Engineering Mathematics 2(013)

Quiz #2

2008.10.13

1. (10) Check for path independence. If this vector function is independent, integrate it from (0, 0, 0) to (a, b, c).

$$\vec{F} \bullet d\vec{r} = yz\cosh xdx + z\sinh xdy + y\sinh xdz$$

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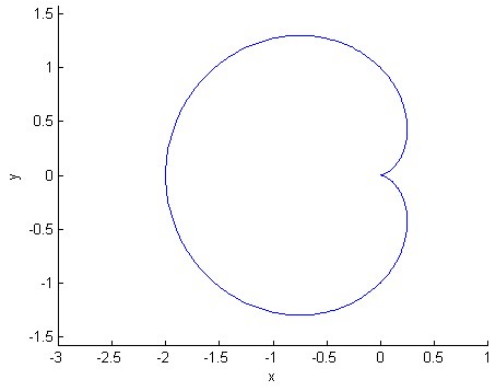
2. (15) Evaluate the surface area of the cardioid shown below.

(Hint: surface area $\mathrm{A} = \frac{1}{2}\oint_C (xdy - ydx)$)



The Cardioid: $r = 1 - \cos\theta$

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3. (20) Find the Fourier transform of xe^{-x^2} .

(Hint: $F(e^{-ax^2}) = \frac{1}{\sqrt{2a}} e^{-w^2/4a} \quad (a > 0)$)

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4. (30) Find the Fourier integral representation of the function

$$f(x) = \begin{cases} 1 & \text{if} \quad |x| < 1 \\ 0 & \text{if} \quad |x| > 1 \end{cases}$$

And prove $\int_0^\infty \frac{\sin w}{w} dw = \frac{\pi}{2}$ (when x=0)

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5. (25) Prove $(f * g)(x) = \int_{-\infty}^{\infty} \hat{f}(w)\hat{g}(w)e^{iwx} dw$.

(Hint: $h(x) = (f * g)(x) = \int_{-\infty}^{\infty} f(p)g(x-p)dp$)

P. 523 Theorem 4 Proof