Name:______________________

Student Number:______________________

You must show your work and give reasons for your answers!
Good luck.

Part I. All problems in part I count for 10 points.

(1) Find the area bounded by the parabola $x = y^2 - 2$ and the line $x = 2y + 1$.

(2) Set up an integral for the volume of the solid of revolution obtained by rotating the area bounded by the graphs of $y = \sin(x) + 5$, $y = e^x + 1$ and the lines $x = 0$ and $x = 1$ about the line $x = 7$. You don't need to compute or simplify the integral.

Evaluate the following integrals or state does not exist (**like always, you must justify your answer!**):

(3) $\int_1^\infty \frac{1}{x^2}\,dx$.

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

(5) Find n such that the approximation to the integral $\int_0^1 \sin(x^2)\,dx$ using the midpoint rule makes an error less than $\frac{1}{10{,}000}$.

(6) Set up an integral for the arc length of the curve

$$\begin{cases} x = t\sin(t) \\ y = te^{5t} \end{cases}$$

for $0 \leq t \leq 1$. You don't need to simplify or compute the integral.

Part II. Both problems in Part II count for 20 points each.

(7) Find the volume of the solid whose cross sections with planes perpendicular to the x-axis are squares one side of which stretches from the graph of $y = x + 1$ to the graph of $y = 2x - 1$ for $0 \leq x \leq 1$.

(8) Find the work done in pumping water out of a full trough whose vertical cross sections are inverted triangles, with base $3m$ and height $5m$, which is $10m$ long. (You can use that water has a density of $1,000kg/m^3$ and that $g \approx 10m/sec^2$.)