MATHS

BOOKS - RD SHARMA MATHS (ENGLISH)

CONGRUENT TRIANGLE

Others

1. In Figure, $AB = ACB\dot{E}$ and CF are respectively the bisectors of $\angle B$ and $\angle C$. Prove that $EBC = FCB$.

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2. ABC is an isosceles triangle in which $AB = AC$. Side BA is produced to D such that $AD = AB$ (see Fig. 7.34). Show that $\angle BCD$ is a right angle.

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3. If any two angles and a non-included side of one triangle are equal to the corresponding angles and side of another triangle, then the two triangles are congruent. GIVEN : Two $sABC$ and DEF such that $\angle A = \angle D, \angle B = \angle E, BC = EF$ TO PROVE : $ABC \cong DEF$ Figure

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4. BD and CE are bisectors of $\angle B$ and $\angle C$ of an isosceles ABC with $AB = AC$. Prove that $BD = CE$.

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5. Two lines AB and CD intersect at O such that BC is equal and parallel to AD. Prove that the lines AB and CD bisect at O.

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6. In Figure, $AC = BC, \angle DCA = \angle ECB$ and $\angle DBC = \angle EAC$. Prove that triangles DBC and EAC are congruent, and hence $DC = EC$ and $BD = AE$

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7. If the bisector of the vertical angle of a triangle bisects the base of the triangle. then the triangle is isosceles. GIVEN : triangle A B C in which A D is the bisector of angle A meeting B C in D such that $BD = DCTOPROVE$: triangleA B C` is an isosceles triangle.

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8. In an isosceles triangle altitude from the vertex bisects the base. GIVEN : An isosceles triangle ABC such that $AB = AC$ and an altitude AD from A on side BC. TO PROVE : D bisects BC i.e. $BD = DC$. Figure

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9. If the altitude from one vertex of a triangle bisects the opposite side, then the triangle is isosceles. GIVEN : A ABC such that the altitude AD from A on the opposite side BC bisects BC i.e., $BD = DC$. TO PROVE : $AB = AC$ i.e. the triangle ABC is isosceles.

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10. Angles opposite to two equal sides of a triangle are equal. GIVEN : ABC in which $AB = AC$ TO PROVE : $\angle C = \angle B$ CONSTRUCTION : Draw the bisector AD of $\angle A$ which meets BC in D Figure

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11. Prove that the perimeter of a triangle is greater than the sum of its altitudes.

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12. In ABC, side AB is produced to D so that $BD = b \cdot$ If $\angle B = 60^0$ and $\angle A = 70^0$, prove that : $AD > CD\ AD > AC$

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13. Prove that in a quadrilateral the sum of all the sides is greater than the sum of its diagonals.

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14. In Figure, $PQRS$ is a quadrilateral in which diagonals PR and QS intersect in O . Show that $PQ + QR + RS + SP > PR + QS$ PQ+QR+RS+SP<2 (PR+QS) Figure

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15. GIVEN : $PQRS$ is a quadrilateral. PQ is its longest side and RS is its shortest side. TO PROVE : (i) $\angle R > \angle P$ (ii) $\angle S > \angle Q$ CONSTRUCTION :

Join PR and QS. Figure

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16. In Figure, AB and CD are respectively the smallest and longest sides of a quadrilateral $ABCD$. Show that $\angle A > \angle C$ and $\angle B > \angle D$.

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17. Of all the line segments drawn from a point P to a line m not containing P, let PD be the shortest. If B and C are points on m such that D is the mid-point of BC, prove that $PB = PC$.

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18. In Figure, AD is a median and BL, CM are perpendiculars drawn from B and C respectively on AD and AD produced. Prove that $BL = CM$. Figure

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19. In Figure, BM and DN are both perpendiculars to the segments AC and $BM = DN$. Prove that AC bisects BD. Figure

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20. If ABC is an isosceles triangle with $AB = AC$. Prove that the perpendiculars from the vertices B and C to their opposite sides are equal.

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21. If the altitudes from two vertices of a triangle to the opposite sides are equal, prove that the triangle is isosceles.

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22. AD and BC are equal perpendiculars to a line segment AB . Show that CD bisects AB.

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23. In ABC, $AB = AC$, and the bisectors of angles B and C intersect at point O . Prove that $BO = CO$ and the ray AO is the bisector of angles BAC.

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24. In Figure, it is given that $AB = EF$, $BC = DE$, $AB \perp BD$ and $FE \perp CE$. Prove that $ABD \cong FEC$.

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25. In Figure, it is given that $AB = BC$ and $AD = EC$. Prove that $ABE \cong CBD$

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26. In Figure, $lIIm$ and M is the mid-point of the line segment AB. Prove that M is also the mid-point of any line segment CD having its end-points on l and m respectively.

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27. In Figure, line l is the bisector of angle A and B is any point on l . BP and BQ are perpendiculars from B to the arms of A. Show that : $APB \cong AQB$ $BP = BQ$ or B is equidistant from the arms of $\angle A$. Figure

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28. In Figure, O is the mid point of AB and CD . Prove that (i) $AOC \cong BOD$ (ii) AC=BD

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29. Prove that measure of each angle of an equilateral triangle is 60^0.

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30. In Figure, it is given that $AE = AD$ and $BD = CE$. Prove that $\triangle AEB \cong \triangle ADC$

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31. In Figure, it is given that $AB = CF, EF = BD$ and $\angle AFE = \angle CBD$. Prove that $AFE \cong CBD$.

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32. Two triangles are congruent if two sides and the included angle of one are equal to the corresponding sides and the included angle of the

other triangle. GIVEN : Two triangles ABC and DEF such that $AB = DE$, $AC = DF$ and $\angle A = \angle D$ PROVE : $ABC \cong DEF$ Figure

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33. In ΔABC, $\angle A = 100^0$ and $AB = AC$. Find $\angle B$ and $\angle C$

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34. Angles opposite to two equal sides of a triangle are equal. GIVEN : ABC in which $AB = AC$ TO PROVE : $\angle C = \angle B$ CONSTRUCTION : Draw the bisector AD of $\angle A$ which meets BC in D Figure

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35. In Figure, X and Y are two points on equal sides AB and AC of a ABC such that $AX = AY$. Prove that $XC = YB$.

