Chapter - 7

(Triangles)

- Triangle - A closed figure formed by three intersecting lines is called a triangle. A triangle has three sides, three angles and three vertices.

- Congruent figures - Congruent means equal in all respects or figures whose shapes and sizes are both the same for example, two circles of the same radii are congruent. Also two squares of the same sides are congruent.

- Congruent Triangles - two triangles are congruent if and only if one of them can be made to superpose on the other, so as to cover it exactly.

- If two triangles ABC and PQR are congruent under the correspondence $A \leftrightarrow \ P, B \leftrightarrow Q \text{ and } C \leftrightarrow \ R$ then symbolically, it is expressed as $\triangle ABC \cong \triangle PQR$

- In congruent triangles corresponding parts are equal and we write 'CPCT' for corresponding parts of congruent triangles.

- SAS congruency rule - Two triangles are congruent if two sides and the included angle of one triangle are equal to the two sides and the included angle of the other triangle. For example $\triangle ABC \text{ and } \triangle PQR$ as shown in the figure satisfy SAS congruent criterion.
• ASA Congruence Rule - Two triangles are congruent if two angles and the included side of one triangle are equal to two angles and the included side of other triangle. For examples $\Delta ABC$ and $\Delta DEF$ shown below satisfy ASA congruence criterion.

![ASA Congruence Rule Diagram](image1)

• AAS Congruence Rule - Two triangle are congruent if any two pairs of angles and one pair of corresponding sides are equal for example $\Delta ABC$ and $\Delta DEF$ shown below satisfy AAS congruence criterion.

![AAS Congruence Rule Diagram](image2)

• AAS criterion for congruence of triangles is a particular case of ASA criterion.

• Isosceles Triangle - A triangle in which two sides are equal is called an isosceles triangle. For example $\Delta ABC$ shown below is an isosceles triangle with $AB = AC$.

![Isosceles Triangle Diagram](image3)

• Angle opposite to equal sides of a triangle are equal.
• Sides opposite to equal angles of a triangle are equal.
• Each angle of an equilateral triangle is $60^0$.
• SSS congruence Rule - If three sides of one triangle are equal to the three sides of another triangle then the two triangles are congruent for example $\Delta ABC$ and $\Delta DEF$ as shown in the figure satisfy SSS congruence criterion.

\[\text{Diagram showing SSS congruence rule.}\]

• RHS Congruence Rule - If in two right triangles the hypotenuse and one side of one triangle are equal to the hypotenuse and one side of the other triangle then the two triangle are congruent. For example $\Delta ABC$ and $\Delta PQR$ shown below satisfy RHS congruence criterion.

\[\text{Diagram showing RHS congruence rule.}\]

RHS stands for right angle - Hypotenuse side.
• A point equidistant from two given points lies on the perpendicular bisector of the line segment joining the two points and its converse.
• A point equidistant from two intersecting lines lies on the bisectors of the angles formed by the two lines.
• In a triangle, angle opposite to the longer side is larger (greater)
• In a triangle, side opposite to the large (greater) angle is longer.
• Sum of any two sides of a triangle is greater than the third side.
Section - A

Q.1 Which of the following is not a criterion for congruence of triangles?
(a) SAS (b) SSA (c) ASA (d) SSS

Q.2 If AB=QR, BC=PR and CA=PQ then
(a) ΔABC ≅ ΔPQR (b) ΔCBA ≅ ΔPRQ
(c) ΔBAC ≅ ΔRPQ (d) ΔPQR ≅ ΔBCA

Q.3 In Δ PQR, if ∠R > ∠Q then
(a) QR > PR (b) PQ > PR (c) PQ < PR (d) QR < PR

Q.4 ΔABC ≅ ΔDEF and if AB = 3 = DE and BC = EF = 4 then necessary condition is
(a) ∠A = ∠D (b) ∠B = ∠E (c) ∠C = ∠F (d) CA = FD

Q.5 In the given figure, if OA=OB, OD=OC then ΔAOD ≅ ΔBOC by congruence rule.
(a) SSS (b) ASA (c) SAS (d) RHS

