ALGEBRAIC FORMULAS

1. $(a+b)^2 = a^2 + 2ab + b^2$; $a^2 + b^2 = (a+b)^2 - 2ab$
2. $(a-b)^2 = a^2 - 2ab + b^2$; $a^2 + b^2 = (a-b)^2 + 2ab$
3. $(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$
4. $(a+b) = a^3 + b^3 + 3ab(a+b)$; $a^3 + b^3 = (a+b)^3 - 3ab(a+b)$
5. $(a-b)^3 = a^3 - b^3 - 3ab(a-b)$; $a^3 - b^3 = (a-b)^3 + 3ab(a-b)$
6. $a^2 - b^2 = (a+b)(a-b)$
7. $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$
8. $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
9. $a^n - b^n = (a-b)(a^{n-1} + a^{n-2}b + a^{n-3}b^2 + \cdots + b^{n-1})$
10. $a^n = a.a.a \ldots n\ times$
11. $a^m \cdot a^n = a^{m+n}$
12. $\frac{a^m}{a^n} = a^{m-n}$ $if\ m > n$

    $= 1$ $if\ m = n$

    $= \frac{1}{a^{m-n}}$ $if\ m < n; a \in R, a \neq 0$
13. $(a^m)^n = a^{mn} = (a^n)^m$
14. $(ab)^n = a^n \cdot b^n$
15. $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$
16. $a^0 = 1\ where\ a \in R, a \neq 0$
17. $a^{-n} = \frac{1}{a^n},\ a^n = \frac{1}{a^{-n}}$
18. $a^{\frac{p}{q}} = \sqrt[q]{a^p}$
19. $If\ a^m = a^n\ and\ a = \pm 1, a \neq 0, then\ m = n$
20. $If\ a^n = b^n\ where\ n \neq 0, then\ a = \pm b$

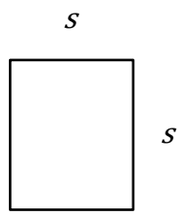
GEOMETRIC FORMULAS

➢ *SHAPES*

1. *Square*

Perimeter: $P = 4s \text{ or } 2s + 2s$

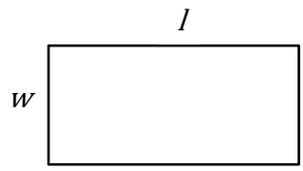
Area: $A = s^2$



2. *Rectangle*

Perimeter: $P = 2w + 2l$

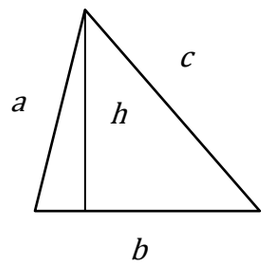
Area: $A = l \cdot w$



3. *Triangles*

Perimeter: $P = a + b + c$

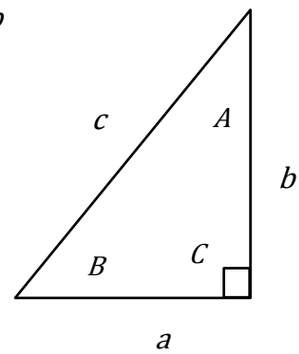
Area: $A = \left(\frac{1}{2}\right) \times b \times h \text{ or } \frac{bh}{2}$



- *Types of triangle*
  - *a) Isosceles – two equal sides*
  - *b) Equilateral – all sides are equal*
  - *c) Right – one* $90°$ *or right angle*
- *Pythagorean Theorem (for right triangles only):*

  $a^2 + b^2 = c^2$
- *Sum of all angles (all triangles):*

  $A + B + C = 180°$

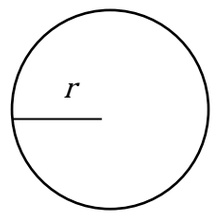


4. *Circle*

Diameter: $d = 2r$

Circumference: $C = 2\pi r \text{ or } \pi d$

Area: πr^2

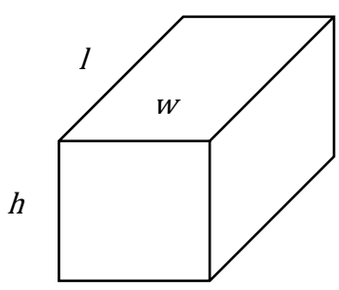


5. *Rectangular Solid*

Volume: $v = l \times w \times h$

Surface Area: $s = (2 \times h \times w) + (2 \times l \times h) + (2 \times l \times w)$

