1. Simplify: $\cos\left(\frac{\pi}{6}+x\right)\cos\left(\frac{\pi}{6}-x\right)-\sin\left(\frac{\pi}{6}+x\right)\sin\left(\frac{\pi}{6}-x\right)$
2. If $\sin x = \frac{-1}{3}$ and "x" is in quadrant 3, then what is the value of $\sin 2x$?
3. Suppose for some angles "x" and "y" that $sin^2x + cos^2y = \frac{3a}{2}$ and $cos^2x + sin^2y = \frac{1}{2}a^2$, determine the possible values of "a".
4. Suppose $0 < x < \pi$ and $2sin^2x + cos^2x = \frac{25}{16}$. What is the value of $\sin x$?
5. Prove: $\frac{\sin 3x}{\sin x} - \frac{\cos 3x}{\cos x} = 2$
6. Prove: $\frac{\sin 2x}{1+\cos 2x} = \tan x$

Answer:

1. 0.5
2. $\frac{2\sqrt{8}}{9}$
3. $a = -4, 1$
4. $\frac{3}{4}$

3. $\sin^2 x + \cos^2 y = \frac{3a}{2}$

$+ \cos^2 x + \sin^2 y = \frac{1}{2}a^2$

$1 + 1 = \frac{3}{2}a + \frac{1}{2}a^2$

$2 = \frac{3}{2}a + \frac{1}{2}a^2$

$4 = 3a + a^2$

$a^2 + 3a - 4 = 0$

$(a+4)(a-1) = 0$

$a = -4, 1$

5. $\frac{\sin 3x}{\sin x} - \frac{\cos 3x}{\cos x} = 2$

$\frac{\sin 3x \cos x}{\sin x \cos x} - \frac{\cos 3x \sin x}{\sin x \cos x}$

$\frac{\sin 3x \cos x - \cos 3x \sin x}{\sin x \cos x}$

$\frac{\sin(3x - x)}{\sin x \cos x}$

$\frac{\sin 2x}{\sin x \cos x}$

$\frac{2 \sin x \cos x}{\sin x \cos x} = 2$

6. $\frac{\sin 2x}{1 + \cos 2x} = \tan x$

$\frac{2 \sin x \cos x}{1 + (2\cos^2 x - 1)}$

$\frac{2 \sin x \cos x}{2 \cos^2 x}$

$\frac{\sin x}{\cos x}$

$\tan x$