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36. Prove that the angle between internal bisector of one base angle and the external bisector of the other base angle of a triangle is equal to one half of the vertical angle.

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37. In ABC and PQR Figure, $AB = PQ$, $BC = QR$ and CB and RQ are extended to X and Y respectively and $\angle ABX = \angle PQY$. Prove that $ABC \cong PQR$. Figure

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38. In Figure, the side BC of ABC is produced to form ray BD as shown. Ray CE is drawn parallel to BA . Show directly, without using the angle sum property of a triangle that $\angle ACD = \angle A + \angle B$ and deduced that $\angle A + \angle B + \angle C = 180^0$.

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39. In a triangle the greater angle has the longer side opposite to it.

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40. If the bisectors of the base angles of a triangle enclose an angle of 135^0, prove that the triangle is a right triangle.

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41. If two sides of a triangle are unequal, the longer side has greater angle opposite to it. GIVEN : A ABC in which $AC > AB$. TO PROVE : $\angle ABC > \angle ACB$ CONSTRUCTION : Mark a point D on AC such that $AB = AD$. Joint BD.

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42. The bisectors of base angles of a triangle cannot enclose a right angle in any case.

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43. ABCD is a square, X and Y are points on sides AD and BC respectively such that AY=BX. Prove that BY=AX and $\angle BAY = \angle ABX$.

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44. In figure, if $PQ \perp PS, PQ \| SR, \angle SQR = 28^0$ and $\angle QRT = 65^0$, then find the values of x and y. Figure

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45. If perpendiculars from any point with an angle on its arms are congruent, prove that it lies on the bisector of that angle.

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46. In figure, if lines PQ and RS intersect at a point T such that $PRT = 40^0$, $\angle RPT = 95^0$ and $\angle TSQ = 75^0$, find $\angle SQT$. Figure

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47. ABC is a triangle is which BE and CF are, respectively, the perpendiculars to the sides AC and AB. If $BE = CF$, prove that ABC is isosceles.

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48. Sides BC, CA and BA of a triangle ABC are produced to D, Q, P respectively as shown in Figure. If $\angle ACD = 100^0$ and $\angle QAP = 35^0$, find all the angles of the triangle. Figure

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49. ABC is a triangle and D is the mid-point of BC . The perpendiculars from D to AB and AC are equal. Prove that the triangle is isosceles.

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50. The side BC of a triangleABC is produced on both sides. Show that the sum of the exterior angles so formed is greater than $\angle A$ by two right angles.

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51. P is a point equidistant from two lines l and m intersecting at a point A, Show that AP bisects the angle between them.

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52. If two parallel lines are intersected by a transversal, prove that the bisectors of the interior angles on the same side of transversal intersect each other at right angles.

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53. If ABC is an isosceles triangle such that $AB = AC$ and AD is an altitude from A on BC. Prove that (i) $\angle B = \angle C$ (ii) AD bisects BC (iii) AD bisects $\angle A$

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54. If PS is the bisector of $\angle QPR$ and $PT \perp QR$. Show that $\angle TPS = \frac{1}{2}(\angle Q - \angle R)$.

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55. Of all the line segments that can be drawn to a given line, from a point, not lying on it, the perpendicular line segment is the shortest. GIVEN : A straight line l and a point P not lying on l. $PM \perp l$ and N is any point on 1 other than M. TO PROVE : `P M

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56. A triangle ABC is right angled at A. AL is drawn perpendicular to BC . Prove that $\angle BAL = \angle ACB$.

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57. The sum of any two sides of a triangle is greater than the third side. GIVE : A triangle ABC TO PROVE : $AB + AC > BC$, $AB + BC > AC$ and $BC + AC > AB$ CONSTRUCTION : Produce side BA to D such that $AD = AC$. Join CD.

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58. In Figure AB||DC , if $x = \frac{4y}{3}$ and $y = \frac{3z}{8}$, find $\angle BCD, \angle ABC$ and $\angle BAD$.

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59. AB is a line segment and line l is its perpendicular bisector. If a point P lies on l, show that P is equidistant from A and B.

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60. ABC is a triangle in which $\angle A = 72^0$, the internal bisectors of angles B and C meet in O . Find the magnitude of $\angle BOC$.

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61. AB is a line-segment. P and Q are points on opposite sides of AB such that each of them is equidistant from the points A and B. Show that the

line PQ is the perpendicular bisector of AB

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62. If one angle of a triangle is equal to the sum of the other two, show that the triangle is a right triangle.

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63. Suppose line segments AB and CD intersect at O in such a way that $AO = OD$ and $OB = OC$. Prove that $AC = BD$ but AC may not be parallel to BD .

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64. Two angles of a triangle are equal and the third angle is greater than each of those angles by 30^0 Determine all the angle of the triangle.

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65. If D is the mid-point of the hypotenuse AC of a right triangle ABC, prove that $BD = \frac{1}{2}AC$. GIVEN : A ABC in which $\angle B = 90^0$ and D is the mid-point of AC. TO PROVE : $BD = \frac{1}{2}AC$ CONSTRUCTION Produce BD to E so that $BD = DE$. Join EC.

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66. In triangle ABC, $\angle B = 45^0$, $\angle C = 55^0$ and bisector of $\angle A$ meets BC at a point D. Find $\angle ADB$ and $\angle ADC$.

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67. AB is a line segment, AX and BY are two equal line segments drawn on opposite sides of line AB such that $AX \| BY$. If AB and XY intersect each other at P, prove that $\triangle APX \cong \triangle BPY$. AB and XY bisect each other.

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68. In Figure, if $AB \mid\mid DE, \angle BAC = 35^0$ and $\angle CDE = 53^0$, find $\angle DCE$.

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69. l and m are two parallel lines intersected by another pair of parallel lines p and q as shown in figure. Show that $\triangle ABC \cong \triangle CDA$.

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70. (Exterior Angle Theorem): If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interior opposite angles. GIVEN : A triangle ABC, D is a point of BC produced, forming exterior angle $\angle 4$. TO PROVE : $\angle 4 = \angle 1 + \angle 2$ i.e. , $\angle ACD = \angle CAB + \angle CBA$.

