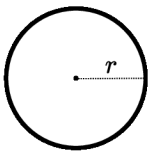
Circles

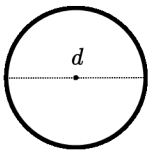
A circle is a round shape where all points are the same distance from the center. This distance is called the radius.

Radius: r



The radius of a circle or sphere is the distance from its center to any point on its boundary. It is half the length of the diameter.

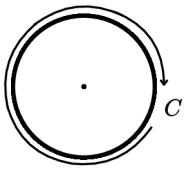
Diameter: d



The diameter of a circle or sphere is the longest straight line that passes through its center and connects two points on its boundary.

Formula: $d = 2r$

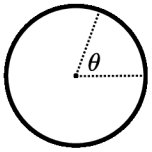
Circumference: C



Circumference is the distance around the outside of a circle.

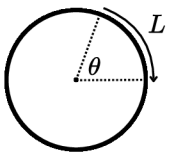
Formula: $C = 2\pi r$

Central Angle: θ



A central angle is an angle whose vertex is at the center of a circle, and its two sides (rays) extend to the circle's boundary, forming an arc. θ can be in either radians or degrees.

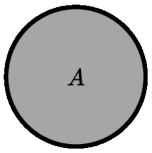
Arc Length: L



Arc length is the distance along a curved part of a circle. It is a portion of the circle's circumference.

Formula: $L = \frac{\theta}{360^\circ} \times C$ (θ in degrees) *or* $L = \theta r$ (θ in radians)

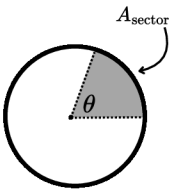
Area: A



The area of a circle is the amount of space inside the circle

Formula: $A = \pi r^2$

Sector Area: A_{sector}

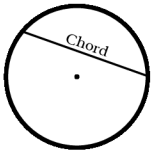


The sector area of a circle is the space inside a sector, which is a portion of the circle enclosed by two radii and an arc.

Formula: $A_{\text{sector}} = \frac{\theta}{360^\circ} \times A$ (θ in degrees) *or* $A_{\text{sector}} = \frac{\theta r^2}{2}$ (θ in radians)

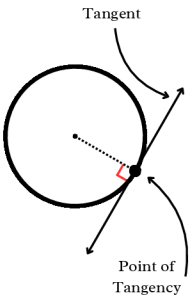
Chord:

A chord is a straight line segment that connects two points on the circumference of a circle. Unlike a diameter, a chord does not necessarily pass through the center of the circle, but the diameter is the longest possible chord.



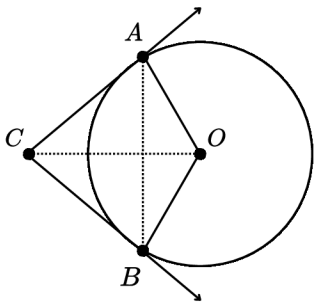
Bisect Chord Theorem: The perpendicular to a chord, drawn from the center of the circle, bisects the chord.
Equal Chords Theorem: Chords of a circle, equidistant from the center of the circle are equal.
Unequal Chords Theorem: For two unequal chords of a circle, the larger chord will be closer to the center than the smaller chord.

Tangent:



A tangent is a straight line that touches a circle at exactly one point without crossing it. This point is called the point of tangency. A tangent is always perpendicular to the radius at the point of tangency.

Tangent Radius Theorem: The tangent at any point of a circle is perpendicular to the radius through the point of contact.
Two Tangents Theorem: Suppose that two tangents are drawn to a circle from an exterior point C. Let the points of contact be A and B, as shown in the image to the right.
The theorem states the following:



- The lengths of these two tangents will be equal, that is, $CA = CB$.
- The two tangents will subtend equal angles at the center, that is, $\angle COA = \angle COB$.
- The angle between the tangents will be bisected by the line joining the exterior point and the center, that is, $\angle ACO = \angle BCO$.