\triangle BGC) = \frac{1}{3} ar(\triangle ABC)$.

GIVEN : $\triangle ABC$ such that its medians AD, BE and CF intersect at G TO PROVE : $ar(\triangle AGB) = ar(\triangle BGC) = ar(\triangle CGA) = \frac{1}{3} ar(\triangle ABC)$.

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

(i) BDEF is a parallelogram.

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

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

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106. BD is one of the diagonals of a quadrilateral $ABCD$. AM and CN are the perpendiculars from $A \text{ and } C$, respectively, on BD. Show that ar (quad. $ABCD$)=$\frac{1}{2}BD(AM+CN)$

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107. $ABCD$ is a quadrilateral. A line through D, parallel to AC, meets BC produced in P as shown in figure. Prove that $ar(\triangle ABP)$=a r (Quad.$ABCD$).

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108. If the median of a △ABC intersect at G. show that ar (△AGC) = ar (△AGB) = ar (△BGC) = 1/3 ar (△ABC)

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109. XY is a line parallel to side BC of triangle$ABC. If BEIIA$C and $CFIIAB$ meet XY at E and F respectively.Show that $ar(ABE) = ar(ACF)$.

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110. E, F, G, H are respectively, the mid-points of the sides AB, BC, CD and DA of parallelogram $ABCD$. Show that the quadrilateral $EFGH$ is a parallelogram and that its area is half the area of the parallelogram, $ABCD$. GIVEN : A quadrilateral $ABCD$ in which L, F, G, H are respectively the mid-points of the sides AB, BC, CD and DA. TO PROVE : (i) Quadrilateral $EFGH$ is a parallelogram $ar(| \quad |^{gm} EFGH) = \frac{1}{2} ar(| \quad |^{gm} ABCD)$ CONSTRUCTION : Join AC and HF

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111. XY is a line parallel to side BC of $\triangle ABC$. $BE \mid \mid AC$ and $CF \mid \mid AB$ meet XY in E and F respectively. Show that $ar(ABE) = ar(ACF)$.

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112. E, F, G, H are respectively, the mid-points of the sides AB, BC, CD and DA of parallelogram $ABCD$. Show that the quadrilateral $EFGH$ is a parallelogram and that its area is half the area of the parallelogram, $ABCD$.

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113. The side AB of a parallelogram $ABCD$ is produced to any point P. A line through A parallel to CP meets CB produced in Q and the parallelogram $PBQR$ completed. Show that

$ar(\hat{} (gm)ABCD) = ar(\hat{} (gm)BPRQ)$. CONSTRUCTION : Join AC and PQ. TO PROVE : $ar(\hat{} (gm)ABCD) = ar(\hat{} (gm)BPRQ)$

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114. Any point D is taken in the base BC of a triangle $ABC \text{ and } AD$ is produced to E, making DE equal to AD. Show that $ar\ (\triangle BCE) = ar(\triangle ABC)$

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115. In ABC, D is the mid-point of AB, P is any point of $BC\dot{C}QPD$ meets AB in Q . Show that $ar(BPQ) = \frac{1}{2}ar(ABC)$.

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116. In a parallelogram $ABCD$, E, F are any two points on the sides AB and BC respectively. Show that $ar(\triangle ADF) = ar(\triangle DCE)$.

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117. In Figure, $ABCD$ is a trapezium in which $AB \mid \mid DC$. DC is produced to E such that $CE = AB$, prove that $ar(\triangle ABD) = ar(\triangle BCE)$. Construction: Draw DM on BA produced and $BN \perp DC$

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118. 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.

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119. In Figure, $BC||XY$, $BX||CA$ and $AB| \ |YC$. Prove that: $ar(ABX) = ar(ACY)$.

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120. In Figure, $ABCD$ is a parallelogram. Prove that: $ar(BCP) = ar(DPQ)$ CONSTRUCTION : Join AC.