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71. Two triangles are congruent if include two angles and the included side of one triangle are equal to the corresponding two angles and the included side of the other triangle. GIVE : Two $\triangle ABC$ and DEF such that $\angle B = \angle E, \angle C = \angle F$ and $BC = EF$ TO PROVE : $\triangle ABC \cong \triangle DEF$

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72. A, B, C are three angles of a triangle. If $A - B = 15^0, B - C = 30^0,$ find $\angle A, \angle B$ and $\angle C$

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73. In the figure, diagonal AC of a quadrilateral $ABCD$ bisects the angles A and C. Prove that $AB = AD$ and $CB = CD$

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74. In a triangle $ABC, \angle ABC = \angle ACB$ and the bisectors of $\angle ABC$ and $\angle ACB$ intersect at O such that $\angle BOC = 120^0$. Show that $\angle A = \angle B = \angle C = 60^0$

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75. In Figure, $\angle BCD = \angle ADC$ and $\angle ACB = \angle BDA$. Prove that $AD = BC$ and $\angle A = \angle B$

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76. If each angle of a triangle is less than the sum of the other two, show that the triangle is acute angled.

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77. In two right triangles, one side and an acute angle of one triangle are equal to one side and the corresponding acute angle of the other triangle. Prove that the two triangles are congruent.

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78. If Figure, if $QT \perp PR$, $\angle TQR = 40^0$ AND $\angle SPR = 30^0$, find x and y. Figure

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79. If D is any point on the base BC produced, of an isosceles triangle ABC, prove that $AD > AB$.

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80. sides QP and RQ of PQR are produced to point S and T respectively. If $\angle SPR = 135^0$ and $\angle PQT = 110^0$, find $\angle PRQ$.

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81. Show that in a right triangle the hypotenuse is the longest side. GIVEN : A right triangle ABC in which $\angle ABC = 90^0$. TO PROVE : Hypotenuse AC is the longest side, i.e. (i) $AC > AB$ (ii) $AC > BC$

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82. An exterior angle of a triangle is 110^0 , and one of the interior opposite angles is 30^0. Find the other two angles of the triangle.

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83. Show that the sum of the three altitudes of a triangle is less than the sum of three sides of the triangle. GIVEN :triangle A B C in which $AD \perp BC, BE \perp AC$ and $CF \perp AB$. PROVE : $AD + BE + CF < AB + BC + AC$

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84. The sides BC, CA and AB of a triangle $ABC,$ are produced in order, forming exterior angles $\angle ACD, \angle BAE$ and $\angle CBF$. Show that $\angle ACD + \angle BAE + \angle CBF = 360^0$

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85. Prove that any two sides of a triangle are together greater than twice the median drawn to the third side. GIVEN : $\triangle ABC$ in which AD is a median. PROVE : $AB + AC > 2AD$ CONSTRUCTION : Produce AD to E such that $AD = DE$. Join EC.

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86. Prove that the sum of the three angles of a triangle is 180^0.

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87. In a $\triangle ABC$, if $\angle A = 50^0$ and $\angle B = 60^0$, determine the shortest and largest sides of the triangle.

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88. Two parallel lines l and m are intersected by a transversal p . Show that the quadrilateral formed by the bisectors of interior angles is a rectangle.

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89. In figure, sides LM and LN of LMN are extended to P and Q respectively. If $x > y$, show that $LM > LN$.

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90. In a triangle ABC, $\angle B = 105^0$, $\angle C = 50^0$, Find $\angle A$

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91. In figure, $PQ = PR$. Show that $PS > PQ$.

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92. The sum of two equal angles of a triangle is equal to its third angle. Determine the measure of the third angle.

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93. In figure, $AB > AC$. Show that $AB > AD$.

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94. Of the three angles of a triangle, one is twice the smallest and another is three times the smallest. Find the angles.

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95. Prove that the perimeter of a triangle is greater than the sum of the three medians. GIVEN : A ABC in which AD, BE and CF are its medians. TO PROVE : $AB + BC + AC > AD + BE + CF$

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96. If the angles of a triangle are in the ratio $2:3:4$. determine three angles.

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97. Show that the difference of any two sides of a triangle is less than the third side. GIVEN : $\triangle ABC$ TO PROVE : (i) AC-AB < BC

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98. The sum of two angles of a triangle is 80^0 and their difference is 20^0 . Find all the angles.

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99. A triangle ABC is an isosceles triangle if any one of the following conditions hold: (a) Altitude AD bisects $\angle BAC$ (b) Bisector of $\angle BAC$ is perpendicular to the base BC.

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100. In a $\triangle ABC$, if $2\angle A = 3\angle B = 6\angle C$, determine $\angle A$, $\angle B$ and $\angle C$.

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101. In a right angled triangle, one acute angle is double the other. Prove that the hypotenuse is double the smallest side. GIVEN : A ABC in which $\angle B = 90^0$ and $\angle ACB = 2\angle CAB$ .to prove : $AC = 2BC$

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102. The sides AB and AC of a ABC are produced to P and Q respectively. If the bisectors of $\angle PBC$ AND $\angle QCB$ intersect at O, then $\angle boc = 90^0 - \frac{1}{2}\angle A$ GIVEN : A ABC in which sides AB and AC are produced to P and Q respectively. The bisectors of $\angle PBC$ and $\angle QCB$ intersect at O.

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103. In Figure, BD and CE are two altitudes of a ABC such that $BD = CE$. Prove that ABC is isosceles. Figure

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104. The side BC of a $\triangle ABC$ is produced, such that D is on the ray BC. The bisector of $\angle A$ meets BC in L as shown in Figure. Prove that $\angle ABC + \angle ACD = 2\angle ALC$

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105. In Figure, AP and BQ are perpendiculars to the line segment AB and $AP = BQ$. Prove that O is the mid-point of line segment AB and PQ. Figure

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106. In Figure, $\angle X = 62^0$, $\angle XYZ = 54^0$. If YO and ZO are bisectors of $\angle XYZ$ and $\angle XZY$ respectively of XYZ, find $\angle OZY$ and $\angle YOZ$. Figure

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107. AD and BE are respectively altitudes of triangleÂ ABC such that AE=BD. Prove that AD=BE.

