# L3 – 4.5 Double Angle Formulas MHF4U

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### Part 1: Proofs of Double Angle Formulas

**Example 1:** Prove  $\sin(2x) = 2\sin x \cos x$ 

LS

RS

**Example 2:** Prove  $\cos(2x) = \cos^2 x - \sin^2 x$ 

LS

RS

**Note:** There are alternate versions of  $\cos 2x$  where either  $\cos^2 x$  OR  $\sin^2 x$  are changed using the Pythagorean Identity.

## **Double Angle Formulas**

$$\sin(2x) = 2\sin x \cos x$$

$$\cos(2x) = \cos^2 x - \sin^2 x$$

$$\cos(2x) = 2\cos^2 x - 1$$

$$\cos(2x) = 1 - 2\sin^2 x$$

$$\tan(2x) = \frac{2\tan x}{1 - \tan^2 x}$$

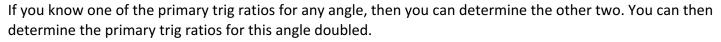
#### Part 2: Use Double Angle Formulas to Simplify Expressions

**Example 1:** Simplify each of the following expressions and then evaluate

a) 
$$2\sin\frac{\pi}{8}\cos\frac{\pi}{8}$$

**b)** 
$$\frac{2 \tan \frac{\pi}{6}}{1 - \tan^2 \frac{\pi}{6}}$$

#### Part 3: Determine the Value of Trig Ratios for a Double Angle



**Example 2:** If  $\cos \theta = -\frac{2}{3}$  and  $0 \le \theta \le 2\pi$ , determine the value of  $\cos(2\theta)$  and  $\sin(2\theta)$ 

We can solve for  $cos(2\theta)$  without finding the sine ratio if we use the following version of the double angle formula:

To find  $\sin(2\theta)$  we will need to find  $\sin\theta$  using the cosine ratio given in the question. Since the original cosine ratio is negative,  $\theta$  could be in quadrant \_\_\_\_\_. We will have to consider both scenarios.

**Scenario 1:**  $\theta$  in Quadrant \_\_\_\_

**Scenario 2:**  $\theta$  in Quadrant \_\_\_\_

**Example 3:** If  $\tan \theta = -\frac{3}{4}$  and  $\frac{3\pi}{2} \le \theta \le 2\pi$ , determine the value of  $\cos(2\theta)$ .

We are given that the terminal arm of the angle lies in quadrant \_\_\_\_: