**MAC 2312 Calculus III, Spring 2016, Hand Out Assignment**

Date: _____ Name:_____

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Qn 1: Set up, but do not evaluate, an integral for the area of the surface obtained by rotating the curve $y = e^x,\ \ln(\sqrt{2}) \leq x \leq e^2$ about $x - axis$ and simplify the integral (but do not integrate).

Qn 2: Find the center of mass of the semi-circle whose center is origin and the radius is $r$.

Qn 3: Solve $\int e^x \sin 3x dx$.

Qn 4: Solve $\int_0^{\frac{\pi}{2}} \cos^4 x dx$.

Qn 5: Solve $\int \sec^4 x \tan^3 x dx$.

Qn 6: Solve $\int \frac{dx}{\sqrt{4x^2+1}}$.

Qn 7: (A) Convert $(1, \sqrt{3})$ from rectangular co-ordinates to polar co-ordinates.

(B) Find the arc length of the curve $r(\theta) = 2 - 2\cos\theta$ from $0 \leq \theta \leq 2\pi$.

Qn 8: Evaluate the integral $\int \frac{4x}{x^3+x^2+x+1} dx$.

Qn 9: A. Find the limit of the sequence

$$\left\{\sqrt{2}, \sqrt{2+\sqrt{2}}, \sqrt{2+\sqrt{2+\sqrt{2}}}, \sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2}}}}, \ldots\right\}.$$

Qn 10: A curve $C$ is defined by the parametric equations $x = t^2$ and $y = t^3 - 3t$. Find all the possible equations tangents at the point $(3, 0)$, if any. Also, determine where the curve is concave upward or downward.

Qn 11: Find the arc length of the cardioid whose parametric equation is

$$x(\theta) = r(\theta - \sin\theta), y(\theta) = r\cos\theta;\ 0 \leq \theta \leq 2\pi.$$

Qn 12: A. Convert $(1, \sqrt{3})$ and $(1, 1)$ from rectangular co-ordinates to polar co-ordinates. [3 points]
B. Find the area of the one loop of the four leaved rose $r(\theta) = \cos(2\theta)$. [6 points]

Qn 13: Let $\Gamma(n) := \int_0^\infty x^{n-1}e^{-x}dx,\ n > 0$.

(a) Find $\Gamma(1)$ and $\Gamma(2)$.
(b) Show that $\Gamma(n+1) = n\Gamma(n)$.
(c) Show that $\Gamma(n+1) = n!$.

*Enjoy the equations, for that it is beautiful, meaningful and (especially) eternal.*

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