The quiz is due Tuesday, April 26th at the beginning of your discussion section.

You may work with other students in this class. However each student should write up solutions separately and independently – nobody should copy someone else’s work.

You may use your notes or the textbook.

No calculators or computers are allowed on any problem.

You must show sufficient work to justify each answer.

Be sure that the pages are nicely stapled – do not just fold the corners.

1. (1 point) One representation for a point in polar coordinates is given by \((r, \theta) = (8, \frac{5\pi}{6})\). Convert this to Cartesian coordinates where each coordinate is written in simplified form.

\[
x = r \cos \theta = 8 \cos \left(\frac{5\pi}{6}\right) = 8 \left(-\frac{\sqrt{3}}{2}\right) = -4\sqrt{3}
\]

\[
y = r \sin \theta = 8 \sin \left(\frac{5\pi}{6}\right) = 8 \left(\frac{1}{2}\right) = 4
\]

\((x, y) = (-4\sqrt{3}, 4)\)

2. (2 points) A point has Cartesian coordinates \((5, \sqrt{75})\). Find two different polar coordinate representations for this point. For one of your representations \(r\) must be negative and for the other \(r\) must be positive.

\[
r^2 = x^2 + y^2 = (5)^2 + (\sqrt{75})^2 = 100
\]

\[
r = \pm 10
\]

\[
\tan \theta = \frac{y}{x} = \frac{\sqrt{75}}{5} = \frac{5\sqrt{3}}{5} = \sqrt{3}
\]

\[
\theta = \frac{\pi}{3} + k\pi \quad \text{for} \quad k \text{ an integer}
\]

\((r_1, \theta_1) = (10, \frac{\pi}{3})\)

\((r_2, \theta_2) = (-10, \frac{4\pi}{3})\)
3. (2 points) Sketch a graph of the polar curve whose points satisfy the following criteria.

- As $\theta$ increases from 0 to $\pi/2$, $r$ decreases from 4 to 2.
- As $\theta$ increases from $\pi/2$ to $\pi$, $r$ decreases from 2 to 0.
- As $\theta$ increases from $\pi$ to $3\pi/2$, $r$ decreases from 0 to $-1$.
- As $\theta$ increases from $3\pi/2$ to $2\pi$, $r$ decreases from $-1$ to $-3$.

4. (3 points) Convert the given polar equation to one using Cartesian coordinates and solve for $y$ in terms of $x$.

$$r = \frac{1}{5 \cos \theta + 3 \sin \theta}$$

$$5r \cos \theta + 3r \sin \theta = 1$$
$$5x + 3y = 1$$

$$3y = 1 - 5x$$
$$y = \frac{1}{3} - \frac{5}{3}x$$
5. (2 points) Given the polar equation \( r = 2\sin(3\theta) \), find a formula for \( \frac{dy}{dx} \). You do not need to simplify your answer which may be written in terms of \( \theta \).

\[
X = r\cos\theta = 2\sin(3\theta)\cos\theta \\
Y = r\sin\theta = 2\sin(3\theta)\sin\theta
\]

\[
\frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta}
\]

\[
\frac{dy}{dx} = \frac{6\cos(3\theta)\sin\theta + 2\sin(3\theta)\cos\theta}{6\cos(3\theta)\cos\theta + 2\sin(3\theta)(-\sin\theta)}
\]