Q.6 In the figure if PQ=PR and ∠P = 80°, then measure of Q is
(a) 100° (b) 50° (c) 80° (d) 40°
Q.7 In the figure $\triangle ABC \cong \triangle ADC$, if $\angle ACB = 25^0$ and $\angle B = 125^0$, then $\angle CAD$ is
(a) $25^0$   (b) $65^0$   (c) $30^0$   (d) $75^0$

Q.8 In the figure, if $\triangle ABC \cong \triangle CDA$, the property of congruence is
(a) SSS       (b) SAS       (c) RHS       (d) ASA

Q.9 It is not possible to construct a triangle when its sides are
(a) $8.3\text{cm, }3.4\text{cm, }6.1\text{cm}$   (b) $5.4\text{cm, }2.3\text{cm, }3.1\text{cm}$
(c) $6\text{cm, }7\text{cm, }10\text{cm}$       (d) $3\text{cm, }5\text{cm, }5\text{cm}$

Q.10 In a $\triangle ABC$, 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) $80^0$

Q.11 If $\triangle PQR \cong \triangle EFD$, then $\angle E$ =
(a) $\angle P$   (b) $\angle Q$   (c) $\angle R$   (d) None of these

Q.12 If $\triangle PQR \cong \triangle EFD$, then $ED$ =
(a) $PQ$   (b) $QR$   (c) $PR$   (d) None of these
Section - B

Q.13 In the figure AB=AC and
\[ \angle ACD = 120^\circ \] find \( \angle A \)

Q.14 In a \( \triangle ABC \) if \( \angle A = 45^\circ \) and \( \angle B = 70^\circ \) determine the shortest and largest sides of the triangle.

Q.15 In the given figure AB is bisector of \( \angle A \) and AC=AD Prove that BC=BD and \( \angle C = \angle D \)

Q.16 AD is an altitude of an isosceles triangle ABC is which AB=AC. Prove that 
\[ \angle BAD = \angle DAC \]

Q.17 In an acute angled \( \triangle ABC \), S is any point on BC. Prove that \( AB+BC+CA > 2AS \)

Q.18 In the given figure \( BA \perp AC, DE \perp DF \)
such that BA=DE and BF=EC
show that \( \triangle ABC \cong \triangle DEF \)

Q.19 Q is a point on the side SR of \( \triangle PSR \) such that PQ=PR. Prove that PS>PQ
Section - C

Q.20 In the given figure if AD is the bisector of $\angle A$ show that
(i) $AB > BD$  
(ii) $AC > CD$

Q.21 In the given figure $AB = AC$, D is the point is the interior of $\triangle ABC$ such that $\angle DBC = \angle DCB$ Prove that AD bisects $\angle BAC$ of $\triangle ABC$.

Q.22 Prove that if two angles of a triangle are equal then sides opposite to them are also equal.

Q.23 In the figure, it is given that $AE = AD$ and $BD = CE$. Prove that $\triangle AEB \cong \triangle ADC$.

Q.24 Prove that angles opposite to two equal sides of a triangle are equal.
Q.25 In the figure $AD = AE$ and $D$ and $E$ are points on $BC$ such that $BD = EC$ Prove that $AB = AC$

Q.26 Prove that medians of an equilateral triangle are equal.

Q.27 In the given figure $\angle CPD = \angle BPD$ and $AD$ is the bisector of $\angle BAC$. Prove that $\triangle BAP \cong \triangle CAP$ and hence $BP = CP$

Section - D

Q.28 In the figure $\angle B = \angle C$ show that $AE > AF$
Q.29 In the figure \( \angle BCD = \angle ADC \) and \( \angle ACB = \angle BDA \). Prove that \( AD=BC \) and \( \angle A = \angle B \)

Q.30 In the given figure \( AP \perp l \) and \( PR > PQ \). Show that \( AR > AQ \)

Q.31 Prove that if in two triangles two angles and the included side of one triangle are equal to two angles and the included side of the other triangle, then the two triangles are congruent.

Q.32 In the given figure \( PQR \) is a triangle and \( S \) is any point in its interior, show that \( SQ + SR < PQ + PR \)

Answers :

(1) b  (2) b  (3) b  (4) b  (5) c  (6) b  
(7) c  (8) c  (9) b  (10) a  (11) a  (12) c  
(13) 60°  (14) BC, AC