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121. ABC is a triangle in which D is the mid-point of BC and E is the mid-point of AD. Prove that area of $\triangle BED = \frac{1}{4} area\ of\ \triangle ABC$. GIVEN : A $\triangle ABC$, D is the mid-point of BC and E is the mid-point of the median AD. TO PROVE : $ar(\triangle BED) = \frac{1}{4} ar(\triangle ABC)$.

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122. $ABCD$ is a parallelogram X and Y are the mid-points of BC and CD respectively. Prove that $ar(AXY) = \frac{3}{8} ar(\hat{\ } (gm) ABCD)$

GIVEN : A parallelogram $ABCD$ in which X and Y are the mid-points of BC and CD respectively. TO PROVE : $ar(AXY) = \frac{3}{8} ar(\hat{\ } (gm) abcd)$ CONSTRUCTION : Join BD.

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123. The diagonals of a parallelogram $ABCD$ intersect at a point O. Through O, a line is drawn to intersect AD at P and BC at Q. Show that PQ divides the parallelogram into two parts of equal area.

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124. The medians $BE \text{ and } CF$ of a triangle ABC intersect at G. Prove that area of $\triangle\ GBC = area\ of\ quadrilateral\ AFGE.$

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125. In Figure, compute the area of quadrilateral $ABCD$.

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126. In Figure, $PQRS$ is a square and $T \text{ and } U$ are, respectively, the mid-points of $PS \text{ and } QR$. Find the area of $\triangle OTS$ if $PQ = 8 \text{ cm}$.

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127. Compute the area of trapezium $PQRS$ in the given figure.

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128. In Figure, $\angle AOB = 90^\circ, \ AC = BC, \ OA = 12 \text{ cm and } OC = 6.5 \text{cm}.$ Find the area of $\triangle AOB$.

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129. In Figure, $ABCD$ is a trapezium in which $AB = 7cm, \ AD = BC = 5cm, \ DC = X\ cm,$ and distance between $AB\ and\ DC$ is $4cm$. Find the value of X and area of trapezium $ABCD$

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

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131. In figure, $ABCD$ is a trapezium in which $AB \mid \mid CD$. Prove that: $ar(\triangle AOD) = ar(\triangle BOC)$.

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132. In Figure, $ABCD$, $ABFE \, and \, CDEF$ are parallelograms. Prove that $ar(\triangle ADE) = ar(\triangle BCF)$

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133. Diagonals $AC \, and \, BD$ of a quadrilateral $ABCD$ intersect each at P. Show that: $ar(\triangle APB)$x $ar(\triangle CPD)$= $ar(\triangle APD)$ x $ar(\triangle PBC)$

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134. In Figure, ABC and ABD are two triangles on the base AB. If line segment CD is bisected by AB at O, show that $ar(\triangle ABC) = ar(\triangle ABD)$

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135. If P is any point in the interior of a parallelogram $ABCD$, then prove that area of the triangle APB is less than half the area of parallelogram.

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136. If AD is a median of a triangle ABC, then prove that triangles ADB and ADC are equal in area. If G is the mid-point of median AD, prove that $ar(\triangle BGC) = 2ar(\triangle AGC)$.

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137. A point D is taken on the side BC of a ABC such that $BD = 2DC$. Prove that $ar\ (\ ABD) = \ 2\,ar\ (\ ADC)$

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138. $ABCD$ is a parallelogram whose diagonals intersect at O. If P is any point on BO, prove that: $ar\ (\ \triangle\ \ ABP) = \ ar\ (\ \triangle\ \ CBP)$

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139. $ABCD$ is a parallelogram in which BC is produced to E such that $CE = BC$. AE intersects CD at F. Prove that $ar\ (\ ADF) = \ ar\ (\ ECF)$. If the area of $DFB = 3\,cm^2$, find the area of ABCD.

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140. $ABCD$ is a parallelogram whose diagonals $AC \text{ and } BD$ intersect at O. A line through O intersects $AB \text{ at } P \text{ and } DC$ at Q. Prove that $ar(\triangle POA) = ar(\triangle QOC)$.