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108. In Figure, $\angle QPR = \angle PQR$ and M and N are respectively on sides QR and PR of PQR such that $QM = PN$. Prove that $OP = OQ$, where O is the point of intersection of PM and QN.

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109. In Figure, line segment AB is parallel to another line segment CD. O is the mid-point of AD. Show that: (i)$AOB \cong DOC$ (ii)O is also the mid-point of BC.

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110. AD and BE are respectively altitudes of an isosceles triangle ABC with $AC = BC$. Prove that $AE = BD$.

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111. PQR is a triangle in which $PQ = PR$ and S is any point on the side PQ. Through S, a line is drawn parallel to QR and intersecting PR at T. Prove that $PS = PT$.

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112. If the bisector of the exterior vertical angle of a triangle be parallel to the base. Show that the triangle is isosceles.

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113. Prove that Two right triangles are congruent if the hypotenuse and one side of one triangle are respectively equal to the hypotenuse and one side of the other triangle.

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114. AD,Â BE and CF , the altitudes of triangle ABC are equal. Prove that ABC is an equilateral triangle.

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115. A point O is taken inside an equilateral four sided figure $ABCD$ such that its distances from the angular points D and B are equal. Show that AO and OC are in one and the same straight line. GIVEN : A point O inside an equilateral quadrilateral four sided figure $ABCD$ such that $BO = OD$. TO PROVE : AO and OC are in one and the same straight line.

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116. In ΔPQR, if $PQ = QR$ and L, M and N are the mid-points of the sides PQ, QR and RP respectively. Prove that $LN = MN$.

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117. If two isosceles triangles have a common base, prove that the line joining their vertices bisects them at right angles.

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118. Side Side Side(SSS) Congruence : Two triangles are congruent if the three sides of one triangle are equal to the corresponding three sides of the other triangle.

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119. $ABCD$ is a parallelogram, if the two diagonals are equal, find the measure of $\angle ABC$.

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120. In a ABC, it is given that $AB = AC$ and the bisectors of $\angle B$ and $\angle C$ intersect at O, If M is a point on BO produced, prove that $\angle MOC = \angle ABC$.

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121. ABC is a triangle in which $\angle B$ =2 $\angle C\dot{D}$ is a point on BC such that AD bisects $\angle BAC$ and $AB = CD$. Prove that $\angle BAC = 72^0$.

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122. In ABC, $\angle A = 100^0 and\ AB = AC$. Find $\angle B\ and\ \angle C$

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123. In Figure, $AB = AC\ and\ \angle ACD = 120^0$. Find $\angle A$

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124. Prove that measure of each angle of an equilateral triangle is 60^0.

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125. In Figure O is the mid-point of $AB \, and \, CD$. Prove that $AOC \cong BOD$ (b) $AC = BD$ (iii) $AC \, | \, | \, BD$

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126. In Figure, it is given that $AB = CF, \; EF = BD \, and \, \angle AFE = \angle CBD$. Prove that $AFE \cong CBD$

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127. In Figure, it is given that $AE = AD \, and \, BD = CE$. Prove that $AEB \cong ADC$

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128. In ΔABC and ΔPQR, $AB = PQ$, $BC = QR$ and CB and RQ are extended to X and Y respectively and $\angle ABX = \angle PQY$. Prove that $ABC \cong PQR$.

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129. In Figure, X, Y are two points on equal sides AB and AC of a ABC such that $AX = AY$. Prove that $XC = YB$

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130. Suppose line segments AB and CD intersect at O in such a way that $AO = OD$ and $OB = OC$. Prove that $AC = BD$ but AC may not be parallel to BD.

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131. If D is the mid-point of the hypotenuse AC of a right triangle ABC, prove that $BD = \frac{1}{2}AC$

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132. AB is a line segment and line l is its perpendicular bisector. If a point P lies on l, show that P is equidistant from A and B.

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133. In quadrilateral $ACBD$, $AC = AD \; and \; AB$ bisects $\angle A$. Show that $ABC \cong ABD$. What can you say about $BC \; and \; BD$?

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134. Prove that ABC is isosceles if any one of the following holds: $Altitude$ AD bisects BC Median AD is perpendicular to the base BC

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135. In Figure, $PQRS$ is a quadrilateral and $T \, and \, U$ are respectively points on PS and RS such that $PQ = RQ, \, \angle PQT = \angle RQU \, and \, \angle TQS = \angle UQS.$ Prove that $QT = QU.$

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136. In Figure, $PS = QR \, and \, \angle SPQ = \angle RQP.$ Prove that $PQS \cong QPR, \, PR = QS \, and \, \angle QPR = \angle PQS$

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137. In right triangle ABC , right angle at $C, \, M$ is the mid-point of the hypotenuse $AB.$ C is jointed to M and produced to a point D such that $DM = CM.$ Point D is joined to point $B.$ Show that $AMC \cong BMD$ (ii) $\angle DBC = \angle ACB \, DBC \cong ACB$ (iii) $CM = \frac{1}{2} AB$

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138. In Figure, $AC = AE,\ AB = AD\ and\ \angle BAD = \angle EAC$. Prove that $BC = DE$

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139. In Figure, the side $BA\ and\ CA$ have been produced such that $BA = AD\ and\ CA = AE$. Prove that segment $DE \| \| BC$

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140. In triangle $PQR,$ if $PQ = RQ\ and\ L,\ M\ and\ N$ are the mid-points of the sides $PQ,\ QR\ and\ RP$ respectively. Prove that $LN = MN.$

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141. In Figure, $PQRS$ is a square and SRT is an equilateral triangle. Prove that $PT = QT$ (ii) $\angle TQR = 15^0$

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142. Prove that the medians of an equilateral triangle are equal.

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143. In a ABC, if $\angle A = 120^0 and\ AB = AC$. Find $\angle B\ and\ \angle C$

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144. In ABC, if $AB = AC\ and\ \angle B = 70^0$, find $\angle A$

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145. The vertical angle of an isosceles triangle is 100^0. Find its base angles.

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146. In Figure, $AB = AC \; and \; \angle ACD = 100^0$, find $\angle BAC$

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147. Find the measure of each exterior angle of an equilateral triangle.

