Math 122 Section 5.1-5.2, 5.4 Study Guide

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1 Sections 5.1-5.2

Problem 1) Approximate the following integrals using (i) a left-hand sum with $n = 4$ subdivisions; and then (ii) a right-hand sum with $n = 4$ subdivisions. Does the left-hand sum overestimate or underestimate the integral? What about the right-hand sum?

(a) $\int_1^3 e^x \, dx.$

(b) $\int_{-3}^{-1} x^2 \, dx.$

(c) $\int_1^3 \ln(x) \, dx.$

(d) $\int_{-1}^{-3} \frac{1}{x} \, dx.$

(e) $\int_1^3 \sqrt{x} \, dx.$

Problem 2) Consider the following table:

x	0	10	20	30	40
$f(x)$	350	410	435	450	460

(a) Estimate $\int_0^{40} f(x) \, dx$ with a left-hand sum.

(b) Estimate $\int_0^{40} f(x) \, dx$ with a right-hand sum.

2 Section 5.4

Problem 3) After a foreign substance is introduced into the blood, the rate at which antibodies are made is given by $r(t) = \frac{t}{t^2+1}$ thousands of antibodies per minute, where t is in minutes. Assuming there are no antibodies at time $t = 0$, find the total quantity of antibodies in the blood at the end of 4 minutes.

Problem 4) A forest fire covers 2000 acres at time $t = 0$. The fire is growing at a rate of $8\sqrt{t}$ acres per hour. How many acres are covered 24 hours later?

Problem 5) Water is pumped out of a holding tank at a rate of $5 - 5e^{-0.12t}$ litres per minute, where t is the number of minutes since the pump started. If the holding tank contains 1000 litres of water when the pump is started, how many litres does it contain an hour later?