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141. $ABCD$ is a parallelogram. E is a point on BA such that $BE = 2EA \text{ and } F$ is a point on DC such that $DF = 2FC$. Prove that $AECF$ is a parallelogram whose area is one third of the area of parallelogram $ABCD$.

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142. In $\triangle ABC$, $P \text{ and } Q$ are respectively the mid-points of $AB \text{ and } BC$ and R is the mid-point of AP. Prove that: $ar(\triangle PBQ) = ar(\triangle ARC)$

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143. In $\triangle ABC, P \text{ and } Q$ are respectively the mid-points of $AB \text{ and } BC$ and R is the mid-point of AP. Prove that: $ar(\triangle PRQ) = \frac{1}{2} ar(\triangle ARC)$.

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144. In $\triangle ABC, P \text{ and } Q$ are respectively the mid-points of $AB \text{ and } BC$ and R is the mid-point of AP. Prove that: $ar(\triangle RQC) = \frac{3}{8} ar(\triangle ABC)$.

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145. $ABCD$ is a parallelogram, G is the point on AB such that $AG = 2GB$, E is a point of DC such that $CE = 2DE \text{ and } F$ is the point of BC such that $BF = 2FC$. Prove that: $ar(ADEG) = ar(GBCE)$

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146. $ABCD$ is a parallelogram, G is the point on AB such that $AG = 2\,GB$, E is a point of DC such that $CE = 2DE\ and\ F$ is the point on BC such that $BF = 2FC$. Prove that: $ar(\triangle EGB) = \frac{1}{6}ar\,(ABCD)$

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147. $ABCD$ is a parallelogram, G is the point on AB such that $AG = 2\,GB$, E is a point of DC such that $CE = 2DE\ and\ F$ is the point of BC such that $BF = 2FC$. Prove that: $ar\,(\triangle EFC) = \frac{1}{2}\,ar\,(\triangle EBF)$

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148. In figure, ABCD is a parallelogram, AE perpendicular to DC and CF perpendicular to AD. If AB = 16cm, AE = 8cm and CF = 10cm, Find AD.

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149. In Figure, $CD||AE \text{ and } CY||BA$. (i) Name a triangle equal in area of $\triangle CBX$ (ii) Prove that $ar(\triangle ZDE) = ar(\triangle CZA)$ (iii) Prove that $ar(BCZY) = ar(\triangle EDZ)$.

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150. In figure, $PSDA$ is a parallelogram in which $PQ = QR = RS \text{ and } AP||BQ||CR||DS$. Prove that $ar(\triangle PQE) = ar(\triangle CFD)$.

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151. In Figure, $ABCD$ is a trapezium in which $ABDC$ and $DC = 40cm$ and $AB = 60cm$. If X and Y are, respectively, the mid-points of AD and BC , prove that : $XY = 50cm$ $DCYX$ is a trapezium $ar\left(trap\dot{D}CYX\right) = \frac{9}{11}ar\left(trapXY\dot{B}A\right.$

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152. In Figure, $ABCD$ is a trapezium in which $AB || DC$ and $DC = 40cm$ and $AB = 60cm$. If X and Y are, respectively, the mid-points of AD and BC , prove that :

(i) $XY = 50cm$

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

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153. In Figure, $ABCD$ is a trapezium in which $AB || DC$ a n d DC=40cm and AB=60 cm. If $X \, and \, Y$ are, respectively, the mid-points of $AD \text{ and } BC$, prove that: $ar\left(trap\dot{D}CYX\right) = \frac{9}{11}\, ar\left(trapXY\dot{B}A\right)$

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154. In Figure, $ABC \text{ and } BDE$ are two equilateral triangls such that D is the mid-point of BC. If AE intersects BC in F, Prove that: $ar(BDE) = \frac{1}{4} ar\,(\,ABC)$.