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148. If the base of an isosceles triangle is produced on both sides, prove that the exterior angles so formed are equal to each other.

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149. In Figure, $AB = AC \; and \; DB = DC$, find the ratio $\angle ABD : \angle ACD$

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150. Determine the measure of each of the equal angles of a right-angled isosceles triangle.

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151. ABC is a right-angled triangle is which $\angle A = 90^0 and \; AB = AC$. Find $\angle B \; and \; \angle C$

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152. AB is a line segment. $P \; and \; Q$ are points on opposite sides of AB such that each of them is equidistant from the points $A \; and \; B$ (in

figure). Show that the line PQ is perpendicular bisector of AB.

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153. In Figure, diagonal AC of a quadrilateral $ABCD$ bisects the angles $A \text{ and } C$. Prove that $AB = AD \text{ and } CB = CD$

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154. AB is a line segment. $AX \text{ and } BY$ are two equal line segments drawn on opposite sides of line AB such that $AX \| BY$. If $AB \text{ and } XY$ intersect each other at P, prove that (i)$APX \cong BPY$ (ii) $AB \text{ and } XY$ bisect each other.

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155. $l \text{ and } m$ are two parallel lines intersected by another pair of parallel lines $p \text{ and } q$ as shown in figure. Show that $ABC \cong CDA$

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156. In Figure, if $AB \mid\mid DC$ and P is the mid-point BD, prove that P is also the midpoint of AC

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157. In Figure, $\angle BCD = \angle ADC$ and $\angle ACB = \angle BDA$. Prove that $AD = BC$ and $\angle A = \angle B$

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158. In two right triangles, one side and an acute angle of one triangle are equal to one side and the corresponding acute angle of the other triangle. Prove that the two triangles are congruent.

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159. In Figure, $AC = BC,\ \angle DCA = \angle ECB\ and\ \angle DBC = EAC$. Prove that triangle $DBC\ and\ EAC$ are congruent, and hence $DC = EC\ and\ BD = AE$

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160. In Figure, it is given that $RT = TS,\ \angle 1 = 2\angle 2\ and\ \angle 4 = 2\angle 3$. Prove that $RBT \cong SAT$

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161. Two lines $AB\ and\ CD$ intersect at O such that BC is equal and parallel to AD. Prove that the lines $AB\ and\ CD$ bisect at O

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162. $BD\ and\ CE$ are bisectors of $\angle B\ and\ \angle C$ of an isosceles ABC with $AB = AC$. Prove that $BD = CE$

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163. In Figure, $AB = AC \; and \; DB = DC$. Prove that $\angle ABD = \angle ACD$

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164. ABC is an isosceles triangle with $AB = AC$. Side BA is produced to D such that $AB = AD$. Prove that $\angle BCD$ is a right angle.

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165. In Figure, $AB = AC\dot{B}E \; and \; CF$ are respectively the bisectors of $\angle B$ and $\angle C$. Prove that $ECB \cong FCB$

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166. If ABC is an isosceles triangle with $AB = AC$. Prove that the perpendiculars from the vertices $B \, and \, C$ to their opposite sides are equal.

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167. If the altitudes from two vertices of a triangle to the opposite sides are equal, prove that the triangle is isosceles.

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168. In Figure, it is given that $\angle A = \angle C \, and \, AB = BC$. Prove that $ABD \cong CBE$

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169. $AD \text{ and } BC$ are equal perpendiculars to a line segment AB . Show that CD bisects AB.

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170. In $ABC,\ AB = AC,$ and the bisectors of angles $B \text{ and } C$ intersect at point O. Prove that $BO = CO$ and the ray AO is the bisector of angle BAC

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171. In Figure, it is given that $AB = EF,\ BC = DE,\ AB \perp BD \text{ and } FE \perp CE.$ Prove that $ABD \cong FEC.$

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172. In Figure, it is given that $AB = BC \; and \; AD = EC$. Prove that (i) $ABE \cong CBD$ (ii) $BD = BE$

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173. In Figure, $l \mid \mid m$ and M is the mid-point of the line segment AB. Prove that M is also the mid-pooint of any line segment CD having its end-points on $l \; and \; m$ respectively.

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174. In Figure, line l is the bisector of angle $A \; and \; B$ is any point on $l\dot{B}P \; and \; BQ$ are perpendiculars from B to the arms of A. Show that: $APB \cong AQB$ BP=BQ or B is equidistant from the arms of $\angle A$

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175. In Figure, AD is a median and BL, CM are perpendiculars drawn from $B\,and\,C$ respectively on $AD\,and\,AD$ produced. Prove that $BL = CM$

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176. In Figure, $BM\,and\,DN$ are both perpendiculars to the segments $AC\,and\,BM = DN$. Prove that AC bisects BD.

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177. In a right angled triangle, one acute angle is double the other. Prove that the hypotenuse is double the smallest side.

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178. A triangle ABC is an isosceles triangle if any one of the following conditions hold: Altitude AD bisects $\angle BAC$ Bisector of $\angle BAC$ is perpendicular to the base BC

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179. A triangle ABC is an isosceles triangle if any one of the following conditions hold: Bisector of $\angle BAC$ is perpendicular to the base BC

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180. In Figure, $AP\ and\ BQ$ are perpendiculars to the line segment $AB\ and\ AP = BQ$. Prove that O is the mid-point of line segment $AB\ and\ PQ$

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181. In Figure, ABC is an isosceles triangle with $AB = AC$, BD and CE are two medians of the triangle. Prove that $BD = CE$

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182. In Figure, $AD = AE$ and D and E are points on BC such that $BD = EC$. Prove that $AB = AC$

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183. In Figure, if $AB = AC$ and $BE = CD$, prove that $AD = AE$.

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184. In Figure, $PS = PR$, $\angle TPS = \angle QPR$. Prove that $PT = PQ$

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185. In Figure, If $PQ = PT \; and \; \angle TPS = \angle QPR,$ prove that PRS is isosceles

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186. In Figure, $ABC \; and \; DBC$ are two isosceles triangles on the same base BC such that $AB = AC \; and \; DB = CD.$ Prove that $\angle ABD = \angle ACD$

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187. In Figure, $ABC \; and \; DBC$ are two triangles on the same base BC such that $AB = AC \; and \; DB = DC.$ Prove that $\angle ABD = \angle ACD$

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188. In Figure, BD and CE are two altitudes of a ABC such that $BD = CE$. Prove that ABC is isosceles.

