Discussion Problems **Name:** _____

Worksheet 12: Newton's Method/Newton-Raphson Method

Math 408D:

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Problem 1. Consider Kepler's equation regarding planetary orbits, $M = E - \epsilon \sin(E)$, where M is the mean anomaly, E is the eccentric anomaly, and ϵ is the eccentricity of an orbit. Use Newton's method to solve for the eccentric anomaly E when the mean anomaly $M = \frac{\pi}{3}$ and the eccentricity of the orbit $\epsilon = 0.25$.

Problem 2. The figure shows the sun located at the origin and the earth at the point $(1, 0)$.The unit here is the distance between the center of the earth and the sun, called an astronomical unit: $1AU \approx 1.496 \times 10^8$ km. There are five locations L_i in this plane of rotation of the earth about the sun where a satellite remains motionless with respect to the earth because the forces acting on the satellite balance each other. These locations are called the libration points. If m_1 is the mass of the sun and m_2 is the mass of the earth, then $lambda$ is defined as follows.

$$\lambda = \frac{m_2}{m_1 + m_2}$$

The x-coordinate of L_1 is the root of the equation $p_1(x)$.

$$p_1(x) = x^5 - (2 + \lambda)x^4 + (1 + 2\lambda)x^3 - (1 - r)x^2 + 2(1 - r)x + r - 1 = 0$$

The x-coordinate of L_2 is the root of the equation $p_1(x)$.

$$p_2(x) - 2rx^2 = 0$$

Use the value $\lambda \approx 3.04042 \times 10^-6$ and estimate the locations for L_1 and L_2.

Problems

Problem 2

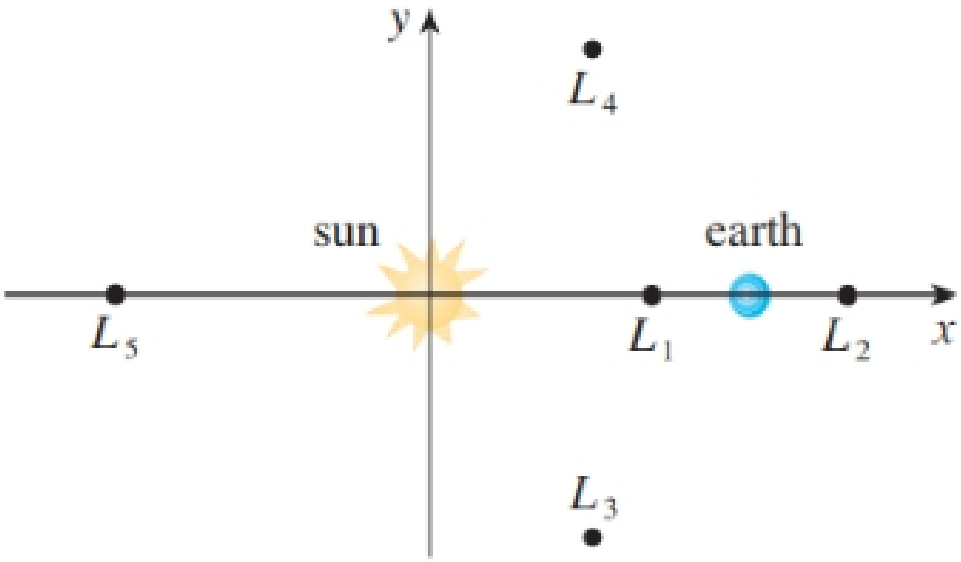

Figure 1: Libration Points of Earth-Sun