

1) The Law of Sines

1) _____

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

2) Area of an Oblique Triangle

2) _____

$$\text{Area} = \frac{1}{2} bc \sin A = \frac{1}{2} ac \sin B = \frac{1}{2} ab \sin C.$$

3) Law of Cosines

3) _____

Standard Form

Alternative Form

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$b^2 = a^2 + c^2 - 2ac \cos B$$

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

4) Heron's Area Formula

4) _____

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)} ; \text{ where } s = \frac{a+b+c}{2}.$$

5) Relations Between Polar and Rectangular Coordinates

5) _____

Use the formulas $r = \sqrt{x^2 + y^2}$ or $r^2 = x^2 + y^2$

$$\cos \theta = \frac{x}{r} \text{ or } x = r \cos \theta$$

$$\sin \theta = \frac{y}{r} \text{ or } y = r \sin \theta.$$

$$\tan \theta = \frac{y}{x}$$

6) Symmetry with Respect to the Polar Axis (x-Axis)

6) _____

Replace θ with $-\theta$. If an equivalent equation results, the graph is symmetric with respect to the polar axis.

7) Symmetry with Respect to the Line $\theta = \pi/2$ (y-Axis) 7) _____
Replace (r, θ) with $(-r, -\theta)$. If an equivalent equation results, the graph is symmetric with respect to the line $\theta = \pi/2$.

8) Symmetry with Respect to the Pole (Origin) 8) _____
Replace r with $-r$. If an equivalent equation results, the graph is symmetric with respect to the pole.

9) Circles in Polar Coordinates 9) _____
The graph of $r = a \cos \theta$ is a circle with center at $\left(\frac{a}{2}, 0\right)$ and diameter $|a|$.
The graph of $r = a \sin \theta$ is a circle with center at $\left(0, \frac{a}{2}\right)$ and diameter $|a|$.

10) Limacons in Polar Coordinates 10) _____
The graphs of $r = a \pm b \cos \theta$, $r = a \pm b \sin \theta$ are called limacons.
If $\frac{a}{b} = 1$, the limacon is heart-shaped, and called a cardioid.
If $\frac{a}{b} < 1$, the limacon has an inner loop.
If $1 < \frac{a}{b} < 2$, the limacon is dimpled with no inner loop.
If $\frac{a}{b} \geq 2$, the limacon has no dimple and no inner loop.

11) Polar Form of a Complex Number 11) _____
The polar form of $z = a + bi$ is $z = r(\cos \theta + i \sin \theta)$, where $a = r \cos \theta$, $b = r \sin \theta$, $r = \sqrt{a^2 + b^2}$, and $\tan \theta = \frac{b}{a}$.

12) Product of Two Complex Numbers in Polar Form 12) _____
Let $z_1 = r_1(\cos \theta_1 + i \sin \theta_1)$ and $z_2 = r_2(\cos \theta_2 + i \sin \theta_2)$.
 $z_1 z_2 = r_1 r_2 [\cos(\theta_1 + \theta_2) + i \sin(\theta_1 + \theta_2)]$.

- 13) Quotient of Two Complex Numbers in Polar Form 13) _____
 Let $z_1 = r_1(\cos \theta_1 + i \sin \theta_1)$ and $z_2 = r_2(\cos \theta_2 + i \sin \theta_2)$.

$$\frac{z_1}{z_2} = \frac{r_1}{r_2} [(\cos (\theta_1 - \theta_2) + i \sin (\theta_1 - \theta_2))].$$
- 14) DeMoivre's Theorem 14) _____
 If $z = r(\cos \theta + i \sin \theta)$, then $z^n = r^n(\cos (n\theta) + i \sin (n\theta))$.
- 15) Component Form of a Vector 15) _____
 With initial point $P = (p_1, p_2)$ and terminal point
 $Q = (q_1, q_2)$, $\overrightarrow{PQ} = \langle q_1 - p_1, q_2 - p_2 \rangle = \langle v_1, v_2 \rangle$
- 16) Magnitude of a Vector 16) _____
 If $v = \langle v_1, v_2 \rangle$, then $\|v\| = \sqrt{v_1^2 + v_2^2}$.
- 17) Linear combination of the vectors i and j 17) _____
 If $v = \langle v_1, v_2 \rangle$, then $v = v_1i + v_2j$
- 18) Direction Angle 18) _____
 If θ is the angle from the positive x -axis to vector v , then
 θ is called the direction angle of the vector v ; $\tan \theta = \frac{v_2}{v_1}$.
 The vector v can be written as $v = \|v\| \langle \cos \theta, \sin \theta \rangle$.
- 19) Dot Product 19) _____
 If $u = \langle u_1, u_2 \rangle$ and $v = \langle v_1, v_2 \rangle$, then $u \cdot v = u_1v_1 + u_2v_2$
- 20) Angle Between Two Vectors 20) _____

$$\cos \theta = \frac{u \cdot v}{\|u\| \|v\|}; 0 \leq \theta \leq \pi$$
- 21) Work 21) _____

$$W = \|F\| \cdot \|\overrightarrow{AB}\| \cdot \cos \theta$$