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189. In Figure, $\angle QPR = \angle PQR$ and M and N are respectively on sides QR and PR of PQR such that $QM = PN$. Prove that $OP = OQ$, where O is the point of intersection of PM and QN

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190. AD and BE are respectively altitudes of ABC such that $AE = BD$. Prove that $AD = BE$.

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191. In Figure, $AD\,and\,BE$ are respectively altitudes of an isosceles triangle ABC with $AC = BC$. Prove that $AE = BD$

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192. In Figure, line segments AB is parallel to another line segment CD. O is the mid-point of AD. Show that: $AOB \cong DOC$.

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193. In Figure, line segments AB is parallel to another line segment $CD\dot{O}$ is the mid-point of AD. Show that: O is also the mid-point of BD

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194. In two right triangles one side an acute angle of one are equal to the corresponding side and angle of the other. Prove that the triangles are

congruent.

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195. If the bisector of the exterior vertical angle of a triangle be parallel to the base. Show that the triangle is isosceles.

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196. In an isosceles triangle, if the vertex angle is twice the sum of the base angles, calculate the angles of the triangle.

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197. PQR is a triangle is which $PQ = PR \; and \; S$ is any point on the side PQ . Through $S,$ a line is drawn parallel to QR and intersecting PR at T. Prove that $PS = PT$

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198. In a ABC, it is given that $AB = AC$ and the bisectors of $\angle B \, and \, C$ intersect at O. If M is a point on BO produced, prove that $\angle MOC = \angle ABC$

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199. P is a point on the bisector of an angle $\angle ABC$. If the line through P parallel to AB meets BC at Q, prove that triangle BPQ is isosceles.

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200. Prove that each angle of an equilateral triangle is 60^0

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201. Angle A, B, C of a triangle ABC are equal to each other. Prove that ABC is equilateral.

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202. ABC is a triangle in which $\angle B = 2\angle C$. D is a point on BC such that AD bisects $\angle BAC \; and \; AB = CD$. Prove that $\angle BAC = 72^\circ$.

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203. ABC is a right angled triangle in which $\angle A = 90^0 and \; AB = AC$. Find $\angle B \; and \; \angle C$

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204. In Figure, it is given that $AB = CD \; and \; AD = BC$. Prove that $ADC \cong CBA$.

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205. $ABCD$ is a parallelogram, if the two diagonals are equal, find the measure of $\angle ABC$.

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206. If two isosceles triangles have a common base, prove that the line joining their vertices bisects them at right angles.

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207. $ABC\ and\ DBC$ are two isosceles triangles on the same bas BC and vertices $A\ and\ D$ are on the same side of BC . If AD is extended to intersect BC at P, show that $ABD \cong ACD$ (ii) $ABP \cong ACP$

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208. $ABC\ and\ DBC$ are two isosceles triangles on the same bas BC and vertices $A\ and\ D$ are on the same side of BC . If AD is extended to intersect BC at P, show that AP bisects $\angle A$ as well as $\angle D$ and AP is the perpendicular bisector of BC

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209. A point O is taken inside an equilateral four sided figure $ABCD$ such that its distances from the angular points D and B are equal. Show that AO and OC are in one and the same straight line. GIVEN : A point O inside an equilateral quadrilateral four sided figure $ABCD$ such that $BO = OD$. TO PROVE : AO and OC are in one and the same straight line.

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210. In Figure, two sides $AB\ and\ BC$ and the median AD of ABC are equal respectively to the two sides $PQ\ and\ QR$ and the median PM of

the other triangle PQR. Prove that $ABD \cong PQM$ (ii) $ABC \cong PQR$

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211. In Figure, $AD = BC \; and \; BD = CA$. Prove that ∠A D B= ∠B C A a n d ∠D A B=∠ C B A`.

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212. In Figure, $AB = AC$, D is the point in the interior of ABC such that $\angle DBC = \angle DCB$. Prove that AD bisects BAC of ABC.

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213. In Figure, it is given that $AB = CD \; and \; AD = BC$. Prove that $ADC \cong CBA$

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214. In A PQR, if $PQ = QR$ and L, M and N are the mid-points of the sides PQ, PR and RP respectively. Prove that $LN = MN$

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215. AD, BE and CF, the altitudes of ABC are equal. Prove that ABC is an equilateral triangle.

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216. In Figure, it is given that $LM = MN$, $QM = MR$, $ML \perp PQ$ and $MN \perp PR$. Prove that $PQ = PR$

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217. If ABC is an isosceles triangle such that $AB = AC$ and AD is an altitude from A on BC . Prove that (i) $\angle B = \angle C$ (ii) AD bisects BC (iii) AD bisects $\angle A$

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218. P is a point equidistant from two lines l and m intersecting at point A (see Fig. 7.38). Show that the line AP bisects the angle between them.

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219. ABC is a triangle and D is the mid-point of BC . The perpendiculars from D to AB and AC are equal. Prove that the triangle is isosceles.

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220. ABC is a triangle is which BE and CF are, respectively, the perpendiculars to the sides AC and AB. If $BE = CF$, prove that ABC is isosceles.

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221. In perpendiculars from any point within an angle on its arms are congruent, prove that it lies on the bisector of that angle.

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222. In Figure, $AD \perp CD$ and $CB \perp CD$ If $AQ = BP$ and $DP = CQ$, prove that $\angle DAQ = \angle CBP$.

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223. $ABCD$ is a square, $X \, and \, Y$ are points on sides $AD \, and \, BC$ respectively such that $AY = BX$. Prove that $BY = AX \, and \, \angle BAY = \angle ABX$

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224. Which of the following statements are true (T) and which are false (F): Side opposite to equal angles of a triangle may be unequal. Angle opposite to equal sides of a triangle are equal. The measure of each angle of an equilateral triangle is 60^0 If the altitude from one vertex of a triangle bisects the opposite side, then the triangle may be isosceles. The bisectors of two equal angles of a triangle are equal. If the bisector of the vertical angle of a triangle bisects the base, then the triangle may be isosceles. The two altitudes corresponding to two equal sides of a triangle need not be equal. If any two sides of a right triangle are respectively equal to two sides of other right triangle, then the two triangles are congruent. Two right triangles are congruent if hypotenuse

and a side of one triangle are respectively equal to the hypotenuse and a side of the other triangle.

