NAME: ID#:

TAKE HOME EXAM 3

Solve the following problems showing all your work for full credit.

- **1.** Find the exact value of:
 - a) (5 pts.) $\cos(\alpha \beta)$ if $\cos \alpha = \frac{1}{3}$, α is in quadrant IV and $\cos \beta = -\frac{1}{4}$, β is in quadrant II.

b) (5 pts.)
$$\tan(\alpha + \beta)$$
 if $\sin \alpha = -\frac{3}{5}$, α is in quadrant III and $\cos \beta = -\frac{5}{12}$, β is in quadrant II.

2. Use a sum or difference identity to finda) (3 pts.) sin 165° exactly.

b) (3 pts.)
$$\tan \frac{19\pi}{12}$$
 exactly.

3. Simplify the expression:

a) (5 pts.)
$$\frac{(\sin x - \sin y)^2 + (\cos x - \cos y)^2 - 2}{\sin(x - y)} =$$

b) (4 pts.)
$$\frac{\tan^4 x - 1}{\tan^2 x - 1} =$$

- **4.** Verify each identity:
 - a) (5 pts.) $\cos^4 x \sin^4 x = \cos 2x$

b) (5 pts.)
$$\cos^2 2x = \frac{\tan 4x + \sin 4x}{2 \tan 4x}$$

c) (5 pts.)
$$\tan^2\left(\frac{x}{2}\right) = \frac{1-\cos x}{1+\cos x}$$

5. Use half-angle identity to evaluate a) (3 pts.) $\sin(-22.5^{\circ})$ exactly.

b) (3 pts.)
$$\cos\left(-\frac{3\pi}{8}\right)$$
 exactly.

- 6. Given that $\cos \theta = \frac{2}{3}$ and the terminal side is in quadrant IV, find: a) (2 pts.) $\cos(\frac{\pi}{2} + \theta) =$
 - b) (2 pts.) $\sin 2\theta =$

c) (2 pts.)
$$\cos 2\theta =$$

d) (3 pts.)
$$\sin \frac{\theta}{2} =$$

7. Find the exact value of the expression whenever it is defined: 1

a) (2 pts.)
$$\cos^{-1}(-\frac{1}{2})$$
 in radians

b) (2 pts.)
$$\arcsin(\frac{\sqrt{3}}{2})$$
 in degrees

c) (3 pts.)
$$\tan^{-1}(\tan\frac{3\pi}{4}) =$$

d) (3 pts.)
$$\csc(\cos^{-1}(\frac{1}{5})) =$$

e) (4 pts.)
$$\cos(\sin^{-1}(\frac{4}{5}) + \tan^{-1}(\frac{3}{4})) =$$

8. Solve, finding all solutions of the equation in the interval $[0,2\pi)$: a) (4 pts.) $4\cos^2 x = 1$;

b) (5 pts.) $\cos x(2\cos x + 7) = 4$;

c) $(5 \text{ pts.})\sqrt{3}\cos x + \cos x \cot x = 0.$

d) (5 pts.) $2\sin x \tan x - \tan x = 1 - 2\sin x$.

- 9. Solve the given triangles (round to two decimal places):
 - a) (4 pts.) $\alpha = 45^{\circ}$, $\gamma = 35^{\circ}$, c = 10 cm;

b) (4 pts.) a = 5 in, b = 7 in, c = 9 in.

10. (4 pts.) A plane flew due north 450 mph for four hours. A second plane, starting at the same point and at the same time, flew southeast at an angle 135° clockwise from due north at 375 mph for four hours. At the end of the four hours, how far apart were the two planes? Round to the nearest mile.