Lines And Angles

(a) Segment: - A part of line with two end points is called a line-segment.

A line segment is denoted by AB and its length is is denoted by AB.

(b) Ray: - A part of a line with one end-point is called a ray.

We can denote a line-segment AB, a ray AB and length AB and line AB by the same symbol AB.

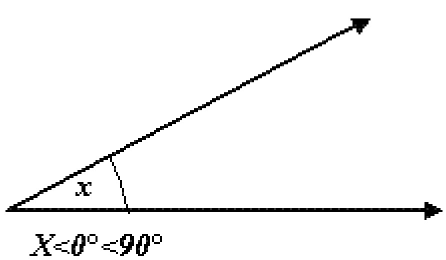
(c) Collinear points: - If three or more points lie on the same line, then they are called collinear points, otherwise they are called non-collinear points.

(d) Angle: - An angle is formed by two rays originating from the same end point.

The rays making an angle are called the arms of the angle and the end-points are called the vertex of the angle.

(d) Types of Angles:-

(i) Acute angle: - An angle whose measure lies between 0° and 90°, is called an acute angle.



(ii) Right angle: - An angle, whose measure is equal to 90°, is called a right angle.

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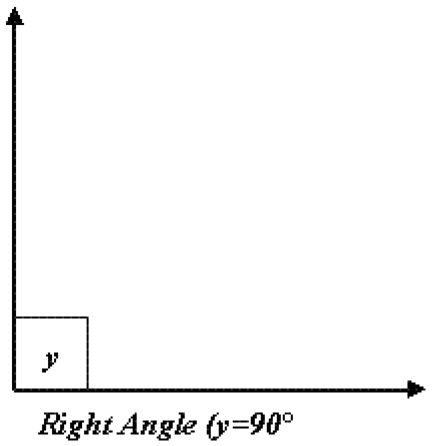
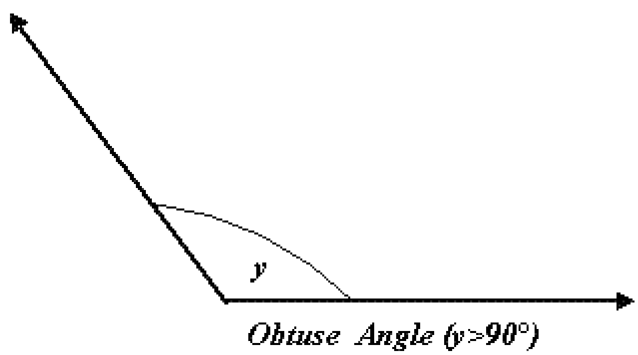
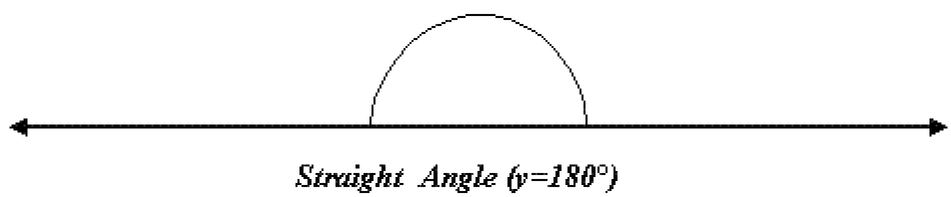


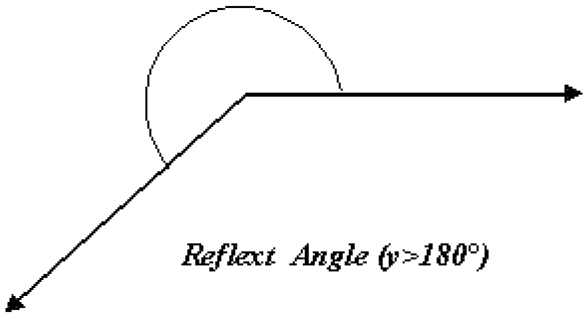
(iii) Obtuse angle: - An angle, whose measure lies between 90° and 180°, is called an obtuse angle.



(iv) Straight angle: - The measure of a straight angle is 180°.



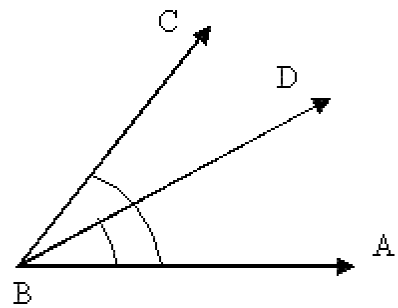
(v) Reflex angle: - An angle which is greater than 180° and less than 360°, is called the reflex angle.



(vi) Complimentary angle: - Two angles, whose sum is 90°, are called complimentary angle.

(vii) Supplementary angle: - Two angles whose sum is 180º, are called supplementary angle.

(viii) Adjacent angle: - Two angles are adjacent, if they have a common vertex, common arm and their non-common arms are on different sides of the common arm.



In the above figure $\angle ABD$ and $\angle DBC$ are adjacent angle. Ray BD is their common arm and point B is their common vertex. Ray BA and ray BC are non-common arms.

When the two angles are adjacent, then their sum is always equal to the angle formed by the two non-common arms.

Thus, $\angle ABC = \angle ABD + \angle DBC$.

