AP Calculus Name_____

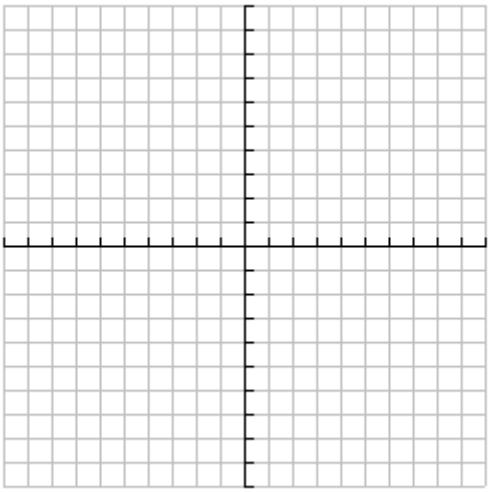
Volume with Cross Sections Application of Integration Day 4

1. The base of the volume is the region bounded by the curves $y = 8 - x^2$ and $y = x^2$. The cross sections perpendicular to the x-axis are:

a. Squares

b. Equilateral triangles

c. Semi-circles

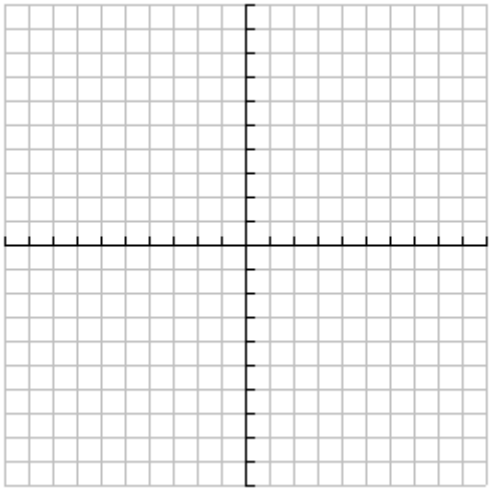


2. The base of the volume is the region bounded by the curve $y = 2 + \sin x$, the x-axis, $x = 0$ and $x = \frac{3\pi}{2}$. The cross sections perpendicular to the x-axis are:

a. Squares

b. Equilateral triangles

c. Semi-circles



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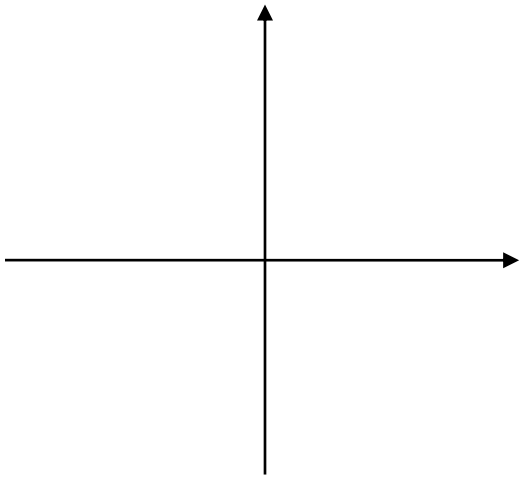
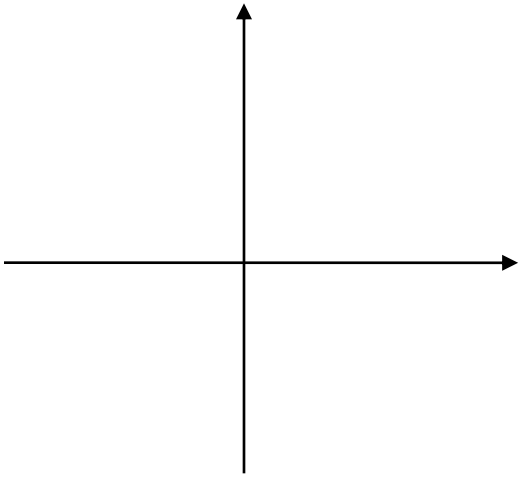
3. Let *R* be the region bounded by the graphs of $y = \sqrt{x}$ and $y = \frac{x}{2}$. The region *R* is the base of a solid. For this solid, each cross section perpendicular to the ***y*-axis** are squares. Find the volume of the solid.



4. Let ***R*** be the region bounded by the x-axis, the *y*-axis, the graph of $y = \cos x$. The region ***R*** is the base of a solid. For this solid, each cross section perpendicular to the **x-axis** is a rectangle whose height is 2 – x. Find the volume of the solid.