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225. Fill in the blanks in the following so that each of the following statements is true.

(i) Sides opposite to equal angles of a triangle are .....

(ii) Angle opposite to equal sides of a triangle are .....

(iii) In an equilateral triangle all angles are .....

(iv) In a ABC if $\angle A = \angle C,$ then $AB =$ .....

(v) If altitudes $CE \; and \; BF$ of a triangle ABC are equal, then $AB =$ .....

(vi) In an isosceles triangle ABC with $AB = AC,$ if $BD \; and \; CE$ are its altitudes, then BD is ..... $CE.$

(vii) In right triangles $ABC \; and \; DEF,$ if hypotenuse $AB = EF$ and side $AC = DE,$ then $ABC \cong$ ....

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226. In a ABC, if $\angle A = 45^0$ and $\angle B = 70^0$. Determine the shortest and largest sides of the triangle.

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227. In a ABC, if $\angle A = 50^0$ and $\angle B = 60^0$, determine the shortest and largest sides of the triangle.

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228. In Figure, $PQ > PR$. QS and RS are the bisectors of $\angle Q$ and $\angle R$ respectively. Prove that $SQ > SR$.

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229. In Figure, sides LM and LN OF $\triangle LMN$ are extended to P and Q respectively. If $x > y$, show that $LM > LN$.

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230. In Figure, $PQ = PR$. Show that $PS > PQ$

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231. In Figure, $AB > AC$. Show that $AB > AD$.

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232. If D is any point on the base BC produced, of an isosceles triangle ABC, prove that $AD > AB$.

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233. In Figure, if AD is the bisector of LA, show that: $AB > BD$ (ii) $AC > CD$

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234. Show that in a right angled triangle, the hypotenuse is the longest side.

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235. In Figure, $AC > AB$ and AD is the bisector of $\angle A$. Show that $ADC > \angle ADB$.

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236. Show that the sum of the three altitudes of a triangle is less than the sum of three sides of the triangle.

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237. Prove that any two sides of a triangle are together greater than twice the median drawn to the third side.

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238. Prove that the perimeter of a triangle is greater than the sum of its three medians.

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239. Show that the difference of any two sides of a triangle is less than the third side.

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240. In Figure, PQR is a triangle and S is any point in its interior, show that $SQ + SR < PQ + PR$. Given : S is any point in the interior of PQR To Prove : $SQ + SR < PQ + PR$ Construction: Produce QS to meet PR in T

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241. In PQR , S is any point on the side QR . Show that $PQ + QR + RP > 2PS$

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242. In Figure, $AP \perp l \, and \, PR > PQ$. Show that $AR > AQ$.

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243. In Figure, $PQRS$ is a quadrilateral. PQ is its longest side and RS is its shortest side. Prove that $\angle R > \angle P \, and \, \angle S > \angle Q$.

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244. In Figure, $PQRS$ is a quadrilateral in which diagonals $PR \, and \, QS$ intersect in O. Show that :

(i) $PQ + QR + RS + SP > PR + QS$

(ii) $PQ + QR + RS + SP < 2(PR + QS)$

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245. Of all the lines segments drawn from a point P to a line m not containing P, let PD be the shortest. If $B \, and \, C$ are points on m such that D is the mid-point of BC, prove that $PB = PC$.

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246. In Figure, $\angle E > \angle A \, and \, \angle C > \angle D$. Prove that $AD > EC$

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247. In Figure, T is a point on side QR of PQR and S is a point such that $RT = ST$. Prove That : $PQ + PR > QS$

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248. In Figure, $AC > AB \, and \, D$ is the point on AC such that $AB = AD$. Prove that $BC > CD$

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249. In Figure, $AB \, and \, CD$ are respectively the smallest and longest sides of a quadrilateral $ABCD$. Show that $\angle A > \angle C \, and \, \angle B > \angle D$

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250. In ABC, if $\angle A = 40^0 and \, \angle B = 60^0$. Determine the longest and shortest sides of the triangle.

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251. In a ABC, if $\angle B = \angle C = 45^0$, which is the longest side?

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252. In ABC, side AB is produced to D so that $BD = BC$. If $\angle B = 60^0$ *and* $\angle A = 70^0$, prove that: $AD > CD$ (ii) $AD > AC$

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253. Is it possible to draw a triangle with sides of length $2cm$, $3cm$ *and* $7cm$?

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254. In ABC, $\angle B = 35^0$, $\angle C = 65^0$ and the bisector of $\angle BAC$ meets BC in P. Arrange AP, BP *and* CP in descending order.

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255. O is any point in the interior of ABC. Prove that

$AB + AC > OB + OC$ $AB + BC + CA > OA + OB + OC$

$OA + OB + OC > \frac{1}{2}(AB + BC + CA)$

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256. Prove that the perimeter of a triangle is greater than the sum of its altitudes.

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257. Prove that in a quadrilateral the sum of all the sides is greater than the sum of its diagonals.

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258. In Figure, prove that $CD + DA + AB + BC > 2AC$

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259. Which of the following statements are true (T) and which are false (F)?

(i) Sum of the three sides of a triangle is less than the sum of its three altitudes.

(ii) Sum of any two sides of a triangle is greater than twice the median drawn to the third side.

(iii) Sum of any two sides of a triangle is greater than the third side.

(iv) Difference of any two sides of a triangle is equal to the third side.

(v) If two angles of a triangle are unequal, then the greater angle has the larger side opposite to it.

(vi) Of all the line segments that can be drawn from a point to a line not containing it, the perpendicular line segment is the shortest one.

