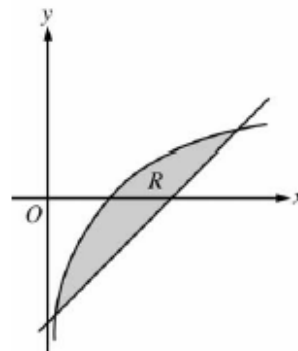


Closed Book, No Notes, Calculator Required.

Note: You must show me a properly constructed integral for each problem requiring integration. This integral may then be evaluated using your calculator unless otherwise specified. Please provide exact answers or 3 decimal place accuracy for full credit.

1. Let R be the shaded region bounded by the graph of $y = \ln x$ and the line $y = x - 2$, as shown below. Sketch an approximating rectangle or cylinder for each integral.
 - a. Find the area of R .
 - b. Find the volume of the solid generated when R is rotated about the horizontal line $y = -3$.
 - c. Write, but do not evaluate, an integral expression that can be used to find the volume of the solid generated when R is rotated about the y -axis.
 - d. The region R is the base of a solid whose cross-sections parallel to the x -axis are semi circles. Set up an integral expression that can be used to find the volume of this solid.



2. The rate of change of the altitude of a hot-air balloon is given by $r(t) = t^3 - 4t^2 + 6$ for $0 \leq t \leq 8$. Which of the following expressions gives the change in altitude of the balloon during the time the altitude is decreasing? Give a reason for your answer.

a. $\int_{1.572}^{3.514} r(t) dt$

b. $\int_0^8 r(t) dt$

c. $\int_0^{2.667} r(t) dt$

d. $\int_{1.572}^{3.514} r'(t) dt$

e. $\int_0^{2.667} r'(t) dt$

3. Find the average value of the function $f(x) = \sin x + 1$ over the interval $\left(\frac{\pi}{4}, \frac{3\pi}{2}\right)$, doing all work by hand and using exact values in your answers.

4. For the function $f(x) = \frac{2x}{(1+x^2)^2}$ on the interval $[0, 2]$,

a. Find the average value of $f(x)$ on the interval.

b. Find c such that $f(c) = f_{ave}$

c. Sketch the graph of f and a rectangle whose area is the same as the area under the graph of f .