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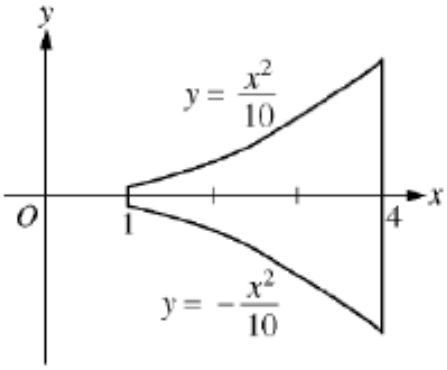
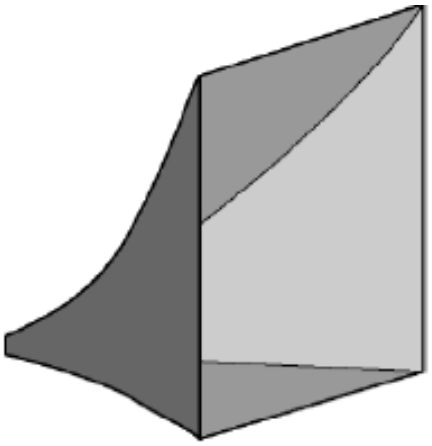
5. *Multiple Choice*





The base of a loudspeaker is determined by the two curves $y = \frac{x^2}{10}$ and $y = -\frac{x^2}{10}$ for $1 \le x \le 4$, as shown in the figure above. For this loudspeaker, the cross sections perpendicular to the x-axis are squares. What is the volume of the loudspeaker, in cubic units?

(A) 2.046 (B) 4.092 (C) 4.200 (D) 8.184 (E) 25.711

6. The base of a solid is the region in the first quadrant enclosed by the parabola $y = 4x^2$, the line x = 1 and the x-axis. Each cross section of the solid perpendicular to the x-axis is a square. The volume of the solid is:

A. $\frac{4\pi}{3}$ B. $\frac{16\pi}{5}$ C. $\frac{4}{3}$

D. $\frac{16}{5}$ E. $\frac{64}{5}$

7. A solid has its base in the xy-plane, bounded by the x-axis, the y-axis, and the function $y = 3 - x^5$. If cross sections taken perpendicular to the x-axis are semicircles whose diameters are in the xy-plane, what is the volume of this solid?

A. 3.335 B. 4.247 C. 5.239

D. 6.671 E. 13.342

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Review: ☺ Must show your work to get credit ☺ **NON-CALCULATOR**

8. If $y = x^2 \ln x$, what is $\frac{dy}{dx}$ in terms of x & y?

a.) $x\left(2\ln\left(x\right)+1\right)$

b) $y\left(2x\ln\left(x\right)+1\right)$

fc) $y\left(2x+\frac{1}{x}\right)$

d) $y\left(2\ln x+x\right)$

e) $xy\left(2\ln x+2\right)$

9. If the derivative of a function is given as $f'(x)=\frac{x-6}{e^x}$, then in which open interval is the function both increasing and concave up?

a.) $\left(-\infty,5\right)$

b) $\left(-\infty,6\right)$

c) $\left(5,6\right)$

d) $\left(6,7\right)$

e) $\left(7,\infty\right)$

10. Which of the following expressions represents the average value of $f(x)=\sqrt{2x-1}$ in $\left[1,3\right]$?

a.) $\frac{\sqrt{2(3)-1}-\sqrt{2(1)-1}}{2}$

b) $f(2)$

c) $\int_1^3 \sqrt{2x-1}dx$

d) $\frac{1}{3}\int_1^3 \sqrt{2x-1}dx$

e) $\frac{1}{2}\int_1^3 \sqrt{2x-1}dx$

11. If $f(x)=\sin x$, $g(x)=\cos\left(2x\right)$, and $h(x)=f\left(g\left(x\right)\right)$, what is $h'\left(\frac{\pi}{4}\right)$?

a.) -2

b) $-\sqrt{2}$

c) 0

d) $\sqrt{2}$

e) 2

Answers:

1.) a.) $V=\int_{-2}^{2}\left(8-2x^2\right)^2dx$ $V=\frac{2048}{15}$ b.) $V=\frac{\sqrt{3}}{4}\int_{-2}^{2}\left(8-2x^2\right)^2dx$ $V=\frac{512\sqrt{3}}{15}$ c) $V=\frac{\pi}{8}\int_{-2}^{2}\left(8-2x^2\right)^2dx$ $V=\frac{256\pi}{15}$

2.) a.) $V=\int_0^{\frac{3\pi}{2}}\left(2+\sin x\right)^2dx$ $V=25.205$ *or* 25.206 b.) $V=\frac{\sqrt{3}}{4}\int_0^{\frac{3\pi}{2}}\left(2+\sin x\right)^2dx$ $V=10.914$ c) $V=\frac{\pi}{8}\int_0^{\frac{3\pi}{2}}\left(2+\sin x\right)^2dx$ $V=9.898$

3.) $\frac{16}{15}$ 4.) 1.429 5.) D 6.) D 7.) A

8.) A 9.) D 10.) E 11.) A