Name: _____

Please show all work and justify your answers.

1. (10 pts.)   Al Samoud missiles have a conical payload with base diameter 10 cm and length 20 cm. Assuming uniform density, how far from the tip is the center of mass of the payload? You may evaluate integrals numerically.

2. (10 pts.) Determine whether the following improper integrals converge. Justify.

$$\text{(a) } \int_1^\infty \left(\frac{\cos x}{x}\right)^2 dx \quad \text{(b) } \int_1^\infty \frac{\sqrt[3]{x}}{2 + \sqrt{x^3 + 1}}\, dx$$

3. (10 pts.)   Bart approximates an integral using Simpson's rule with 5 subdivisions. Lisa is more diligent and makes 10 subdivisions. Based on their approximations 15.243 (Bart) and 15.212 (Lisa) estimate the exact value of the integral.

4. (20 pts.) Demonstrate your mastery of techniques of integration (other than guess-and-check) by evaluating the following integrals. Show all work. Name the techniques you are using. If you use tabulated integrals, cite them.

$$\text{(a) } \int \frac{x^2}{x^2 - 1}\, dx \quad \text{(b) } \int \frac{1}{4x^2 - 8x + 13}\, dx \quad \text{(c) } \int \frac{\sqrt[3]{1 + \ln x}}{x}\, dx \quad \text{(d) } \int \arctan x \, dx$$

1	2	3	4	total (50)

Prelim. course grade: _____ %