First Name: _____ Last Name: _____

Student-No: _____ Section: _____

Grade:

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Indefinite Integrals

1. [9 marks] Each part is worth 3 marks. Please write your answers in the boxes.

   (a) Calculate the indefinite integral $\int \frac{\sin(x)}{\sqrt{\cos(x)}}\,dx$ for $0 < x < \pi/2$.

   Answer:

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   (b) Calculate the indefinite integral $\int \frac{x+1}{x^2+3x}\,dx$ for $x > 0$.

   Answer:

(c) (A Little Harder): Calculate the indefinite integral $\int x^2 e^{-x}\, dx$.

Answer:

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Definite Integrals

2. [12 marks] Each part is worth 4 marks. Please write your answers in the boxes.

(a) Calculate $\int_0^{\pi/2} \cos^3(x)\, dx$.

Answer:

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(b) Calculate $\int_0^3 \frac{9x^2}{x^2+9}\, dx$.

Answer:

(c) (A Little Harder): Calculate $\int_1^{e^2} \frac{\ln x}{x^2}\, dx$.

Answer:

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Riemann Sum, FTC, and Volumes

3. [12 marks] Each part is worth 4 marks. Please write your answers in the boxes.

   (a) Calculate the infinite sum

$$\lim_{n\to\infty} \sum_{i=1}^{n} \frac{3i^2}{n^3} \sqrt{1 + \frac{i^3}{n^3}}$$

   by first writing it as a definite integral. Then, **evaluate this integral**.

   Answer:

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   (b) For $x \geq 0$ define $F(x)$ and $g(x)$ by $F(x) = \int_0^x \cos^2(t)\, dt$ and $g(x) = xF(x^2)$. Calculate $g'(\sqrt{\pi})$.

   Answer:

(c) Write a definite integral, with specified limits of integration, for the volume obtained by revolving the bounded region between $x = -y^2$ and $x = -4+y^2$ about the vertical line $x = 2$. **Do not evaluate the integral**.

Answer:

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4. (a) [2 marks] Plot the finite area enclosed by $y^2 = x$ and $x = 8 - 2y$.

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(b) [4 marks] Write a definite integral with specific limits of integration that determines this area. **Do not evaluate the integral**.

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5. A solid has as its base the region in the xy-plane between $y = 1 - x^2/9$ and the x-axis. The cross-sections of the solid perpendicular to the x-axis are semi-circles with the diameter of the semi-circle in the base.

   (a) [4 marks] Write a definite integral that determines the volume of the solid.

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   (b) [2 marks] **Evaluate the integral** to find the volume of the solid.

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