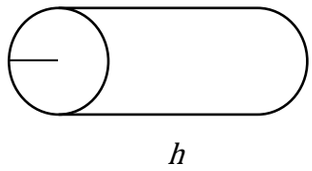
$$s = 2hw + 2lh + 2lw$$



6. *Right Circular Cylinder*

Volume: $v = \pi r^2 h$

Surface Area: $s = 2\pi rh + 2\pi r^2$



h

➢ *ANGLES*

1. *Complementary Angles*

- ✓ *Two angles are complementary if the sum of their measures is* $90°$.
- ✓ $\angle A + \angle B = 90°$, *therefore* $\angle A$ *and* $\angle B$ *are complementary*

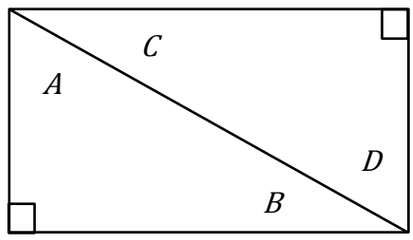


Figure 1.1

2. *Supplementay Angles*

- ✓ *Two angles are supplementary if the sum of their measures is* $180°$
- ✓ $\angle 1$ *and* $\angle 2$ *are supplementary angles*.
- ✓ $\angle 2$ *and* $\angle 4$ *are supplementary angles*.

3. *Opposite/Vertical Angles*

- ✓ *The intersection of two lines,* m_1 *and* m_2*, form four angles. Opposite (vertical) angles are congruent (have equal measures)*
- ✓ $\angle 1$ *and* $\angle 4$ *are congruent*.
- ✓ $\angle 2$ *and* $\angle 3$ *are congruent*.

4. *Alternate Interior and Exterior Angles*

- ✓ *Lines* m_1 *and* m_2 *are parallel.*
- ✓ *∠4 and ∠5 are called alternate interior angles. Alternate interior angles are congruent.*
- ✓ *∠1 and ∠8 are called alternate exterior angles. Alternate exterior angles are congruent.*

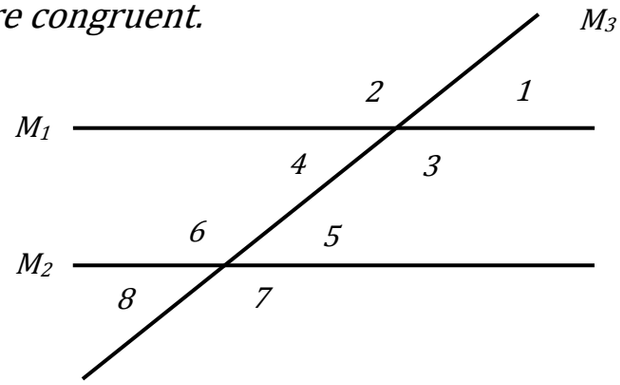
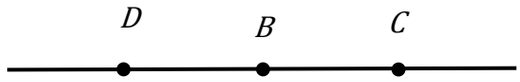


Figure 2.1. For numbers 2, 3 & 4

5. *Straight Lines*

- ✓ *Straight lines have degrees measuring* 180°.
- ✓ *If D to B is a straight line then* $\angle DBC$ *measures* 180°

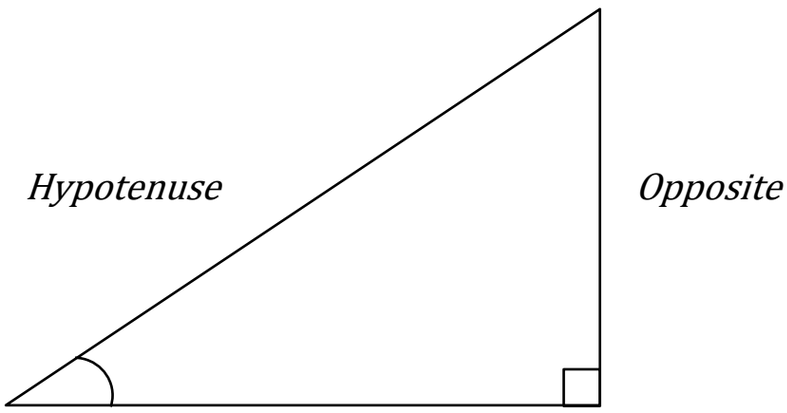


TRIGONOMETRIC FORMULAS

- ***RIGHT TRIANGLE***

Assume that:

