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Spring 2013

PROBLEM 7: What is the centroid of the region bounded by the curves $y = x^2$ and $y = 8 - x^2$?

Hint: draw a picture of this region as your first step.

(a) $(-2, 3)$ (b) $(2, 5)$ (c) $(-1, 4)$ (d) $(0, 4)$ (e) $(0, 3)$ (f) $(1, 4)$

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Fall 2012

11. Suppose that the region bounded by $y = 4\tan(x^2)$ and the x-axis for $0 \leq x \leq \frac{\sqrt{\pi}}{2}$ is a thin homogeneous density plate of area A. Then the x-coordinate of the center of mass of the plate is:

(a) $\frac{2}{A}\pi^2$ (b) $\frac{2}{A}\pi$ (c)* $\frac{1}{A}\ln 2$ (d) $\frac{3}{A}\sqrt{\pi}$ (e) 0 (f) $\frac{e\pi}{2}$

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Spring 2012

12. What is the area of the surface obtained by rotating the part of the curve $y = \sqrt{4 - x^2}$ from $x = 0$ to $x = 1$ around the $x-$axis?

A) 4π B) 2π C) π D) $\sqrt{2}\pi$ E) 3π F) 8π

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Fall 2011

2. Find the length of the arc of the curve defined by $y = \frac{2}{3}\sqrt{x^3}$ for $0 \leq x \leq 3$.

(A) $\frac{\pi}{2}$ (B) $\frac{\pi}{4}$ (C) 4 (D) $5 \ln 3$ (E) $\frac{14}{3}$ (F) $\frac{1}{4}$ (G) $\frac{e}{8}$ (H) $\frac{\ln 3}{2}$

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9. Find the arc length of the graph of $y = \dfrac{x^3}{3} + \dfrac{1}{4x}$ between $x = 1$ and $x = 2$. [Note: It may be helpful to use identities like $(x^2 + \frac{1}{4x^2})^2 = x^4 + \frac{1}{2} + \frac{1}{16x^4}$.]

(a) 0 (b) 59/24 (c) $\frac{8}{27}(10\sqrt{10} - 1)$ (d) $\pi \ln(2)$ (e) $\frac{3}{8} + \ln(2)$ (f) It is divergent.

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Spring 2011

10. Consider the graph of $y = \ln(\cos(x))$ between $x = 0$ and $x = 1$. Which of the following integrals corresponds to the surface area of the object obtained by rotating this graph about the x-axis?

(a) $\int_0^1 2\pi\sqrt{1+\ln(\cos(x))^2}\,dx$

(b) $\int_0^1 2\pi\ln(\sin(x))\sqrt{1+\sec^2(x)}\,dx$

(c) $\int_0^1 2\pi\cos(x)\ln(\sin(x))\,dx$

(d) $\int_0^1 2\pi\sec(x)\ln(\cos(x))\,dx$

(e) $\int_0^1 2\pi x^2\sin(x)\cos(x)\ln(x)\,dx$

(f) $\int_0^1 2\pi\sin^2(x)\sqrt{1+\ln(x)^2}\,dx$

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Fall 2010

7. What is the arclength of the part of the curve $y = \frac{1}{12}e^x + 3e^{-x}$ for $\ln 2 \leq x \leq \ln 4$?

(A) $\frac{5}{12}$ (B) $\frac{1}{2}$ (C) $\frac{7}{12}$ (D) $\frac{2}{3}$ (E) $\frac{3}{4}$ (F) $\frac{5}{6}$ (G) $\frac{11}{12}$ (H) 1

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Spring 2010

10. An artist is designing a wine glass in a flower shape, which can be generated by rotating the region bounded by $y = \sqrt{x}$ and $x = y$, between $x = 0$ and $x = 1$, about x-axis. What is the surface area (which contains both the inside and the outside surfaces) of such a glass?

(a) $\left(\frac{8\sqrt{2}-4}{3}+\sqrt{2}\right)\pi$ (b) $\left(\frac{8\sqrt{2}-4}{3}+\sqrt{5}\right)\pi$ (c) $\left(\frac{8\sqrt{2}-4}{3}+1\right)\pi$

(d) $\left(\frac{5\sqrt{5}-1}{6}+\sqrt{2}\right)\pi$ (e) $\left(\frac{5\sqrt{5}-1}{6}+\sqrt{5}\right)\pi$ (f) $\left(\frac{5\sqrt{5}-1}{6}+1\right)\pi$

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Spring 2007

2. Find the volume of the solid obtained by rotating the region bounded by the curves

$y = e^{x^2}$ and $y = 0$ and $x = 0$ and $x = 2$

about the y-axis.

A.) $4\pi e^4$ B.) $2\pi e^4$ C.) $2\pi(e^4 - 1)$ D.) $\pi(e^4 - 1)$ E.) $\pi\sqrt{e}$ F.) πe

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Spring 2006

1. Find the volume of the solid obtained by rotating the region bounded by the curves

$$y = x^2, \qquad y = 0, \qquad x = 2$$

about the line $x = 4$.

A.) $10\pi/3$ B.) $16\pi/3$ C.) $20\pi/3$ D.) $32\pi/3$ E.) $40\pi/3$ F.) $64\pi/3$

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ANSWERS:

Spring 2013 # 7: D

Fall 2012 # 11: C

SPRING 2012 # 12: A

FALL 2011 # 2: E

SPRING 2011 # 9: B

SPRING 2011 # 10: D

FALL 2010 # 7: G

SPRING 2010 # 10: D

SPRING 2007 # 2: D

SPRING 2006 # 1: E