UNIT CIRCLE

coordinates are
(cos θ, sin θ)

π/2 (0, 1)

π/3 (1/2, √3/2)

π/4 (√2/2, √2/2)

π/6 (√3/2, 1/2)

π/6 (1, 0)

3π/4 (-1, 0)

π (-1, 0)

-π (1, 0)

π/2 (0, 1)

cos(-θ) = cos θ = x/h
sin(-θ) = -sin θ = -y/h
sin²θ + cos²θ = 1
sec²θ = 1 + tan²θ

tan θ = sin θ/cos θ = y/x
cot θ = cos θ/sin θ = 1/tan θ = x/y

sec θ = 1/cos θ = h/x
csc θ = 1/sin θ = h/y

csc²θ = 1 + cot²θ

Round and round we go but where we stop is all we need to know

FUNDAMENTALS
Addition Identities
\[ \sin(A + B) = \sin A \cos B + \cos A \sin B \]
\[ \sin(A - B) = \sin A \cos B - \cos A \sin B \]
\[ \cos(A + B) = \cos A \cos B - \sin A \sin B \]
\[ \cos(A - B) = \cos A \cos B + \sin A \sin B \]

Double-Angle Identities
\[ \sin(2\theta) = 2\sin \theta \cos \theta \]
\[ \cos(2\theta) = \cos^2 \theta - \sin^2 \theta \]
\[ = 2\cos^2 \theta - 1 \]
\[ = 1 - 2\sin^2 \theta \]

Half-Angle Identities
[Memory tip: “sinus-minus”]
\[ \sin \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{2}} \]
\[ \cos \frac{\theta}{2} = \pm \sqrt{\frac{1 + \cos \theta}{2}} \]

Power Reducing Form of Half-Angle Identities
\[ \sin^2 A = \frac{1}{2}(1 - \cos 2A) \]
\[ \cos^2 A = \frac{1}{2}(1 + \cos 2A) \] [Memory tip: “sinus-minus”]

Solving Triangles and Areas of Triangles
Useful for applications
Law of Sines
\[ \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c} \]
Law of Cosines
\[ a^2 = b^2 + c^2 - 2bc \cos A \]
\[ b^2 = a^2 + c^2 - 2ac \cos B \]
\[ c^2 = a^2 + b^2 - 2ab \cos C \]
Area of triangle given two sides \( a, b \) and the included angle \( \theta \)
\[ A = \frac{1}{2}ab \sin \theta \]
Heron’s formula for area of triangle given sides \( a, b, \) and \( c \)
\[ A = \sqrt{s(s-a)(s-b)(s-c)} \text{ where } s = \frac{a+b+c}{2} \]

Inverse Trigonometric Functions
If \( \theta = \sin^{-1} a \), then \[ -\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2} \]
If \( \theta = \cos^{-1} a \), then \[ 0 \leq \theta \leq \pi \]
If \( \theta = \tan^{-1} a \), then \[ -\frac{\pi}{2} < \theta < \frac{\pi}{2} \]