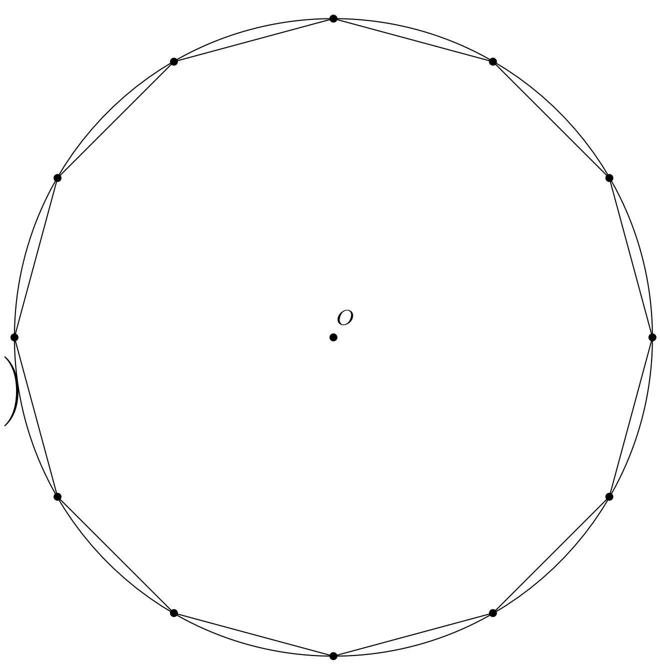
Math 12 **Name (Print):** ____________________________
Exam 3: Chapter 7-10/24/13

Write all responses on separate paper. Remember to organize your work clearly. You may *not* use your books, notes, or any calculator on this exam.

1. (10 points) Use the substitution $x = \frac{3}{5}\tan\theta$ to simply the expression $\frac{1}{x^2\sqrt{25x^2+9}}$
2. (10 points) Simplify the expression as much as possible: $\frac{\sin\phi}{1-\cos\phi} + \frac{1-\cos\phi}{\sin\phi}$
3. (10 points) Find coefficients C and ϕ so that $2\sin(4\theta) + 3\cos(4\theta) = C\sin(4\theta + \arctan\phi)$.
4. (15 points) Given that $\tan(\theta) = -3$ and θ is in quadrant II, find the following:
   (a) $\cos(2\theta)$.
   (b) $\sin(2\theta)$
   (c) $\tan(2\theta)$
5. (10 points) Find the area of a regular polygon with twelves sides (a dodecagon) inscribed in the unit circle (radius = 1) as shown below. Do not approximate.



6. (10 points) Use the addition identities to prove the product to sum identity,
   $\sin\alpha\sin\beta = \frac{1}{2}(\cos(\alpha-\beta) - \cos(\alpha+\beta))$
7. (10 points) Consider the point $\left(\cos\left(\frac{7\pi}{12}\right), \sin\left(\frac{7\pi}{12}\right)\right)$ on the unit circle.
   (a) Use the addition identity on $\frac{7\pi}{12} = \frac{\pi}{3} + \frac{\pi}{4}$ to find simplified radical forms for the coordinates.
   (b) Use the half angle formula on $\theta = \frac{7\pi}{6}$ to find different simplified radical forms for the coordinates.
8. (9 points) Use the addition identities to express $\cos(5x)$ as quintic polynomial in $\cos(x)$.
9. (16 points) Find all solutions in the interval $[0, 2\pi)$ for each equation.
   (a) $2\cos(4\theta) + \sqrt{2} = 0$
   (b) $\cos^2(2\theta) - \cos(2\theta) - 1 = 0$