**Name:** _____
**Student ID:** _____

# Test 3

This test is graded out of 50 marks. No books, notes, no graphing calculator or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work. If you need more space for your answer use the back of the page.

**Question 1.** *(5 marks)* Determine the indeterminate form, then evaluate the limit, using L'Hôpital Rule if necessary:

$$\lim_{x\to\infty} \frac{\ln x^3}{x^2}$$

**Question 2.** *(5 marks)* Determine the indeterminate form, then evaluate the limit, using L'Hôpital Rule if necessary:

$$\lim_{x \to \infty} x^2 e^{-3x}$$

**Question 3.** *(5 marks)* Integrate the following improper integral if it converges:

$$\int_0^{\infty} xe^{-x/3}$$

**Question 4.** *(5 marks)* Integrate the following improper integral if it converges:

$$\int_0^2 \frac{1}{\sqrt[4]{2-x}}\,dx$$

**Question 5.** *(5 marks)* Find the volume of the solid generated by revolving the region bounded by the graphs of the equations: $y = \sqrt{x}$, $y = 0$, $x = 9$ about the $x$-axis.

**Question 6.** *(5 marks)* Find the volume of the solid generated by revolving the region bounded by the graphs of the equations: $x+y=6$, $y=x$, $y=0$ about the $x$-axis.

**Question 7.** *(5 marks)* Find the arc length of the graph of the function $y = \frac{x^4}{10} + \frac{1}{6x^2}$ over the interval $[1, 2]$.

**Question 8.** *(5 marks)* An open tank has the shape of a circular cone with its tip oriented downward. The tank is 8 feet across the top and 12 feet high. How much work is done in filling the tank by pumping the water from 7 feet below the tank? (The water weighs 62.4 pounds per cubic feet)

**Question 9.** *(5 marks)* Integrate the following indefinite integral:

$$\int \frac{3x^2 - 2}{x^3 + x}\, dx$$

**Question 10.** *(5 marks)* Integrate the following indefinite integral:

$$\int x\sqrt{1+x^2}\,dx$$

**Bonus Question.** *(3 marks)* Evaluate the following limit:

$$\lim_{x\to 1^+} (\ln x)^{x-1}$$