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MTH 1108 **Fundamentals of Integral Calculus** **Spring 1999**

QUIZ 2

1. A colony of giant bacteria is cultured for a period of time, but eventually dies out, for lack of sufficient nutrients. Its population at time t in hours is given by $P(t) = 10e^t - te^t$, as long as $P(t) \geq 0$. **(8)**

(a) What is the initial population?

(b) What is the rate of growth of the bacteria population at time $t = 2$ hours?

(c) When is the rate of growth zero?

(d) What is the maximum size of the bacteria population?

(e) When does the population die out?

2. Compute:

(a) $\displaystyle\int x^3(x^4+7)^5\,dx =$ **(4)**

(b) $\displaystyle\int \frac{4x}{(1-5x^2)^3}\,dx =$ **(4)**

(c) $\displaystyle\int \frac{\sqrt{3\ln x}}{x}\,dx =$ **(4)**

(d) $\displaystyle\int e^{\sin(2x)}\cos(2x)\,dx =$ **(4)**

3. **(6)**

(a) Sketch the area represented by the integral $\displaystyle\int_1^3 \frac{1}{x}\,dx$.

(b) Use a left-approximating sum $\sum_{i=0}^{n-1} f(x_i)\Delta x$ with $n = 4$ rectangles to approximate this integral.

Table of Derivatives

$$(fg)' = f'g + fg' \qquad \text{(product rule)}$$

$$\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2} \qquad \text{(quotient rule)}$$

$$f(g(x))' = f'(g(x)) \cdot g'(x) \qquad \text{(chain rule)}$$

$$(x^n)' = nx^{n-1}$$

$$(e^x)' = e^x$$

$$(\ln x)' = \frac{1}{x}$$

$$(\sin x)' = \cos x$$

$$(\cos x)' = -\sin x$$

$$(\arctan x)' = \frac{1}{x^2+1}$$

Table of Antiderivatives

$$\int a\,dx = ax + C$$

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C \qquad (n \neq -1)$$

$$\int \frac{1}{x}\,dx = \ln|x| + C$$

$$\int e^{ax}\,dx = \frac{1}{a}\,e^{ax} + C \qquad (a \neq 0)$$

$$\int \sin(ax)\,dx = -\frac{1}{a}\,\cos(ax) + C \qquad (a \neq 0)$$

$$\int \cos(ax)\,dx = \frac{1}{a}\,\sin(ax) + C \qquad (a \neq 0)$$

$$\int \left(af(x) + bg(x)\right)\,dx = a\int f(x)\,dx + b\int g(x)\,dx$$

$$\int f(g(x))g'(x)\,dx = F(g(x)) + C, \qquad \text{where } F' = f$$