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155. In Figure, $ABC \text{ and } BDE$ are two equilateral triangls such that D is the mid-point of $BC\dot{A}E$ intersects BC in $F\cdot$ Prove that: $ar\,(BDE) = \frac{1}{2} ar\,(BAE)$

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156. In Figure, $ABC \text{ and } BDE$ are two equilateral triangls such that D is the mid-point of $BC\dot{A}E$ intersects BC in $F\cdot$ Prove that: $ar\ (\ BFE) = ar\ (\ AFD)$

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157. ABC is a triangle in which D is the mid-point of BC and E is the mid-point of AD. Prove that area of BED=$\frac{1}{4}$area of ABC.

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158. In figure, $ABC \text{ and } BDE$ are two equilateral triangles such that D is the mid-point of BC. If AE intersects BC in F. Prove that: $ar(\triangle BFE) = 2ar(\triangle FED)$.

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159. D is the mid-point of side BC of ABC and E is the mid-point of BD. If O is the mid-point of AE, prove that $ar(BOE) = \frac{1}{8} ar(ABC)$

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160. In Figure, X and Y are the mid-points of AC and AB respectively, $QP || BC$ and CYQ and BXP are straight lines. Prove that $ar(ABP) = ar(ACQ)$.

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161. In Figure $ABCD$ and $AEFD$ are two parallelograms. Prove that: $PE = FQ$

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162. In Figure, $ABCD\ and\ AEFD$ are two parallelograms? Prove that: $ar\ (\ APE):\ ar\ (\ PFA) = ar\ (QFD)\ : ar\ (\ PFD)$

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163. In Figure, $ABCD$ is a parallelogram. O is any point on AC. $PQ\ ||AB\ and\ LM||AD.$ Prove that $ar(parallelogram DLOP) = ar\ (parallellogram BMOQ)$

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164. In a $\triangle ABC,$ If $L\ and\ M$ are points on $AB\ and\ AC$ respectively such that $LM\ |\ |\ BC.$ Prove that: $ar\ (\ \triangle LCM) = ar\ (\ \triangle LBM)$

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165. In a ABC, If $L \, and \, M$ are points on $AB \, and \, AC$ respectively such that $LM \mid \mid BC$. Prove that: $ar \, (\, LBC) = \, ar \, (\, MBC)$

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166. In a ABC, If $L \, and \, M$ are points on $AB \, and \, AC$ respectively such that $LM \mid \mid BC$. Prove that: $ar \, (\, ABM) = ar \, (\, ACL)$.

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167. In a ABC, If $L \, and \, M$ are points on $AB \, and \, AC$ respectively such that $LM \mid \mid BC$. Prove that: $ar \, (\, LOB) = ar \, (\, MOC)$.

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168. In Figure $D \, and \, E$ are two points on BC such that $BD = DE = EC$. Show that

$ar(ABD) = ar(ADE) = ar(AEC)$.

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169. In Figure, ABC is a right triangle right angled at A, $BCED$, $ACFG$ and AMN are square on the sides BC, CA and AB respectively. Line segment $AX \perp DE$ meets BC at Y. Show that: $MBC \cong ABD$

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170. In Figure, ABC is a right triangle right angled at A, $BCED$, $ACFG$ and AMN are square on the sides BC, CA and AB respectively. Line segment $AX \perp DE$ meets BC at Y. Show that: $ar(BYXD) = 2\, ar(MBC)$

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171. In 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 $AX \perp DE$ meets BC at Y. Show that: $ar(BYXD) = ar(ABMN)$.

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172. In figure, ABC is a right triangle right angled at A. $BCED$, $ACFG$ and $ABMN$ are square on the sides BC, CA and AB respectively. Line segment $AX \perp DE$ meets BC at Y. Show that: $\triangle FCB \cong \triangle ACE$

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173. In figure, ABC is a right triangle right angled at A. $BCED$, $ACFG$ and $ABMN$ are square on the sides

$BC, CA \text{ and } AB$ respectively. Line segment $AX \perp DE$ meets BC at Y. Show that: $ar(CYXE) = 2ar(\triangle FCB)$.

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174. In figure, ABC is a right triangle right angled at A. $BCED, ACFG \text{ and } ABMN$ are square on the sides $BC, CA \text{ and } AB$ respectively. Line segment $AX \perp DE$ meets BC at Y. Show that: $ar(CYXE) = ar(ACFG)$.

