

Applications of Integration: math test, College – download the PDF

Suggested time: 45 minutes. Out of 20 points. Calculator allowed only when the problem says so.

1 Area between a parabola and a line

/ 4 pts

Let $y = x^2$ and $y = 2x$.

- Find the intersection points.
- State which curve is on top between them.
- Compute the area enclosed.

2 Volume with disks

/ 4 pts

The region under $y = e^x$ on $[0, 1]$ is rotated about the x-axis. A calculator is allowed.

- Write the volume as an integral.
- Evaluate it exactly.
- Give a decimal value to two places.

3 Volume with shells

/ 4 pts

The region under $y = 3x - x^2$ for $0 \leq x \leq 3$ is rotated about the y-axis. Set up and compute the volume using shells.

4 Arc length

/ 3 pts

Find the length of $y = \frac{x^3}{3} + \frac{1}{4x}$ for $1 \leq x \leq 2$. Hint: show that $1 + (y')^2$ is a perfect square.

5 Average value and work

/ 3 pts

(a) Find the average value of $\sin x$ on $[0, \pi]$.

(b) A force of 6 N holds a spring stretched 0.15 m. Find the work to stretch it from natural length to 0.3 m.

6 Separable equation

/ 2 pts

Solve $\frac{dy}{dx} = 2xy$ with $y(0) = 1$.



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