Section 5.4 **Solving Trigonometric Equations**

An equation that involves one or more trigonometric ratios of a variable is a trigonometric equation.

ex. $\sin\theta = 0.5$ ex. $4\cos x + 1 = 0$ ex. $2\tan 2x - 5\tan x - 3 = 0$

To solve linear trigonometric equations:

1) Isolate for sinθ, cosθ, tanθ, cscθ, secθ, or cotθ.
2) Switch any reciprocal trig ratios to their corresponding primary trig ratio.
3) Use the inverse function on your calculator or special triangles and the CAST rule to find θ.

Examples: Solve the following equations in the interval $x \in [-2\pi, 2\pi]$

a) Find the exact values of x, for $\sin x = -1/\sqrt{2}$

b) Round answers to 3 decimal places, for $\tan x - 3 = 0$

c) Round answers to 3 decimal places, for $2\sec x + 5 = 0$

To solve quadratic trigonometric equations:

1) Set one side equal to zero.

2) Let **a** = $\sin x$ or $\cos x$ or $\tan x$ or $\csc x$ or $\sec x$ or $\cot x$. Then replace the trig functions with **a** in the equation.

3) Factor the equation if possible. Then set each factor equal to zero and solve for **a**.

4) If it is not possible to factor, use the quadratic formula to solve for **a**.

5) Replace each **a** with the appropriate trig function.

6) Solve each factor using your rules for solving linear trigonometric equations.

Examples: Solve each equation in the interval $x \in [-2\pi, 2\pi]$

a) $\cos 2x - 1 = 0$ b) $2\csc 2x - \csc x - 1 = 0$ c) $5\cot 2x - 2\cot x - 3 = 0$

Example: The range of an arrow shot from a particular box can be modeled by the equation $r = 100\sin 2\theta$, where r is the range in metres and θ is the angle in radians above the horizontal that the arrow is released. A target is placed 80 m away.

a) What are the restrictions on the angle θ?

b) Determine the angle or angles that the archer should use to hit the target, to the nearest hundredth of a radian.