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175. In Figure, ABC is a right triangle right angled at A, $BCED, ACFG \text{ and } ABMN$ are square on the sides $BC, CA \text{ and } AB$ respectively. Line segment $AX \perp DE$ meets BC at Y. Show that: $ar(CYXE) = ar(ACFG)$

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176. In fig, 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) ar(BDE)= 1/4 ar(ABC) (ii) ar(BDE)= 1/2 ar(BAE)

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177. In Figure, $ABCD$ is a rectangle in which $CD = 6cm, \ AD = 8cm.$ Find the area of parallelogram $CDEF$

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178. In Figure, $ABCD$ is a rectangle with sides $AB = 10cm \ and \ AD = 5cm.$ Find the area of $\triangle \ EFG$

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179. In Figure, $ABCD$ is a rectangle with sides $AB = 10cm\ and\ AD = 5cm$. Find the area of EFG

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180. In Figure, $ABCD$ is a rectangle with sides $AB = 10cm\ and\ AD = 5cm$. Find the area of EFG

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181. $PQRS$ is a rectangle inscribed in a quadrant of a circle of radius $13cm$. A is any point on PQ. If $PS = 5cm$, then find $ar\ (\ RAS)$

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182. In square $ABCD$, $P \text{ and } Q$ are mid-point of $AB \text{ and } CD$ respectively. If $AB = 8cm \text{ and } PQ \text{ and } BD$ intersect at O, then find area of OPB

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183. ABC is a triangle in which D is the mid-point of BC, $E \text{ and } F$ are mid-points of $DC \text{ and } AE$ respectively. If area of ABC is $16\ cm^2$, find the area of DEF

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184. $PQRS$ is a trapezium having $PS \text{ and } QR$ as parallel sides. A is any point on $PQ \text{ and } B$ is a point on SR such that $AB \mid\ \mid QR$. If area of $\triangle PBQ$ is $17\ cm^2$, find the area of $\triangle ASR$

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185. $ABCD$ is a parallelogram. P is the mid-point of $AB\dot{B}D$ and CP intersect at Q such that $CQ:QP = 3:1$. If $ar\,(PBQ) = 10\,cm^2$, find the area of parallelogram $ABCD$

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186. P is any point on base BC of ABC and D is the mid-point of $BC\dot{D}E$ is drawn parallel to PA to meet AC at E. If $ar\,(ABC) = 12cm^2$, then find area of EPC

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187. Two parallelograms are on equal bases and between the same parallels.

The ratio of their areas is

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188. A triangle and a parallelogram are on the same base and between the same parallels. The ratio of the areas of triangle and parallelogram is

(a)1:1

(b) 1:2

(c) 2:1

(d) 1:3

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189. Let ABC be a triangle of area 24sq. units and PQR be the triangle formed by the mid-points of sides of ABC. Then the area of PQR is 12 sq. units (b) 6 sq. units 4 sq. units (d) 3 sq. units

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190. The median of a triangle divides it into two (a)congruent triangle (b) isosceles triangles (c)right triangles (d) triangles of equal areas

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191. In a ABC, D, E, F are the mi-points of sides $BC, CA \text{ and } AB$ respectively. If $ar(ABC) = 16cm^2$, then $ar\ (trapezium\ FBCE) =\ 4\ cm^2$ (b) $8\ cm^2$ (c) $12cm^2$ (d) $10cm^2$

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192. $ABCD$ is a parallelogram. P is any point on CD. If $ar\ (DPA) = 15\ cm^2$ and $ar\ (APC) = 20cm^2$, then $ar\ (APB) =$ (a) $15cm^2$ (b) $20cm^2$ (c) $35\ cm^2$ (d) $30cm^2$

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193. The area of the figure formed by joining the mid-points of the adjacent sides of a rhombus with diagonals $16cm\ and\ 12cm$ is $28\ cm^2$ (b) $48\ cm^2$ (c) $96\ cm^2$ (d) $24\ cm^2$

