

Group Exam 4

Name: KEY

Math 141-3, Calculus I

Name of group member: _____

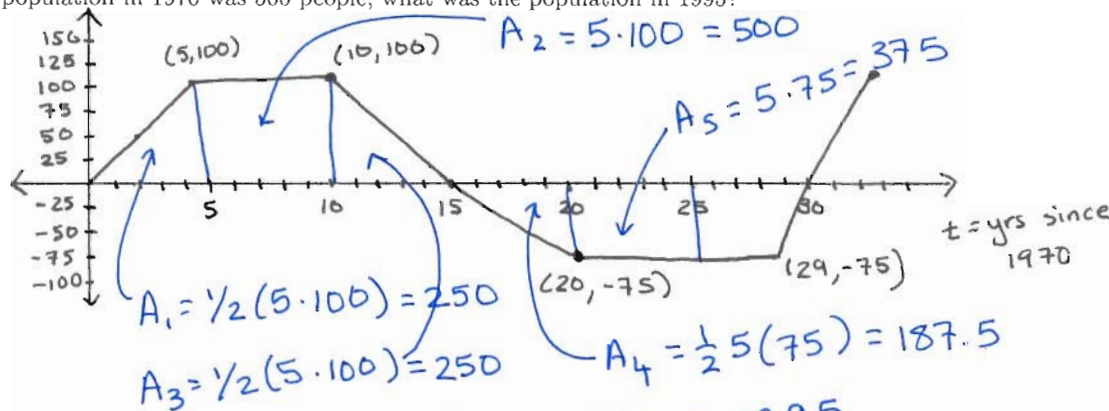
Professor McNicholas

Name of group member: _____

Show your work and make sure your answers are well organized, easy to follow, and properly explained.

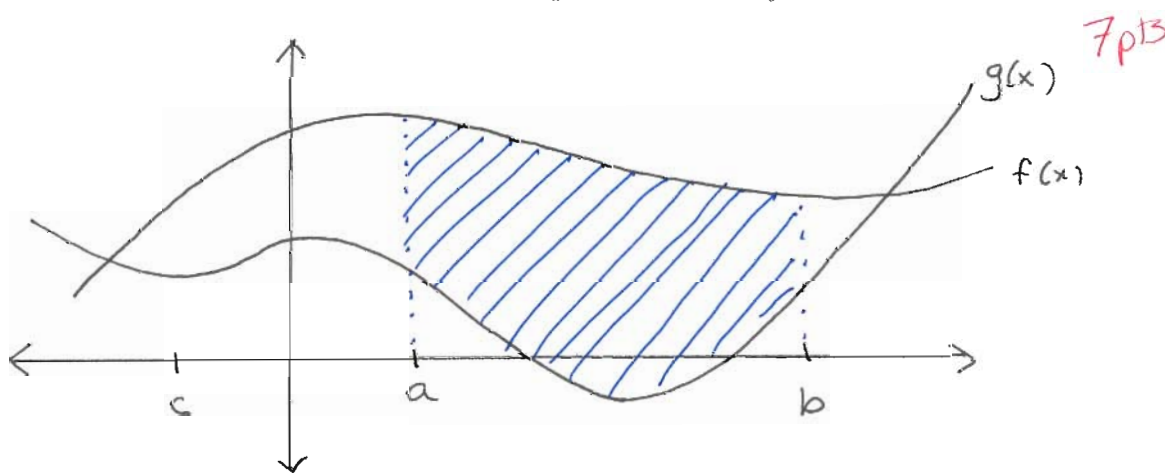
Problem 3:

a. The following graph represents the rate of change in the population of a small eastern Oregon town. If the population in 1970 was 500 people, what was the population in 1995?



Change in population from 1970 to 1995
 $= A_1 + A_2 + A_3 - A_4 - A_5 = 250 + 500 + 250 - 375 - 187.5 = 437.5$ ← 5pts
 Pop. in 1995 = $500 + 437.5 = \boxed{937.5 \text{ people}}$ ← 3pts

b. Shade the area on the following graph representing $\int_a^c [f(x) - g(x)] dx + \int_c^b [f(x) - g(x)] dx$.



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Problem 1:

Consider the left-hand-sum approximation of $\int_0^8 e^{x^2} dx$ using $n = 4$.

a. What is Δx

$$\Delta x = \frac{b-a}{n} = \frac{8-0}{4} = 2$$

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b. Using $n = 4$, calculate the left-hand-sum approximation by hand (i.e. not using a calculator program). To show your work, write out the terms you are adding together.

$$x_0 = 0, x_1 = 2, x_2 = 4, x_3 = 6, x_4 = 8$$

$$\begin{aligned} \int_0^8 e^{x^2} dx &\approx f(x_0)\Delta x + f(x_1)\Delta x + f(x_2)\Delta x + f(x_3)\Delta x \\ &= e^{x_0^2}(2) + e^{x_1^2}(2) + e^{x_2^2}(2) + e^{x_3^2}(2) \\ &= e^0(2) + e^4(2) + e^{16}(2) + e^{36}(2) \\ &= 2(1 + e^4 + e^{16} + e^{36}) = 8.622 \times 10^{15} \end{aligned}$$

6

3

LHS approximation

c. Is your approximation an overestimate or an underestimate? How do you know?

Over the interval $[0, 8]$ e^{x^2} is an increasing function. Thus the LHS estimate is an underestimate.

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Problem 2:Given $g(x) = \int_1^x \ln(t) dt$,a. Find an expression for the composite function $h(x) = g(x^2)$.

5
$$h(x) = g(x^2) = \int_1^{x^2} \ln(t) dt$$

b. Find $h'(x)$

5
$$h'(x) = g'(x^2) \cdot 2x$$

$$g'(x) = \ln(x)$$

$$\Rightarrow g'(x^2) = \ln(x^2)$$

$$h'(x) = \ln(x^2) \cdot 2x$$

c. At $x = 2$, is the function $h(x)$ increasing or decreasing?

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$$h'(2) = \ln(2^2) \cdot 2 \cdot 2$$

$$= 5.545177444$$

since the derivative is positive, the function is increasing.

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