

1. The volume of the solid generated by rotating about the x -axis the region enclosed by $y = 3x^2$ and $y = 6x$ is given by

(A) $\pi \int_0^3 (6x - 3x^2)^2 dx$

(B) $\pi \int_0^2 (6x - 3x^2)^2 dx$

(C) $\pi \int_0^2 (9x^4 - 36x^2) dx$

(D) $\pi \int_0^2 (36x^2 - 9x^4) dx$

(E) $\pi \int_0^2 (6x - 3x^2) dx$

2. The area of the region in the first quadrant bounded by the graphs of $y = 7 \cos x$, $y = 7 \sin x$ and the y -axis is

(A) $7\sqrt{2}$

(B) 14

(C) $7\sqrt{2} + 1$

(D) $7(\sqrt{2} - 1)$

(E) $\frac{7\sqrt{2}}{2}$

3. Which of the following integrals gives the length of the graph $y = \text{Arc sin} \frac{x}{2}$ from $x = a$ to $x = b$

(A) $\int_a^b \sqrt{1 - \frac{1}{\sqrt{4-x^2}}} dx$

(B) $\int_a^b \sqrt{1 + \frac{1}{\sqrt{4-x^2}}} dx$

(C) $\int_a^b \sqrt{1 - \frac{1}{4-x^2}} dx$

(D) $\int_a^b \sqrt{1 + \frac{1}{4-x^2}} dx$

(E) $\int_a^b \left(1 + \frac{1}{4-x^2}\right) dx$

4. A region is bounded by $y = \frac{1}{x^2}$, the x-axis, the line $x = m$, and the line $x = 2m$, where $m > 0$. A solid is formed by revolving the region about the x-axis. The volume of the solid

- (a) is independent of m .
 - (b) increases as m increases.
 - (c) decreases as m increases.
 - (d) increases until $m = \frac{1}{2}$, then decreases.
 - (e) is none of the above
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5. Let R be the region bounded by $y = 3\sin x$ on $0 \leq x \leq \frac{\pi}{2}$. Which of the following integrals gives the volume of the solid generated when R is rotated the line $y = -2$?

(a) $\pi \int_0^{\pi/2} (3\sin x + 2)^2 dx$

(b) $2\pi \int_0^{\pi/2} (9\sin^2 x + 2) dx$

(c) $\pi \int_0^{\pi/2} (9\sin^2 x - 4) dx$

(d) $2\pi \int_0^{\pi/2} 9\sin(x+2)^2 dx$

(e) $2\pi \int_0^{\pi/2} (3\sin x + 2)^2 dx$

6. The base of a solid is the region in the first quadrant bounded by $y = \sqrt{2\cos x}$ for $0 < x < \frac{\pi}{2}$. If each cross-section of the solid perpendicular to the x -axis is a square, the volume of the solid is

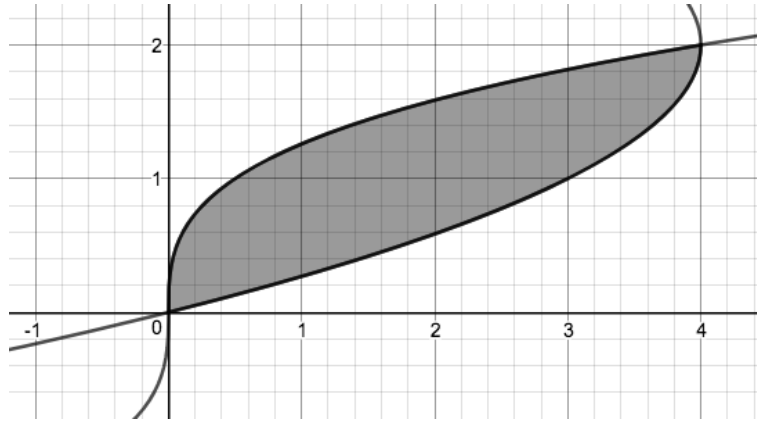
- (a) 0 (b) 1 (c) 2 (d) 3 (e) 4
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7. Let R be the region in the first quadrant that is enclosed by the graph of $f(x) = \ln(x+1)$, the x -axis, and the line $x = e$. What is the volume of the solid generated when R is rotated about the line $y = -1$?

(a) 5.037 (b) 6.545 (c) 10.073

(d) 20.146 (e) 28.686

1. Let R be the region in Quadrant I bounded by the graphs of $x = \frac{1}{2}y^3$ and $x = 4 - (y - 2)^2$ (shaded below). The curves intersect at $(0,0)$ and $(4,2)$.



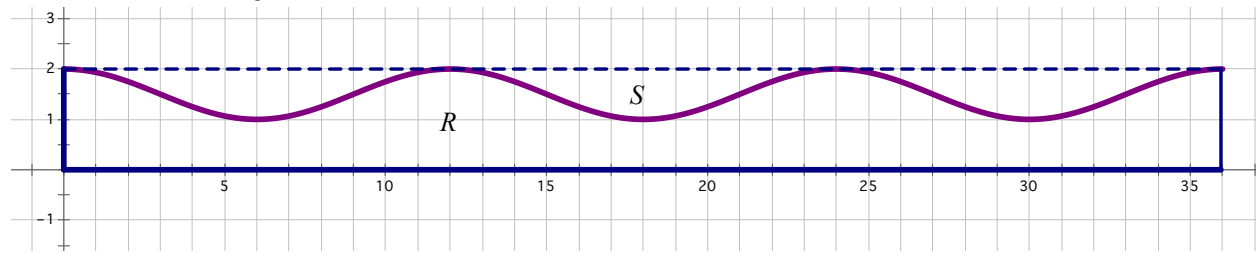
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- (a) Find the area of R . Show the set-up.
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(b) Find the volume of the solid generated when R is revolved about the line $x = -4$. Show the setup.

(c) Let the base of the solid be the region R. Find the volume of the solid where the cross-sections perpendicular to the y -axis are rectangles that are twice as tall as they are wide.

2. Dr. Quattrin wants to replace the end post on his handrail with one curved into a sinusoidal profile. He buys a 4" by 4" by 36" square post made of American Red Oak and brings it to his son to put on a lathe. A lathe is a tool which spins a piece of wood so a gouge can be used to take material off evenly to create a desired profile. The radius of the desired profile in this case conforms to the equation

$$r(x) = \frac{3}{2} + \frac{1}{2} \cos \frac{\pi}{6} x, \text{ where } x \text{ is the distance from the end of the post.}$$



Let region R be bounded by $r(x)$ and the x -axis from $x \in [0, 36]$. Let region S be bounded the region by $r(x)$ and $r=2$ from $x \in [0, 36]$. The finished post will match the solid formed by revolving Region R about the x -axis, while the removed oak would match the solid formed by revolving region S about the x -axis.

a) Find the volume of the finished post in in^3 . Show the setup. [Extra credit for showing the anti-derivative.]

b) The original post weighed 15 pounds and had a volume of 576 in^3 . Therefore, this red oak lumber weighs $\frac{5}{12} \text{ oz/in}^3$. Find the weight of scrap material that was removed to make the sinusoidal post.

c) An ant crawls along the curve at $\frac{1}{2} \text{ in/sec}$. How fast is the radius changing when the ant has been crawling for 40 seconds?
