MATH 202

1. On the planet Andoria, the weight W of a sack of potatoes that is x feet from the ground level is $W = \frac{5 \times 10^6}{(1000 + x)^2}$. Find the work done by lifting the sack of potatoes from x = 0 to x = 1000.

5 2. Find the work done moving a 107 kg mass from x = -2 to x = 5 if the position dependent force is $F(x) = \begin{cases} x & x < 1 \\ 1 & x \ge 1 \end{cases}$, where the units of force are Newtons and the units of distance are meters.

 $\boxed{5}$ 3. Find the *numerical value* of $\int_3^8 \frac{1}{10-5x} dx$.

- $\boxed{5}$ 4. Find a general solution to the DE $y \frac{dy}{dx} = x$.
 - 5. Find a formula for each derivative:

$$\boxed{5} \qquad \text{(a) } \frac{\mathrm{d}}{\mathrm{d}x} \left(x \mathrm{e}^{x^2} \right)$$

$$\boxed{5} \qquad \text{(b) } \frac{\mathrm{d}}{\mathrm{d}x} \left(\frac{\exp(x) + \exp(-x)}{2} \right)$$

$$\boxed{5} \qquad \text{(c) } \frac{\mathrm{d}}{\mathrm{d}x}(x\ln(x))$$

(d)
$$\frac{d}{dx} \ln \left(\frac{1+x}{1-x} \right)$$

 $\boxed{5}$ 6. Find the numerical value of $\int_1^2 1 + \ln(x) dx$. **Hint:** Look at your answer to part 'c' of the previous question.

- 7. Let Q be the portion of the xy plane described by $0 \le x \le 1$ and $0 \le y \le x(1-x)$.
- $\boxed{5}$ (a) Draw a nicely *labeled* picture of the set Q.

(b) Using *disks* (that is strips *perpendicular* to the axis of rotation), find the *volume* of the solid generated by rotating Q about the x axis. Express the result as a *definite integral*, but **do not** find the numerical value of the definite integral.

5	(c) Using <i>shells</i> (that is, strips <i>parallel</i> to the axis of rotation), find the <i>volume</i> of the solid generated by rotating <i>Q</i> about the <i>x</i> axis. Express the result as a <i>definite integral</i> , but do not find the numerical value of the definite integral.
5	(d) Using a strip that is parallel to the y axis, find area of Q .

(e) Using a strip that is parallel to the y axis, find the y coordinate of the centroid of Q.

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 $\boxed{5}$ (f) Using a strip that is parallel to the y axis, find the x coordinate of the centroid of Q.

8. Express the arclength of the portion of the hyperbola $x^2 - y^2 = 1$ with endpoints $(x = 2, y = \sqrt{3})$ and $(x = 3, y = \sqrt{8})$. Do not attempt to find the numerical value of the definite integral.

5 9. Show that $y^5 = x + c$ is a general solution to the DE $y^4 \frac{dy}{dx} = 1/5$.