$$0 < \theta < \frac{\pi}{2} \; or \; 0° < \theta < 90°$$

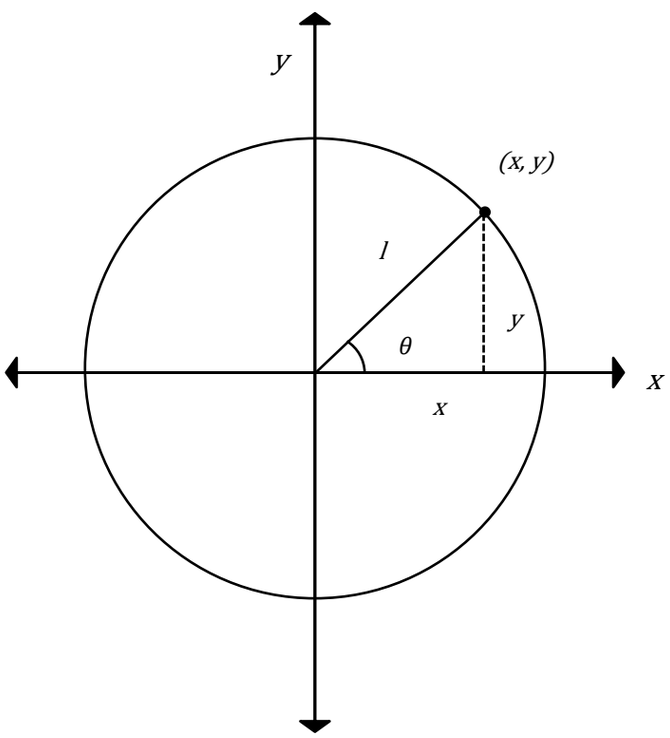


$$\sin\theta = \frac{opp}{hyp} \qquad \csc\theta = \frac{hyp}{opp}$$

$$\cos\theta = \frac{adj}{hyp} \qquad \sec\theta = \frac{hyp}{adj}$$

$$\tan\theta = \frac{opp}{adj} \qquad \cot\theta = \frac{adj}{opp}$$

- ***UNIT CIRCLE***

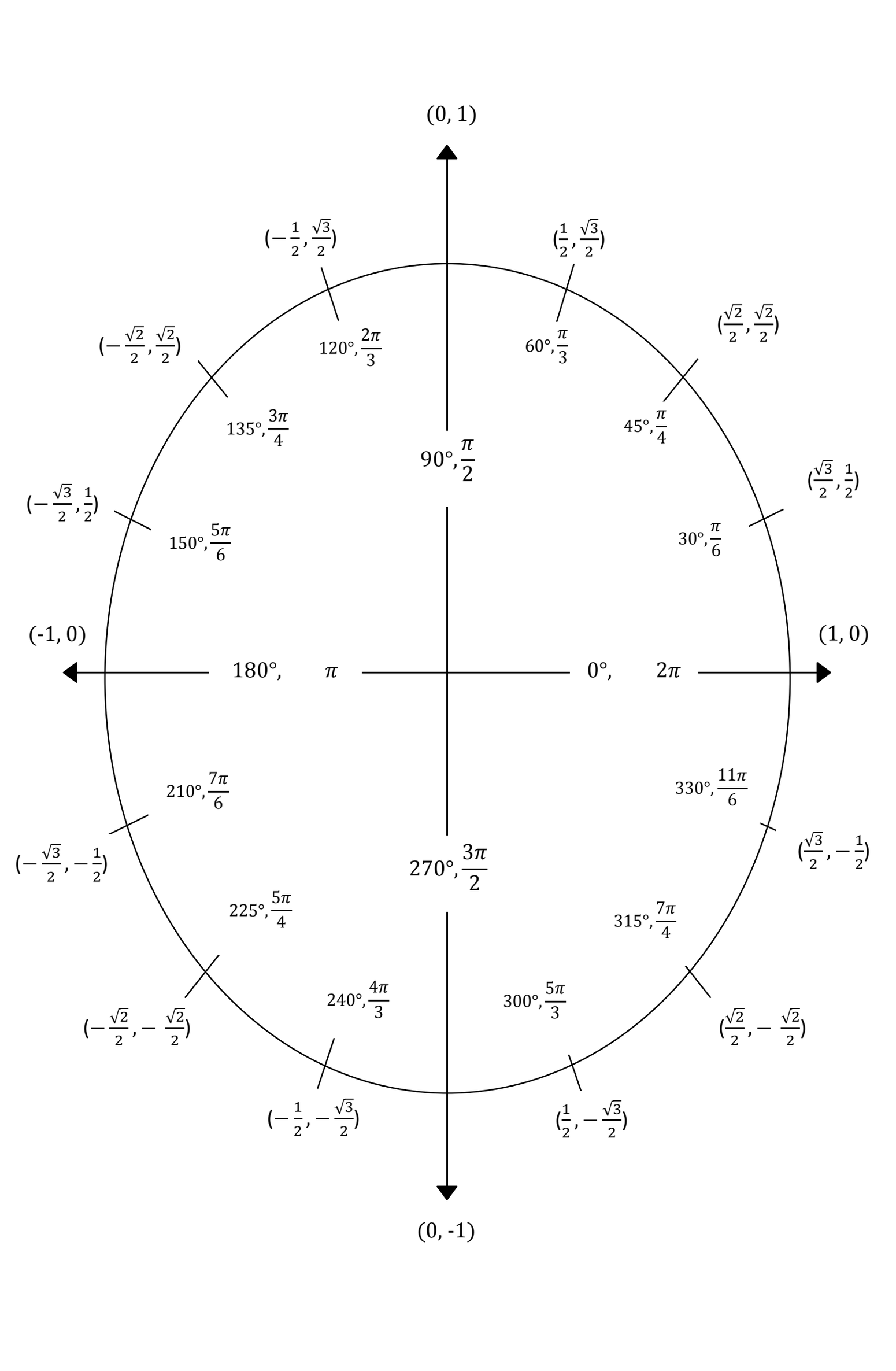


$$\sin\theta = \frac{y}{1} \qquad \csc\theta = \frac{1}{y}$$

$$\cos\theta = \frac{x}{1} \qquad \sec\theta = \frac{1}{x}$$

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

Assume that θ can be any angle.


(0, 1)
$(-\frac{1}{2}, \frac{\sqrt{3}}{2})$
$(\frac{1}{2}, \frac{\sqrt{3}}{2})$
$(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$
$(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$
$120°, \frac{2\pi}{3}$
$60°, \frac{\pi}{3}$
$135°, \frac{3\pi}{4}$
$45°, \frac{\pi}{4}$
$90°, \frac{\pi}{2}$
$(-\frac{\sqrt{3}}{2}, \frac{1}{2})$
$(\frac{\sqrt{3}}{2}, \frac{1}{2})$
$150°, \frac{5\pi}{6}$
$30°, \frac{\pi}{6}$
(-1, 0)
(1, 0)
180°, π
