FRQ #1 Answer)

(a) When converted to a single equation, $y = \cos^2(-2\ln x^{-2})$. Plugging in the x(t) that is given, $y = \cos^2(\ln(2t + 1))$. So, the answer is $((2t + 1)^{0.25}, \cos^2(\ln(2t + 1)))$.

(b) $v_x(t) = dx(t)/dt = -e^{-t} = -e^{-5} = -0.00673$ and $v_y(t) = dy(t)/dt = -2\sin(4t) = -2\sin(20) = -1.826$, so the speed is $\text{sqrt}((v_x(t))^2 + (v_y(t))^2) = \text{sqrt}(-0.00673^2 + -1.826^2) = 1.826$.

Total distance $d = \int_0^5 \sqrt{(-e^{-t})^2 + (-2\sin(4t))^2}\,dt = 6.543$

Standing point $s = (2 + e^{-5}, 3 + \cos^2(10)) = (2.00674, 3.704)$

(c) Velocity change = acceleration = dv(t)/dt

$a_x = dv_x(t)/dt = e^{-t}$ and $a_y = dv_y(t)/dt = -8\cos(4t)$, so $a = \sqrt{(e^{-t})^2 + (-8\cos(4t))^2}$. One can get the smallest value of a by graphing and tracing the values, which gives out t = 1.970s.

FRQ #2 Answer)

(a) $r = 4\sin(2\theta)$, $r^2 = 4r\sin(2\theta)$, $r^3 = 4y$, $(\sqrt{x^2 + y^2})^2 = 4y$, $x^2 + y^2 = 4y$, $x^2 + (y-2)^2 = 4$

$r^2 = 4r + 4r\cos\theta$, $x^2 + y^2 = 4\sqrt{x^2 + y^2} + 4x$, $x^2 + y^2 - 4\sqrt{x^2 + y^2} - 4x = 0$

(b) Using graphing calculator, intersections are (0,0), (2.469, 1.963), (2.469, 4.320).

FRQ #3 Answers)

(a) Using the calculator, range of the areas can be find. So,

$$\int_{0.524}^{1.571} (2+\cos 3\theta)\,d\theta + \int_{2.618}^{3.665} (2+\cos 3\theta)\cdot d\theta + \int_{4.712}^{5.760} (2+\cos 3\theta)\,d\theta + \int_{0}^{0.524} 2\,d\theta + \int_{1.571}^{2.618} 2\,d\theta + \int_{3.665}^{4.712} 2\,d\theta + \int_{5.760}^{6.283} 2\,d\theta$$

$= 10.566$

(b) Using the calculator, range of the areas can be find. So,

$$\int_{0}^{0.524} 2\,d\theta + \int_{0.524}^{1.571} (2+\cos 3\theta)\,d\theta = 2.475$$

Answers:

Parametric

A) -.0422

B) 0.176

c) 23.005

Related Rates

A) 4π

B) 27/4 cm^3/min

Volumes of Rotation

a) $A = \int_0^1 \sqrt{x} - x^2 + \int_0^1 -\frac{1}{2}(x-\frac{1}{2})^2 + \frac{1}{8}$

$A = .417$

b) $V = \int_0^1 A\,dx$

$V = \int_0^1 \pi(r_o^2 - r_i^2)\,dx + \int_0^1 \pi r^2\,dx$

$V = \int_0^1 \pi(\sqrt{x}^2 - (x^2)^2\,dx + \int_0^1 \pi\left(-\frac{1}{2}(x-\frac{1}{2})^2 + \frac{1}{8}\right)^2 dx$

$V = \pi\int_0^1 (x - x^4)\,dx + \pi\int_0^1 \left(-\frac{1}{2}(x-\frac{1}{2})^2 + \frac{1}{8}\right)^2 dx$

$V = .942 + .026$

$V = .968$

c) $\sqrt{y} = x \qquad y^2 = x \qquad \frac{1}{2}\sqrt{y} + \frac{1}{2} = x$

$\pi\int_0^1 r_o^2 - r_i^2\,dy + \pi\int_0^1 r_o^2 - r_i^2\,dy$

Volumes on a Base

a) $A = \int_{-.942}^{.337} e^x - 2(x+\frac{1}{2})^2 \, dx$

$A = .562$

b) $V = \int_{-.942}^{.337} \frac{\pi}{2} r^2$

$V = \frac{\pi}{2} \int_{-.942}^{.337} (e^x - 2(x+\frac{1}{2})^2)^2 \, dx$

~~$V = .467$~~

c) $V = \int_{-.942}^{.337} \frac{h}{2}(b_1 + b_2) \, dx$

$V = \int_{-.942}^{.337} \frac{b_1}{4}\left(b_1 + \frac{b_1}{2}\right) dx$

$V = \frac{1}{4} \int_{-.942}^{.337} \frac{(e^x - 2(x+\frac{1}{2})^2)^2}{4} + \frac{(e^x - 2(x+\frac{1}{2})^2)^2}{2} \, dx$

$V = \frac{1}{4} \int_{-.942}^{.337} \frac{5}{4}(e^x - 2(x+\frac{1}{2})^2)^2 \, dx$

$V = .093$