

Answers

1a) $-1/2$ 1b) e^{-2} 1c) 0

2) I is made up of 3 integrals, only one of which converges, so I diverges.

3) $\pi/3$

4) Compare to $f(x) = 1/3x^2$ which is bigger. Show $f(x) \geq g(x) \geq 0$ and $\int_1^\infty f(x) dx$ converges and then invoke the theorem.

5) $(x, y) = (1/2, 1/2)$ and $(x, y) = (0, 0)$

6) $\text{Area} = 2 \int_0^{\pi/6} \frac{\sin^2 \theta}{2} d\theta + 2 \int_{\pi/6}^{\pi/2} \frac{(1 - \sin \theta)^2}{2} d\theta$

7) $\left. \frac{dy}{dx} \right|_{t=0} = \frac{1}{2} \qquad \left. \frac{d^2}{dx^2} \right|_{t=0} = \frac{3}{8}$

8a) $A = 1$

8b) The curve starts at $(1,0)$ and spirals around as r decreases until it crosses the origin at $\theta = \pi$. Then it makes a small loop above the x-axis and across the y-axis returning to the origin along the same angle. The y-intercepts are at $2/\pi$ and $2/3\pi$.

9a) A line through the origin with slope 5.

9b) A parabola opening left turning around at $(x, y) = (1/2, 0)$ and crossing the y-axis at $y = \pm 1$.

10) $\sqrt{\frac{5}{4}} \cdot 2(e^\pi - 1)$