Name:_____

Student Number:_____

Show all your work and give reasons for your answers. Good luck!

Part I

In part I essentially no partial credit is awarded. Hence work these problems carefully. Each problem in part I is 8 points.

In 1-4, evaluate the integrals:

(1) $\int x^2 \sqrt[5]{5x^3+4}\, dx$

(2) $\int \frac{x^3+\sqrt{x}}{x^9}\, dx$

(3) $\int \arctan(x)\, dx$

(4) $\int \frac{1}{x^2-x-2}\, dx$

(5) Use a Riemann sum with $n = 4$ terms to estimate $\int_0^1 e^{x^2}\,dx$. How many terms would be needed if we want an error of less than $1/100$? You can use that $e^1 = e \leq 3$.

(6) **Set up** an integral for the volume of the solid of revolution obtained by rotating the area bounded by $y = x^9 + 3x^2 + x + 5$, $y = -1$, $x = 0$ and $x = 1$, about the line $x = -4$.

(7) Let

$$F(x) = \int_{x^2}^{\sqrt[3]{x}} \ln(t^2)\, dt.$$

Find $F'(x)$

(8) **Set up** an integral for the arc length of the parametric curve

$$\begin{cases} x = te^t \\ y = \arctan(t) \end{cases}$$

with $0 \leq t \leq 1$.

In part II you can receive partial credit. Each problem in part II is 13 points.

Part II

(9) Find the volume of the solid in three-space whose intersection, by planes perpendicular to the x-axis, is a square one side of which stretches from the graph of $y = x^2$ to the graph of $y = x^3$, where $0 \leq x \leq 1$.

(10) Find the work done in pumping the water out of an inverted round cone of height $h = 5\,m.$ and radius $r = 7\,m.$ You may use that the density of water if $1000\,kg/m^3$.

(11) Evaluate $\int \frac{x^2+5}{x^3+x}\,dx$

Name:_____

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Show all your work and give reasons for your answers. Good luck!

Part I

In part I essentially no partial credit is awarded. Hence work these problems carefully. Each problem in part I is 8 points.

In 1-4, evaluate the integrals:

(1) $\int x \sin(5x^2 + 4)\, dx$

(2) $\int \frac{x+\sqrt{x}}{x^3}\, dx$

(3) $\int \ln(x)\, dx$

(4) $\int \frac{1}{x^2-1}\, dx$

(5) Use a Riemann sum with $n = 5$ terms to estimate $\int_0^1 \cos(x^2)\,dx$. How many terms would be needed if we want an error of less than $1/100$?

(6) **Set up** an integral for the volume of the solid of revolution obtained by rotating the area bounded by $y = x^7 + 3x^2 + x + 5$, $y = 1$, $x = 0$ and $x = 1$, about the line $x = -3$.

(7) Let

$$F(x) = \int_{\sqrt{x}}^{x^2} \ln(t^2)\, dt.$$

Find $F'(x)$

(8) **Set up** an integral for the arc length of the parametric curve

$$\begin{cases} x = t\sin(t) \\ y = \arctan(t) \end{cases}$$

with $0 \leq t \leq 1$.

Part II

In part II you can receive partial credit. Each problem in part II is 13 points.

(9) Find the volume of the solid in three-space whose intersection, by planes perpendicular to the x-axis, is a square one side of which stretches from the graph of $y = x^2$ to the graph of $y = \sqrt{x}$, where $0 \leq x \leq 1$.

(10) Find the work done in pumping the water out of an inverted round cone of height $h = 8\,m.$ and radius $r = 5\,m.$ You may use that the density of water if $1000\,kg/m^3$.

(11) Evaluate $\int \frac{3x+1}{x^3+x}\,dx$