0°, 2π
$210°, \frac{7\pi}{6}$
$330°, \frac{11\pi}{6}$
$(-\frac{\sqrt{3}}{2}, -\frac{1}{2})$
$(\frac{\sqrt{3}}{2}, -\frac{1}{2})$
$270°, \frac{3\pi}{2}$
$225°, \frac{5\pi}{4}$
$315°, \frac{7\pi}{4}$
$240°, \frac{4\pi}{3}$
$300°, \frac{5\pi}{3}$
$(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2})$
$(\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2})$
$(-\frac{1}{2}, -\frac{\sqrt{3}}{2})$
$(\frac{1}{2}, -\frac{\sqrt{3}}{2})$
(0, -1)

- ***IDENTITIES AND FORMULAS***

1. *Tangent and Cotangent Identities*

$$tan\,\theta = \frac{sin\,\theta}{cos\,\theta} \qquad cot\,\theta = \frac{cos\,\theta}{sin\,\theta}$$

2. *Reciprocal Identities*

$$\sin\theta = \frac{1}{\csc\theta} \qquad \csc\theta = \frac{1}{\sin\theta}$$

$$\cos\theta = \frac{1}{\sec\theta} \qquad \sec\theta = \frac{1}{\cos\theta}$$

$$\tan\theta = \frac{1}{\cot\theta} \qquad \cot\theta = \frac{1}{\tan\theta}$$

3. *Pythagorean Identities*

$$\sin^2\theta + \cos^2\theta = 1$$

$$\tan^2\theta + 1 = \sec^2\theta$$

$$1 + \cot^2\theta = \csc^2\theta$$