

$$\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta$$

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

$$\sin^2 \frac{\theta}{2} = \frac{1 - \cos \theta}{2}$$

$$\tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}$$

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

$$\tan^2 \frac{\theta}{2} = \frac{1 - \cos \theta}{1 + \cos \theta}$$

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

1. (8pts) Without using the calculator, find the exact values of the following expressions. Draw the unit circle and the appropriate angle under the expression.

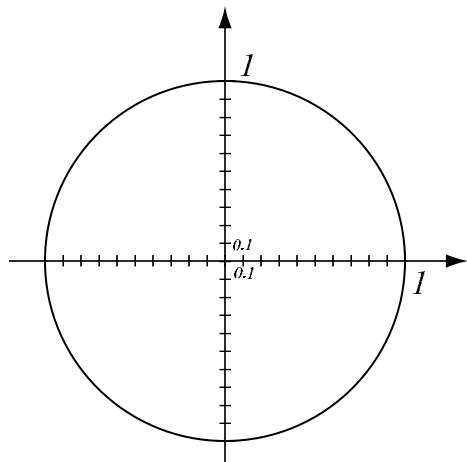
$$\cos 30^\circ =$$

$$\sec \frac{3\pi}{4} =$$

$$\arctan \sqrt{3} =$$

$$\arcsin 1.3 =$$

2. (4pts) Use the picture below to estimate $\cos 18^\circ$ and $\arcsin(-0.4)$ (in degrees). Then evaluate these numbers using a calculator and compare your answers.



3. (5pts) Draw two periods of the graph of $y = -3 \sin(2\theta)$. What is the amplitude? The period? Indicate where the special points are (x -intercepts, peaks, valleys).

4. (5pts) Use a half-angle formula to find the exact value of $\cos 165^\circ$.

5. (4pts) Find all the solutions of the equation $2 \sin \theta + 1 = 0$.

6. (6pts) Solve the triangle: $\alpha = 42^\circ$, $\gamma = 57^\circ$, $b = 5$

7. (5pts) Show the identity: $1 - \frac{\sin^2 \theta}{1 - \cos \theta} = -\cos \theta$.

8. (4pts) Find the exact values of the expressions below. Draw a picture if helpful and do not use the calculator.

$$\sin(\arcsin 0.57) =$$

$$\arctan \left(\tan \frac{7\pi}{8} \right) =$$

9. (9pts) Suppose that $\pi < \alpha < \frac{3\pi}{2}$ and $\frac{\pi}{2} < \beta < \pi$ are angles so that $\tan \alpha = \frac{3}{2}$ and $\cos \beta = -\frac{3}{7}$. Use addition and double formulas to find:

a) $\sin(\alpha - \beta)$

b) $\cos(2\beta)$

Bonus. (5pts) You take a sighting of the top of a building from a certain point and find that the angle of elevation is 33° . Then you move 200ft towards the building and take another sighting, finding the angle of elevation to be 51° now. How tall is the building?