



## MATHEMATICS 201-NYB-05

Integral Calculus

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

# QUIZ #3 B

## Solutions

*Answer all questions and show all your work. Exact answers are required.  
No calculators are permitted.*

### Question 1 (3 points)

Find  $g'(x)$

$$\begin{aligned}g(x) &= \int_{x^2}^{x^4} \cos(t^2) dt \\ &= F(x^4) - F(x^2) \\ g'(x) &= F'(x^4)4x^3 - F'(x^2)2x \\ &= 4x^3 \cos(x^8) - 2x \cos(x^4)\end{aligned}$$

### Question 2 (4 points)

Evaluate the following limit by first recognizing the sum as a Riemann sum.

$$\begin{aligned}\lim_{n \rightarrow \infty} \left( \frac{3e^{\frac{3}{n}+4}}{n} + \frac{3e^{\frac{6}{n}+4}}{n} + \frac{3e^{\frac{9}{n}+4}}{n} + \cdots + \frac{3e^{\frac{3n}{n}+4}}{n} \right) &= \lim_{n \rightarrow \infty} \sum_{i=1}^n e^{4 + \frac{3i}{n}} \frac{3}{n} \\ &= \int_4^7 e^x dx \\ &= e^x \Big|_4^7 = e^7 - e^4\end{aligned}$$

$\Delta x = \frac{3}{n}$   
 $x_i = 4 + \frac{3i}{n}$

### Question 3 (3 points)

During the spring, the rate of growth  $\frac{dP}{dt}$  of the population of squirrels on the Plains of Abraham is given by

$$\frac{dP}{dt} = 5\pi \cos\left(\frac{\pi}{40}t\right) \quad 0 \leq t < 120$$

where  $P$  is the population size and  $t$  is the time in days, with  $t = 0$  corresponding to March 1st. Find the change in population in the first 20 days.

$$\begin{aligned}P(20) - P(0) &= \int_0^{20} 5\pi \cos\left(\frac{\pi}{40}t\right) dt \\ &= 200 \sin\left(\frac{\pi}{40}t\right) \Big|_0^{20} \\ &= 200 \text{ squirrels}\end{aligned}$$