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260. Fill in the blanks to make the following statements true: In a right triangle the hypotenuse is the ..... side. The sum of three altitudes of a triangle is ..... than its perimeter. The sum of any two sides of a triangle is ..... than the third side. If two angles of a triangle are unequal, then the smaller angle has the ..... side opposite to it. Difference of any two sides of a triangle is ..... than the third side. If two sides of a triangle are unequal, then the larger side has ..... angle opposite to it.

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261. In two congruent triangles $ABC \text{ and } DEF$, if $AB = DE \text{ and } BC = EF$. Name the pairs of equal angles.

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262. In two triangles $ABC \text{ and } DEF$, it is given that $\angle A = \angle D$, $\angle B = \angle E$ and $\angle C = \angle F$. Are the two triangles necessarily congruent?

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263. If $ABC \text{ and } DEF$ are two triangles such that $AC = 2.5\ cm,\ BC = 5\ cm,\ \angle C = 75^0,\ DE = 2.5cm,\ DF = 5\ cm \text{ and } \angle$. Are two triangles congruent?

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264. In two triangles $ABC \text{ and } ADC,$ if $AB = AD \text{ and } BC = CD.$ Are they congruent?

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265. In triangle $ABC \text{ and } CDE,$ if $AC = CE,\ BC = CD,\ \angle A = 60^0,\ \angle C = 30^0 \text{ and } \angle D = 90^0.$ Are two triangle congruent?

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266. ABC is an isosceles triangle in which $AB = AC, BE \, and \, CF$ are its two medians. Show that $BE = CF$.

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267. Find the measure of each angle of an equilateral triangle.

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268. ΔCDE is an equilateral triangle formed on a side CD of a square $ABCD$. Show that $\Delta ADE \cong \Delta BCE$.

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269. Show that the sum of the three altitudes of a triangle is less than the sum of three sides of the triangle.

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270. In Figure, if $AB = AC \; and \; \angle B = \angle C$. Prove that $BQ = CP$

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271. If $ANC \cong LKM,$ then side of LKM equal to side AC of ABC is

(a) LK (b) KM (c) LM (d) None of these

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272. If $ABC \cong ACB,$ then ABC is isosceles with

(a)$AB = AC$ (b) $AB = BC$ (c) $AC = BC$ (d) $None \; of \; these$

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273. If $ABC \cong PQR$ and ABC is not congruent to $RPQ,$ then which of the following not true: (a)$BC = PQ$ (b) $AC = PR$ (c) $AB = PQ$ (d)

$QR = BC$

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274. In triangles $ABC\ and\ PQR$ three equality relations between some parts are as follows: $AB = QP,\ \angle B = \angle P\ and\ BC = PR$ State which of the congruence conditions applies: (a) SAS (b) ASA (c) SSS (d) RHS

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275. In triangles $ABC\ and\ PQR,$ if $\angle A = \angle R,\ \angle B = \angle P\ and\ AB = RP$, then which one of the following congruence conditions applies: SAS (b) ASA (c) SSS (d) RHS

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276. If $PQR \cong EFD,$ then $ED =$ PQ (b) QR (c) PR (d) None of these

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277. If $\Delta PQR \cong \Delta EFD$, then $\angle E =$

(a) $\angle P$

(b) $\angle Q$

(c) $\angle R$

(d) None of these

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278. In a ABC, if $AB = AC \, and \, BC$ is produced to D such that $\angle ACD = 100^0$, then $\angle A =$

(a) 20^0 (b) 40^0 (c) 60^0 (d) 80^0

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279. In an isosceles triangle, if the vertex angle is twice the sum of the base angles, then the measure of vertex angle of the triangle is

(a) 100^0 (b) 120^0 (c) 110^0 (d) 130^0

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280. D, E, F are the mid-point of the sides BC, CA and AB respectively of $\triangle ABC$. Then DEF is congruent to triangle.

$(a) ABC$

(b) AEF

(c) BFD, CDE

(d) AFE, BFD, CDE

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281. Which of the following is not a criterion for congruence of triangles?

SAS (b) SSA (c) ASA (d) SSS

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282. In Figure, the measure of $\angle B'A'C'$ is

(a) 50^0

(b) 60^0

(c) 70^0

(d) 80^0

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283. If ABC and DEF are two triangles such that $ABC \cong FDE \, and \, AB = 5cm, \, \angle B = 40^0 \, and \, \angle A = 80^0$. Then, which of the following is true? $(a) DF = 5cm, \, \angle F = 60^0$ (b) $DE = 5cm, \, \angle E = 60^0$ $(c) DF = 5 \, cm, \, \angle E = 60^0$ (d) $DE = 5cm, \, \angle D = 40^0$

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284. In Figure, $AB \perp BE \, and \, FE \perp BE$. If $BC = DE \, and \, AB = EF$, then ABD is congruent to: EFC (b) ECF (c) CEF (d) FEC

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285. $In figure ABC$ is an isosceles triangle such that $AB = AC \, and \, AD$ is the median to base BC . Then, $\angle BAD =$ 55^0 (b) 70^0 (c) 35^0 (d) 110^0

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286. In Figure, if $AE \mid \mid DC$ and $AB = AC,$ the value of $\angle ABD$ is 70^0 (b) 110^0 (c) 120^0 (d) 130^0

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287. In Figure, ABC is an isosceles triangle whose side AC is produced to E . Through $C,$ CD is drawn parallel to BA . The value of x is 52^0 (b) 76^0 (c) 156^0 (d) 104^0

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288. In Figure, X is a point in the interior of square $ABCD.$ $AXYZ$ is also a square. If $DY = 3 \, cm \, and \, AZ = 2 \, cm,$ then $BY =$

(a) $5cm$

(b) $6\ cm$

(c) $7\ cm$

(d) $8\ cm$

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289. In Figure, ABC is a triangle in which $\angle B = 2\angle C$. D is a point on side BC such that AD bisects $\angle BAC\ and\ AB = CD.\ BP$ is the bisector of $\angle B$. The measure of $\angle BAC$ is

(a) 72^0

(b) 73^0

(c) 74^0

(d) 96^0

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290. In Figure, if AC is bisector for $\angle BAD$ such that $AB = 3\ cm\ and\ AC = 5\ cm,$ then $CD =$

(a) $2\ cm$

(b) $3\ cm$

(c) $4\ cm$

(d) $5\ cm$

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