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194. $A,\ B,\ C,\ D$ are mid-points of sides of a parallelogram $PQRS$. If $ar\ (PQRS) = 36CM^2,$ then $ar(ABCD) =\ 24\ cm^2$ (b) $18\ cm^2$ (c) $30\ cm^2$ (d) $36\ cm^2$

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195. The figure obtained by joining the mid-points of the adjacent sides of a rectangle of sides $8cm\ and\ 6\ cm$ is. a) rhombus of area $24\ cm^2$ (b) a rectangle of area $24cm^2$ a square of area $26\ cm^2$ (d) a trapezium of area $14\ cm^2$

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196. The mid points of the sides of a triangle ABC along with any of the vertices as the fourth point make a parallelogram of area equal to: $ar\ (ABC)$ (b) $\frac{1}{2}ar\ (ABC)$ $\frac{1}{3}ar\ (ABC)$ (d) $\frac{1}{4}\ ar\ (ABC)$

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197. If AD is median of ABC and P is a point on AC such that $ar\ (ADP):\ ar\ (ABD) = 2:3,$ then $ar(PDC):ar\ (ABC)$ is $1:5$ (b) $1:5$ (c) $1:6$ (d) $3:5$

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198. Medians of ABC intersect at G . If $ar\ (ABC) = 27\ cm^2,$ then $ar\ (BGC) =$

(i) $6\ cm^2$

(b) $9\ cm^2$

(c) $12\ cm^2$

(d) $18 cm^2$

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199. In a ABC if $D\ and\ E$ are mid-points of $BC\ and\ AD$ respectively such that $ar\ (AEC) = 4\ cm^2$, then $ar\ (BEC) =$

(b) $4\ cm^2$

(b) $6\ cm^2$

(c) $8\ cm^2$

(d) $12 cm^2$

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200. In Figure, $ABCD$ is a parallelogram. If $AB = 12\ cm,\ \ AE = 7.5\ cm,\ \ CF = 15\ cm,$ then $AD =$ (a) 3 cm

(b) 6 cm (c) 8 cm (d) 10.5 cm

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201. In Figure, $PQRS$ is a parallelogram. If $X \, and \, Y$ are mid-points of $PQ \, and \, SR$ respectively and diagonal SQ is joined. The ratio $arXQRY : \, ar \, (QSR) =$

(a) 1:4

(b) 2:1

(c) 1:2

(d) 1:1

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202. In Figure, $ABCD \, and \, FECG$ are parallelograms equal in area. If $ar \, (AQE) = 12cm^2$, then $arFGBQ =$

(a) $12 \, cm^2$

(b) $20\ cm^2$

(c) $24\ cm^2$

(d) $36\ cm^2$

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203. Diagonal $AC\ and\ BD$ of trapezium $ABCD$, in which $AB \mid \mid DC$, intersect each other at O. The triangle which is equal in area of AOD is AOB (b) BOC (c) DOC (d) ADC

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204. $ABCD$ is a trapezium in which $AB \mid \mid DC$. If $ar(ABD) = 24\ cm^2 and\ AB = 8\ cm$, then height of ABC is 3 cm (b) 4 cm (c) 6 cm (d) 8 cm

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205. $ABCD$ is a trapezium with parallel sides $AB = a \text{ and } DC = b$. If $E \text{ and } F$ are mid-points of non-parallel sides $AD \text{ and } BC$ respectively, then the ratio of areas of quadrilaterals $ABFE \text{ and } EFCD$ is: $a : b$ (b) $(a + 3b) : (3a + b)$ $(3a + b) : (a + 3b)$ (d) $(3a + b) : (3a + b)$

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206. $ABCD$ is a rectangle with O as any point in its interior. If $ar\ (AOD) = 3\ cm^2 \text{and } ar\ (BOC) = 6\ cm^2$, then area of rectangle $ABCD$ is: $9cm^2$ (b) $12\ cm^2$ (c) $15cm^2$ (d) $18\ cm^2$

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