Name ______________________

Date ______________ Pd ______

**Double-Angle Formulas**

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

$\tan(2u) = \dfrac{2\tan(u)}{1-\tan^2(u)}$

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

**Example 1**

Solve the equation $\sin(2x) - \sin(x) = 0$ in the interval $[0, 2\pi)$.

**Example 2**

Rewrite the expression $8\sin(x)\cos(x)$.

**Example 3**

Given $\sin(u) = 3/5$, $0 < u < \pi/2$, find the exact values of $\sin(2u)$, $\cos(2u)$, and $\tan(2u)$.

**Half-Angle Formulas**

$$\sin\left(\frac{u}{2}\right)=\pm\sqrt{\frac{1-\cos(u)}{2}} \qquad \cos\left(\frac{u}{2}\right)=\pm\sqrt{\frac{1+\cos(u)}{2}}$$

$$\tan\left(\frac{u}{2}\right)=\frac{1-\cos(u)}{\sin(u)}=\frac{\sin(u)}{1+\cos(u)}$$

The signs of $\sin(u/2)$ and $\cos(u/2)$ depend on the quadrant in which $u/2$ lies.

## Example 4

Solve the equation $\sin\left(\frac{x}{2}\right)-\cos(x)=0$ in the interval $[0,\ 2\pi)$.

## Example 5

Determine the exact values of the sine, cosine, and tangent of the angle $15°$.

**Power-Reducing Formulas**

$$\sin^2(u)=\frac{1-\cos(2u)}{2} \qquad \cos^2(u)=\frac{1+\cos(2u)}{2}$$

$$\tan^2(u)=\frac{1-\cos(2u)}{1+\cos(2u)}$$

## Example 6

Rewrite the expression $\cos^4(x)$.

Trigonometry/Precalculus

§5.5 Multiple-Angle Formulas HOMEWORK

Name ______________________

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In Exercises 1-2, solve the equation in the interval $[0, 2\pi)$.

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

2. $\cos(2x) - \cos(x) = 0$

3. Given $\cos(u) = -2/7$, $\pi/2 < u < \pi$, find the exact values of $\sin(2u)$, $\cos(2u)$, and $\tan(2u)$.

4. Rewrite the expression $6 - 12\sin^2(x)$.

5. Rewrite the expression $\sin^4(x)$.

6. Determine the exact values of the sine, cosine, and tangent of the angle $165°$.

7. Given $\tan(u) = -8/5$, $3\pi/2 < u < 2\pi$, find the exact values of $\sin(u/2)$, $\cos(u/2)$, and $\tan(u/2)$.

8. Solve the equation $\cos\left(\frac{x}{2}\right) - \sin(x) = 0$ in the interval $[0, 2\pi)$.