Math 172
5 Feb 2016

Quiz 3
Show Appropriate Work

Name: ____________________
Point Values in $\boxed{\text{boxes}}$.

1. Integrate.

(a) $\boxed{3}$ $\int (2x+1)\sin 3x\,dx$ $= (2x+1)\left(-\frac{1}{3}\cos 3x\right) + \int \frac{2}{3}\cos 3x\,dx$

$u = 2x+1 \qquad dv = \sin 3x\,dx$

$du = 2dx \qquad v = -\frac{1}{3}\cos 3x$

$= (2x+1)\left(-\frac{1}{3}\cos 3x\right) + \frac{2}{9}\sin 3x + C$

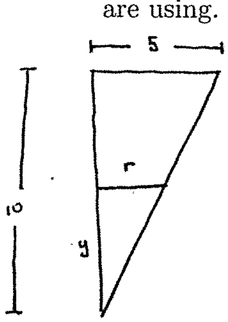
(b) $\boxed{3}$ $\int_1^e x^2 \ln x\,dx$ $= \ln x \cdot \frac{x^3}{3}\Big|_1^e - \int_1^e \frac{x^2}{3}\,dx = \frac{e^3}{3} - \frac{x^3}{9}\Big|_1^e = \frac{e^3}{3} - \frac{e^3}{9} + \frac{1}{9}$

$u = \ln x \qquad dv = x^2\,dx$

$du = \frac{1}{x}dx \qquad v = \frac{x^3}{3}$

$= \frac{2e^3+1}{9}$

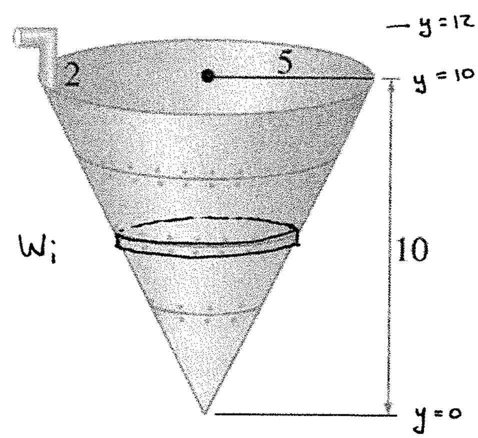
2. $\boxed{4}$ Express, as an integral, the work (in joules) required to pump all of the water out of the full conical tank in the figure below; water exits through the spout. Distances are in meters, the density of water is $\rho$, acceleration due to gravity is $g$. Clearly specify the coordinate system you are using. **You do not need to evaluate the integral.**




$\frac{r}{y} = \frac{5}{10}$ so $r = \frac{1}{2}y$

$\rho g \pi (\text{radius})^2 \Delta y (12-y) = W_i$

$\frac{1}{4}\rho g \pi y^2 (12-y)\,\Delta y$




$\text{Work} = \frac{1}{4}\rho g \pi \int_0^{10} y^2(12-y)\,dy$