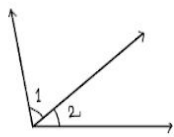# Angles

Measurement of angles discriminate the types of angles. Through measurement, we have pairs of angles likewise adjacent angles, complementary angles, supplementary angles, vertical angles, etc.

Adjacent Angles

Let's us know about adjacent angles with the help of figure.

In the above figure, we can observe angle having a common side and common vertex and they do not overlap. Hence, the given two angles are adjacent.

In next figure, two angles are not adjacent angles even they have common sides and vertex as they overlap.

Complementary Angles

If two angles make up 90^0 by adding up then it is called complementary angles. But angles do not have to be together. Let's us know more with figure help.
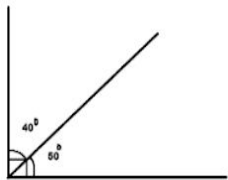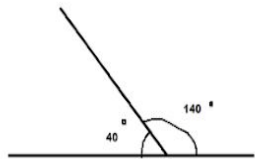

In the given figure, two angles (40 and 50) are complementary angles because they add up to 90^0.
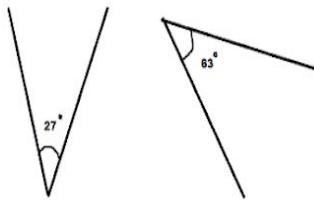
These two angles are complementary because $27° + 63° = 90^0$

Supplementary Angles

If two angles make up to 180^0 by adding then it is called supplementary angles. But angles do not have to be together. Let's us know more with figure help.
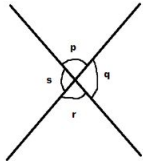
These two angles are supplementary because 60° + 120° = 180°.

Vertical Angles

Angles sharing the same vertex are called vertical angles. Angles share their vertex when two line intersect and it form vertical angles or vertically opposite angles.
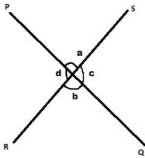
In the given figure, ∠p and ∠s are opposite to ∠r and ∠q. Therefore ∠p and ∠r are vertical angles. Similarly ∠s and∠ q are also vertical angles.

Vertical Angle Theorem

Experiment:

In the given figure, two lines PQ and RS intersect each other. Look at the figure and complete the table given below.

| Statements	Reasons
1. a + c =180°	1. Supplementary angles
2. b + c =180°	2. ....
3. a + c ≅ b + c	3. From 1 and 2
4. a ≅ b	4. Concealing c from both sides
5. Similarly, c ≅ d	5. As above

Parallel lines

Two lines lie in the same plane but do not intersect each other is known as parallel lines.
In the given figure, the lines AB and CD are parallel. Mathematically,AB//CD.

Parallel lines are apart always at the same distance .Hence, the distance between two parallel lines is the same everywhere.
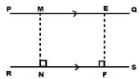
In the figure, PQ//RS.
Take any point M on PQ and draw MN⊥ RS.
Take any point E on PQ and draw EF⊥ RS.
Measure MN and EF.
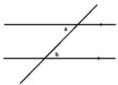You will find that MN=EF.

Transversal

The line that intersects two or more lines is called transversal. Transversal lines create an angle where some them have a name and give relation to the lines.
Let's identify some of the angles with name and their relation.
i) a and b are alternative interior angles.

ii) a and b are alternative exterior angles.

iii) a and b are corresponding angles.

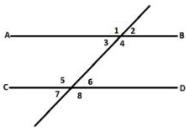iv) a and b are interior angles on the same side.

Alternative Angles Theorem

When transversal cuts two line forming corresponding angles which are congruent prove two line to be parallel.

Experiment:

Draw a pair of Line AB and CD which are parallel and intersect them by transversal EF. Name the interior angles as 3, 4, 5 and 6 and exterior angles as 1, 2, 7 and 8.
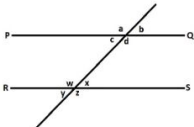

In the given figure AB//CD. Complete the table below.

S.No.	Statements	Reasons
1.	3 ≅ 2	Vertical angles
2.	2 ≅ 6	Corresponding angles
3.	3 ≅ 6	Transitive property
4.	5 ≅ 8	....
5.	5 ≅ 4	....
6.	1 ≅ 4	....
7.	3 ≅ 7	....

Alternative Angles Converse

Alternative angles converse proves the two line are parallel by cutting the lines by a transversal and forming a congruent angle.
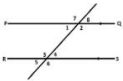

In the given figure x≅ c. Complete the table.

S.No.	Statements	Reasons
1.	x ≅ c	Given
2.	b ≅ c	Vertical angles
3.	x ≅ b	....
4.	b ≅ z	....
5.	b ≅ w	....
6.	d ≅ y	....
7.	PQ//RS	....

Corresponding Angles Theorem

Corresponding angles are equal in parallel line which is formed by transversal cutting the parallel line.

In the figure, PQ//RS

So, ∠1 ≅ ∠5, ∠7 ≅ ∠3, ∠8 ≅ ∠4 and ∠2 ≅ ∠6

Corresponding Angles Converse

When corresponding angles are congruent drawing the transversal line then the crossed line by a transversal are parallel.
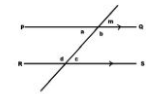
In the figure, $\angle a \cong \angle b$, so PQ//RS.

Consecutive Interior Angles Theorem

Consecutive interior angles theorem states that consecutive interior angles form by two parallel lines and a transversal are supplementary.
In the figure, PQ//RS. Look at the figure and complete the table below:

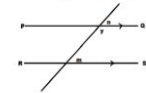| S.No.	Statements	Reasons
1.	$b+m=180^O$	Being supplementary angles
2.	$m \cong c$	....
3.	$b+c=180^O$	....
4.	Similarly, $a+d=180^O$	....

Consecutive Interior Angles Converse

If transversal forms interior angles that are supplementary angles by cutting two line, then the lines are parallel.
In the figure, $m+y=180^O$

Complete the table that is given below.

S.No.	Statements	Reasons
1.	$m+y=180^O$	Supplementary angles
2.	$n+y=180^O$	....
3.	$m+y \cong n+y$	....
4.	$m \cong n$	....
5.	PQ//RS	....