# Math Formulas: Circle

## Equation of a circle

In an $x - y$ coordinate system, the circle with center $(a, b)$ and radius $r$ is the set of all points $(x, y)$ such that:

1. $$(x - a)^2 + (y - b)^2 = r^2$$

**Circle centered at the origin:**

2. $$x^2 + y^2 = r^2$$

**Parametric equations**

3. $$\begin{aligned} x &= a + r\ \cos t \\ y &= b + r\ \sin t \end{aligned}$$

where $t$ is a parametric variable.

**In polar coordinates the equation of a circle is:**

4. $$r^2 - 2 \cdot r \cdot r_0 \cdot cos(\Theta - \phi) + r_0^2 = a^2$$

## Area of a circle

5. $$A = r^2\pi$$

## Circumference of a circle

6. $$C = \pi \cdot d = 2 \cdot \pi \cdot r$$

## Theorems:

**(Chord theorem)** The chord theorem states that if two chords, $CD$ and $EF$, intersect at $G$, then:

7. $$CD \cdot DG = EG \cdot FG$$

**(Tangent-secant theorem)** If a tangent from an external point $D$ meets the circle at $C$ and a secant from the external point $D$ meets the circle at $G$ and $E$ respectively, then

8. $$DC^2 = DG \cdot DE$$

**(Secant - secant theorem)** If two secants, $DG$ and $DE$, also cut the circle at $H$ and $F$ respectively, then:

9. $$DH \cdot DG = DF \cdot DE$$

**(Tangent chord property)** The angle between a tangent and chord is equal to the subtended angle on the opposite side of the chord.