Here we can observe that $\angle ABC$ and $\angle DBC$ are not adjacent angles, because their non-common arms BD and AB lie on the same side of the common arm BC.

(ix) Linear pair of angles: - If the sum of two adjacent angles is 180º, then their non-common lines are in the same straight line and two adjacent angles form a linear pair of angles.

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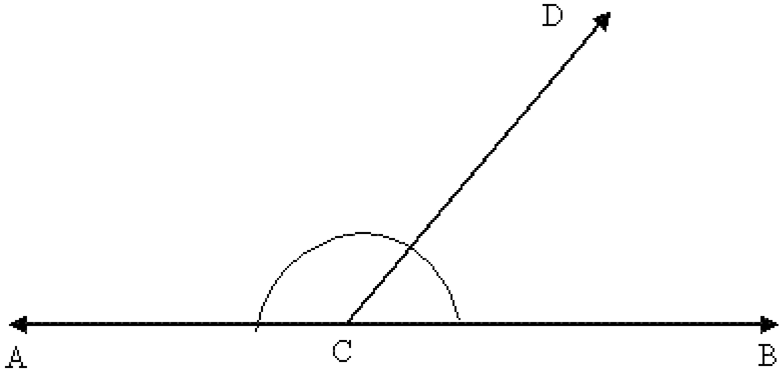
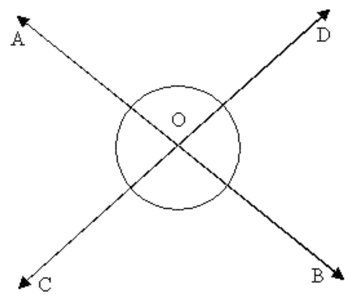


In the fig. $\angle ABD$ and $\angle CBD$ form a linear pair of angles because

$$\angle ABD + \angle CBD = 180°.$$

(x) Vertically opposite angles: - When two lines AB and CD intersect at a point O, the vertically opposite angles are formed.



Here are two pairs of vertically opposite angles. One pair is $\angle AOD$ and $\angle BOC$ and the second pair is $\angle AOC$ and $\angle BOD$ The vertically opposite angles are always equal.

So, $\angle AOD = \angle BOC$ and $\angle AOC = \angle BOD$

(e) Intersecting lines and non-intersecting lines: - Two lines are intersecting if they have one point in common. We have observed in the above figure that lines AB and CD are intersecting lines, intersecting at O, their point of intersection.

Parallel lines: - If two lines do not meet at a point if extended to both directions, such lines are called parallel lines.

$$\angle AOC = \angle BOD$$

and $$\angle AOD = \angle BOC$$

Lines PQ and RS are parallel lines.

The length of the common perpendiculars at different points on these parallel lines is same. This equal length is called the distance between two parallel lines.

Axiom 1. If a ray stands on a line, then the sum of two adjacent angles so formed is 180º.

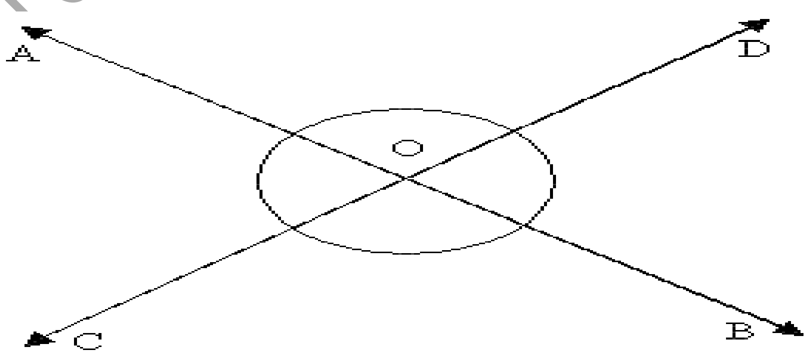
Conversely if the sum of two adjacent angles is 180º, then a ray stands on a line (i.e., the non-common arms form a line).

Axiom 2. If the sum of two adjacent angles is 180º, then the non-common arms of the angles form a line. It is called Linear Pair Axiom.

(f) Theorem 1. If two lines intersect each other, then the vertically opposite angles are equal.

Solution: Given: Two lines AB and CD intersect each other at O.

To Prove:



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Ray OA stands on line CD.

∴ $\angle AOC + \angle AOD = 180^\circ$ ....equation (i) {Linear Pair Axiom}

Again ray OD stands on line AB.

∴ $\angle AOD + \angle BOD = 180^\circ$ ....equation (ii)

From equation (i) and (ii),

$$\angle AOC + \angle AOD = \angle AOD + \angle BOD$$

$$\Rightarrow \angle AOC + \angle AOD - \angle AOD = \angle BOD$$

$$\Rightarrow \angle AOC = \angle BOD$$

Now, Again

Ray OB stands on line CD.

∴ $\angle BOC + \angle BOD = 180^\circ$ ....equation (iii) {Linear Pair Axiom}

Again ray OD stands on line AB.

∴ $\angle AOD + \angle BOD = 180^\circ$ ....equation (iv)

From equation (iii) and (iv),

$$\Rightarrow \angle BOC + \angle BOD = \angle AOD + \angle BOD$$

$$\Rightarrow \angle BOC + \angle BOD - \angle BOD = \angle AOD$$

$$\Rightarrow \angle BOC = \angle AOD$$

Hence Proved.

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