

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

22 problems graded by difficulty (★ easy, ★★ medium, ★★★ hard). Try first, without looking at the solutions!

1 Area between a line and a parabola

★ ★ ★

Find the area of the region between $y = x$ and $y = x^2$ for $0 \leq x \leq 1$.

2 Area under a roof line

★ ★ ★

A decorative window is bounded above by $y = 4$ and below by $y = x^2$, with x in feet. Find its area.

3 A cone from a line

★ ★ ★

Rotate the region under $y = x$ for $0 \leq x \leq 3$ about the x-axis. Find the volume with disks and check it with the cone formula.

4 Length of a ramp

★ ★ ★

Use the arc length formula to find the length of $y = 3x + 1$ from $x = 0$ to $x = 4$, then check with the distance formula.

5 Average of a linear function



Find the average value of $f(x) = 2x + 1$ on $[0, 4]$. At which x does f take that value?

6 Constant force



A worker pushes a crate with a constant 25 lb force over 12 ft. Find the work in foot-pounds and in joules ($1 \text{ ft}\cdot\text{lb} \approx 1.3558 \text{ J}$).

7 Checking a differential equation

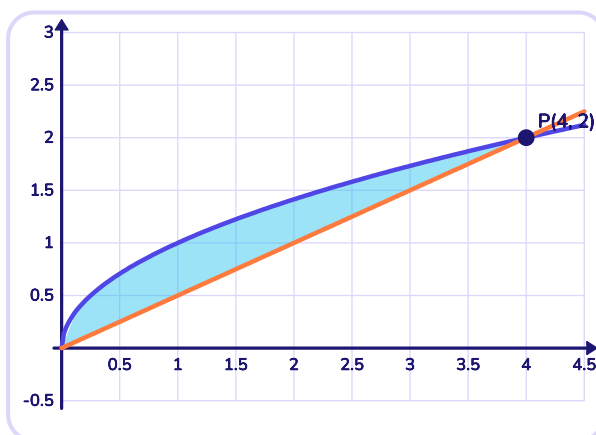


Show that $y = Ce^{-2x}$ solves $y' = -2y$ for every constant C . Then find the solution with $y(0) = 5$ and compute $y(1)$.

8 Square root against a line



Find the area between $y = \sqrt{x}$ and $y = \frac{x}{2}$ (see the figure).



9 Curves that cross



Find the total area enclosed by $y = x$ and $y = x^3$.

10 Washer about the x-axis

The region between $y = 2x$ and $y = x^2$ is rotated about the x-axis. Find the volume.

11 A cubic bowl

Rotate the region under $y = x^3$ for $0 \leq x \leq 1$ about the x-axis. Find the volume.

12 A vase by shells

Use shells to find the volume when the region under $y = 4x - x^2$ (for $0 \leq x \leq 4$) is rotated about the y-axis.

13 Length of a curved cable

A hanging cable follows $y = x^{3/2}$ for $0 \leq x \leq 4$ (feet). Find its length.

14 Stretching a spring in metric units

A spring has constant $k = 200$ N/m. How much work is needed to stretch it from 0.1 m to 0.3 m beyond its natural length?

15 Average temperature

The temperature in a greenhouse is $T(t) = 60 + 20 \sin\left(\frac{\pi t}{12}\right)$ degrees Fahrenheit, t hours after 6 a.m., for $0 \leq t \leq 12$. Find the average temperature over these 12 hours.

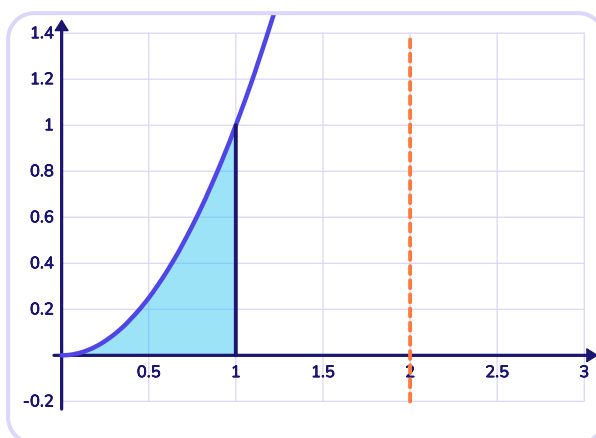
16 Integrating with respect to y

Find the area enclosed by the parabola $x = y^2$ and the line $x = y + 6$.

17 Shells about a vertical line

★★★

The region under $y = x^2$ on $[0, 1]$ is rotated about the line $x = 2$ (dashed in the figure). Use shells to find the volume.

**18 Washers about a horizontal line**

★★★

The region between $y = x$ and $y = x^2$ on $[0, 1]$ is rotated about the line $y = -1$. Find the volume.

19 An arc that needs a table

★★★

Find the length of $y = \frac{x^2}{2}$ from $x = 0$ to $x = 1$. You may use $\int \sqrt{1+x^2} dx = \frac{1}{2} (x\sqrt{1+x^2} + \ln(x + \sqrt{1+x^2})) + C$.

20 Pumping water from a tank

★★★

A cylindrical tank of radius 3 ft and height 8 ft is full of water (62.4 lb/ft^3). How much work is needed to pump all the water to the top rim?

21 A separable initial-value problem

★★★

Solve $\frac{dy}{dx} = xe^{-y}$ with $y(0) = 0$, then find $y(2)$.

22

Cooling coffee

Newton's law says $\frac{dT}{dt} = -k(T - 70)$ for coffee in a 70 °F room. The coffee starts at 190 °F and is 150 °F after 10 minutes. Find its temperature after 20 minutes and the time to reach 100 °F.

**Test yourself: quick challenge for College**[Change level](#)Level : **College**

6 random questions, instant feedback.

**Start the challenge****Speed drill for College: how many in 60 seconds?****Keep exploring with Zyro**

✓ **Practice solutions**

Applications of Integration: practice solutions, College

■ **Math lessons**

Applications of Integration: math lesson, College

🎯 **Math quizzes**

Applications of Integration: math quiz, College

✓ **Practice solutions**

Sequences and Series: practice solutions, College

✓ **Practice solutions**

Linear Systems and Matrices: practice solutions, College

■ **Math lessons**

Sequences and Series: math lesson, College

Zyro takes you to our partner sites

Blast off to other planets of knowledge and their apps.

Lift off