Honors Calculus Quiz 7 10/17/3

Name: Signature

Show your work.

Question 1

• A particle is moving along an ellipse in the plane has position vector \( \mathbf{X} \) at time \( t \) seconds given by the formula:

\[
\mathbf{X} = [10 \cos(t), -20 \cos(t) + 10 \sin(t)].
\]

• Find the velocity vector and the acceleration vector of the particle.

• Find the minimum and maximum speeds of the particle as it moves around the ellipse.

• Plot the ellipse and show on the ellipse the points where the particle is moving its fastest and where it is moving its slowest.

Question 2

• Find the linear approximation to the function \( \tan(x) \) near \( x = \frac{\pi}{4} \).

• Plot the percentage error in the linear approximation and estimate an interval on which the percentage error is less than five percent.

• Use your approximation to estimate \( \tan\left(\frac{2\pi}{3}\right) \).

Question 3

Newton’s law of gravity gives the force size \( F \), between two point masses \( m_1 \) and \( m_2 \), separated by a distance \( r \), in terms of the formula \( F = G \frac{m_1 m_2}{r^2} \), where \( G \) is the gravitational constant.
If the force \( F \), the distance \( r \), the masses \( m_1 \) and \( m_2 \) are each measured with an accuracy of one percent, what is the accuracy in the determination of the constant \( G \)?