

MA131 Calculus for Life and Management Sciences A

Exam 4 Form 41

November 23, 2009

Instructions: Show all work relevant to the solution of each problem. i.e. no credit will be given for “just the answers.” Please do *all* work in the Blue Books! There are **seven** problems which carry a total 100 points. You will have until the end of class to complete this exam. Good luck!

(15 pts) **Problem 1.** Let $f(x) = \frac{1}{4}x^3 + \sqrt{x}$.

- Approximate the area under the curve $f(x)$, bounded on the left by $x = 0$, and on the right by $x = 1$, using Riemann Sums. Use the left-handed rule and 2 rectangles.
- Find the exact area of the region described.

(15 pts) **Problem 2.** Let $f(x) = \frac{1}{x}$

- Compute $F(x)$, the anti-derivative of $f(x)$.
- Let a region be bounded by the x -axis, $f(x)$, $x = 1$, and $x = 2$. Compute the volume of the solid obtained by rotating this region about the x -axis.

(10 pts) **Problem 3.** Compute the area bounded by the curve $f(x) = 1 - x$, the x -axis, $x = -1$ and $x = 1$.

(15 pts) **Problem 4.** Let $f(x) = 2x\sqrt{x^2 + 5}$.

- Compute $\int_1^3 f(x) dx$.
- Find the average value of $f(x)$ over the interval $[1, 3]$.

(15 pts) **Problem 5.** Find the area of the region bounded by the curves $f(x) = x^4$ and $g(x) = x^5$.

(15 pts) **Problem 6.** Watsonium-Q is a fuel used for rockets in the late 21st century. Usage is given in tons according to the formula $A(t) = 50000e^{.05t}$, where t is years since 2070.

- Calculate the total usage of Watsonium-Q over the years 2070 to 2100.
- Suppose worldwide reserves of Watsonium-Q is a fixed 4.1 million tons. Assuming no future growth in reserves, is 4.1 million tons enough to meet the predicted demand over the years 2070 - 2100?

(15 pts) **Problem 7.** The birth rate $b(t)$ and death rate $d(t)$ for Watson City is given as the following functions of t (years since 2000).

$$b(t) = 713 - 9t^2, \text{ and } d(t) = 337 + 32t^2$$

- Find the total number of births from the years 2000 to 2010.
- Find the total number of deaths from the years 2000 to 2010.
- The population in the year 2000 was 50,000. Estimate the population in the year 2010.