

Name: \_\_\_\_\_

Please show all work and justify your answers.

1. (10 pts.) Position of a Spud missile is given in meters as a function of time in seconds by  $x(t) = 100t, y(t) = 50t - 10t^2$ .

- (a) When and how far away will the Spud hit the ground?
- (b) What is the Spud's speed at the time of impact?

2. (10 pts.) Duff brewing company is redesigning its cans to optimize the amount of aluminum used (proportional to surface area). Assume that the can is cylindrical and must contain half a liter (500 cc) of Duff. What should be the radius and height of an optimal Duff can?

3. (10 pts.) Sulphurous smoke is spewed from a coal burning electrical plant. The rate of release of sulphur into the atmosphere is periodically measured. Tabulated results are shown below.

time (days)	0	1	2	3
rate (grams/day)	150	130	115	102

- (a) Find upper and lower estimates on the amount of sulphur spewed during the 3 days.
- (b) Approximately how often should measurements have been made in order for upper and lower estimates to differ by 1 g?

4. (10 pts.) Evaluate the following integrals

(a)  $\int_1^4 [t\sqrt{t} - t^3] dt$     (b)  $\int_0^{\frac{\pi}{8}} \sin(4t) dt$     (c)  $\int \left[\frac{1+t}{t}\right]^2 dt$     (d)  $\int 5^{2t} dt$

5. (10 pts.) Brushing teeth removes most of the plaque leaving a 0.1 mm thick layer. Subsequently the thickness of plaque increases at a rate proportional to the fourth root of time. After 2 hours, the plaque layer is 0.2 mm thick. How thick is the plaque 8 hours after brushing?

1	2	3	4	5	total (50)
					%

Prelim. course grade: \_\_\_\_\_ %