

CLASS: X

SUBJECT: MATHEMATICS

TOPIC	CONSTRUCTIONS
PREREQUISITE KNOWLEDGE	Knowledge of construction of angles, perpendicular bisectors, triangles, circle etc.
OBJECTIVES	Children will be able to: • Divide a line segment, in a given ratio, using a compass. • Define the term- scale factor. • Construct a similar triangle, to a given triangle, as per the specified scale factor. • Prove that a triangle, similar to a given triangle, is constructed as per the specified scale factor.
THE HISTORY OF CONSTRUCTIONS	The ancient Greek mathematician's first attempted straightedge and compass constructions, and they discovered how to construct sums, differences, products, ratios, and square roots of given lengths. They could also construct half of a given angle, a square whose area is twice that of another square, a square having the same area as a given polygon, and a regular polygon with 3, 4, or 5 sides (or one with twice the number of sides of a given polygon). But they could not construct one third of a given angle except in particular cases, or a square with the same area as a given circle, or a regular polygon with other numbers of sides. Nor could they construct the side of a cube whose volume would be twice the volume of a cube with a given side. Hippocrates and Menaechmus showed that the volume of the cube could be doubled by finding the intersections of hyperbolas and parabolas, but these cannot be constructed by straightedge and compass. In the fifth century BCE, Hippias used a curve that he called a quadratrix to both trisect the general angle and square the circle, and Nicomedes in the second century BCE showed how to use a conchoid to trisect an arbitrary angle; but these methods

	also cannot be followed with just straightedge and compass. No progress on the unsolved problems was made for two millennia, until in 1796 Gauss showed that a regular polygon with 17 sides could be constructed; five years later he showed the sufficient criterion for a regular polygon of n sides to be constructible. In 1837 Pierre Wantzel published a proof of the impossibility of trisecting an arbitrary angle or of doubling the volume of a cube, based on the impossibility of constructing cube roots of lengths. He also showed that Gauss's sufficient constructibility condition for regular polygons is also necessary.
SUMMARY OF THE CHAPTER	Construct a tangent to a circle. Children will be taught to divide a line segment, in a given ratio, using compass. They will learn the construction of a triangle similar to a given triangle as per the specified scale factor. Children will also learn the construction of the pair of tangents from an external point, to a given circle. Moreover, they will mathematically prove these constructions
TRANSACTION METHODOLOGY	Warm up session: Children will be asked about the similarity of triangles and criteria for similarity of triangles. Division of a line segment: In this activity, children will divide a line segment in a given ratio using a compass and then mathematically prove the construction. Construction and verification of similar triangles In this activity, children will construct a triangle similar to a given triangle, as per the specified scale factor, using a compass and then mathematically prove the same. Construction and verification of tangents to a circle: In this activity, children will construct tangents to a circle and then mathematically prove the construction.
EXPECTED LEARNING OUTCOMES	Children will be able to:

	Divide a line segment in a given ratio using a compass. Construct a triangle similar to a given triangle as per the specified scale factor. Construct a pair of tangents from an external point to a given circle. Moreover, they will be able to mathematically prove these constructions.
PRACTICE QUESTIONS	1. Divide a line segment of length 9 cm internally in the ratio 4:3. Also, give justification of the construction. 2. Construct a triangle ABC in which AB=4cm, BC=5cm and AC=6cm. Now, construct a triangle, similar to triangle ABC such that each of its sides is two third of the corresponding sides of ABC. Also, prove your assertion. 3. Draw a triangle ABC with side BC=7cm, $\angle B=45^\circ$, $\angle A=105^\circ$. Then construct a triangle whose sides are $\frac{4}{3}$ times the corresponding sides of triangle ABC. 4. Draw a circle of radius 3cm. Take two points p and q on one of its extended diameters each at a distance of 7cm from its centre. Draw tangents to the circle from these two points p and q. 5. Draw a circle of radius 4 cm. Take a point p outside the circle. Without using the centre of the circle, draw two tangents to the circle from point p. 6. Draw a circle of radius 6 cm. Draw a tangent to this circle making an angle of 30 degree with a line passing through the centre. Draw two concentric circles of radii 3cm and 5cm. Construct a tangent to the smaller circle from a point on a larger circle. Also measure its length.
EVALUATION	Class test and extra sums from refreshers and extra marks modules.