

Serial No.: \_\_\_\_\_ Student Name: \_\_\_\_\_ Student Number: \_\_\_\_\_

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Math 102- Q1

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**Problem 1: (12 points)** Consider the area  $A$  under the graph of  $f(x) = x^2 + x + 1$  from  $x = 0$  to  $x = 4$

(a) Estimate the area  $A$  using **four** approximating rectangles and taking the sample point to be the **left endpoint**.

(b) Write the area  $A$  as a limit of a Riemann Sum.

(c) Evaluate the limit and find the exact area.

(d) Write the area as a definite integral and then evaluate it.

**Problem 2: (5 points)** The area of a region over the interval  $[0, \pi/4]$  is given by the limit

$$\lim_{n \rightarrow \infty} \frac{\pi}{n} \sum_{i=1}^n \sin\left(1 + \frac{\pi i}{4n}\right)$$

Write the area as a definite integral on  $[0, \pi/4]$ . (DO NOT EVALUATE THE INTEGRAL)

**Problem 3: (8 points)** For each function, find  $f'(x)$

(a)  $f(x) = \int_x^{x^2} \frac{t - \sin t}{t \cos^2 t} dt$

(b)  $f(x) = \int_1^e \frac{x \ln x}{\sqrt{1+x^2}} dx$