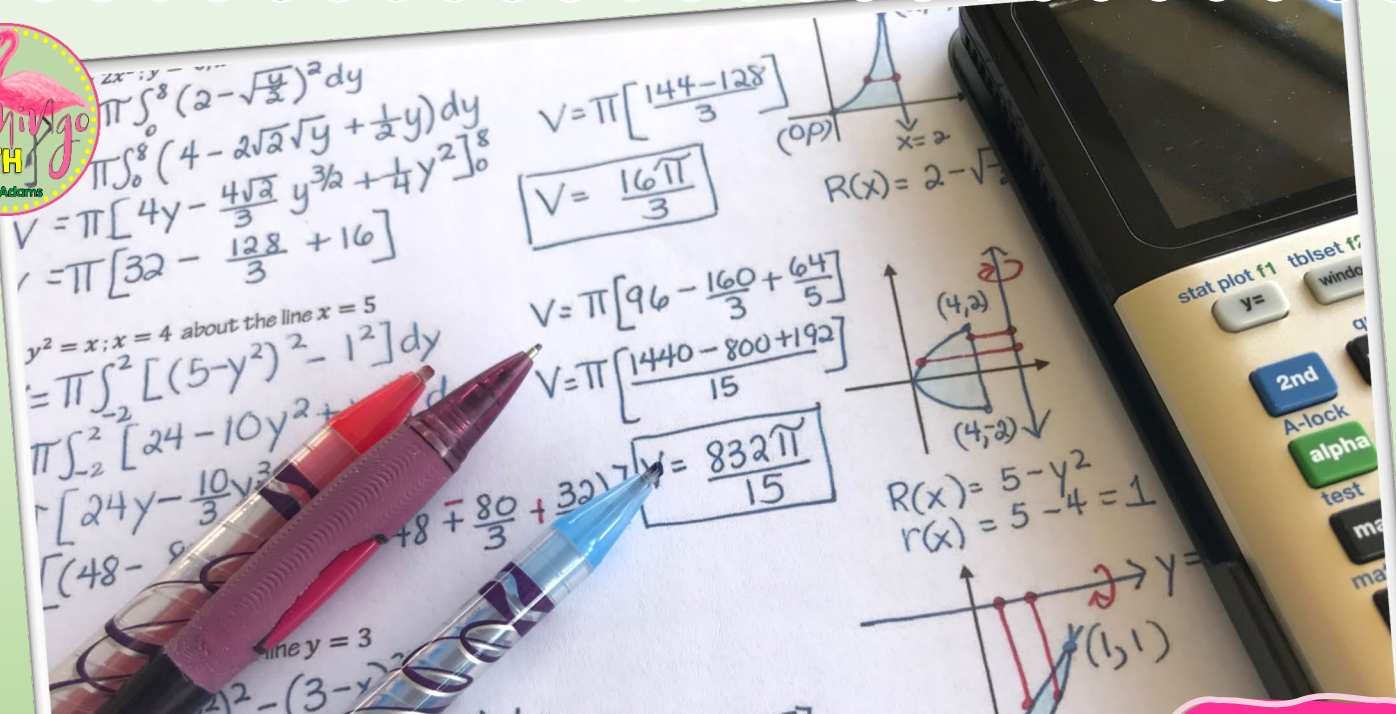
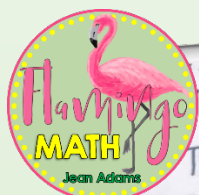


AP[®] Calculus-AB

Applications of

Integration



Homework

Completely Editable

8

AP CALCULUS AB CURRICULUM

Scope and Sequence

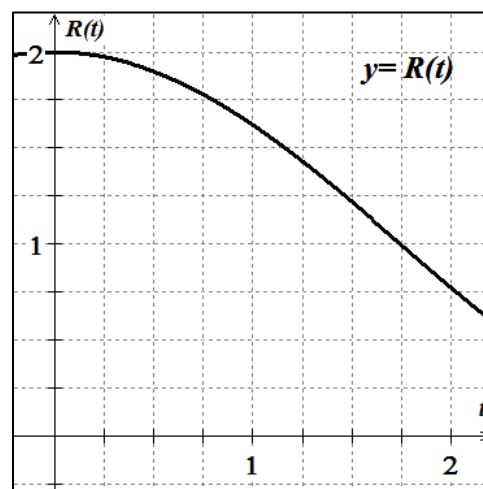
Unit 8: Applications of Integration

Lesson	Skills & Learning Objectives
[8.1] Finding Average Value for Integrals	☐ Apply definite integrals to problems involving the average value of a function over an interval
[8.2] Another Look at Particle Motion	☐ Use properties of integration and accumulation to analyze position, velocity, acceleration functions
[8.3] Accumulation Functions in Applied Contexts	☐ Describe integration as an accumulation process
[8.4] Area Between Two Curves	☐ Find the area of a region between two curves using integration
[8.5] Volumes by Cross Sections	☐ Find the volume of a solid of revolution with known cross sections
[8.6] Volume of Revolution: Disc and Washer Methods	☐ Find the volume of a solid of revolution using the disc and washer methods
[8.7] Volumes-Revolving Around Other Axes	☐ Find the volume of a solid by revolving about a line other than an axis

13. Suppose a certain breed of rabbits was introduced onto a small island in 2015. The rabbit growth rate is estimated to be about 45% per year and can be modeled by the following function where $t = 0$ represents 2015: $N(t) = 50e^{0.45t}$. Find the average rabbit population during a 10-year time period from $t = 2017$ to $t = 2027$.

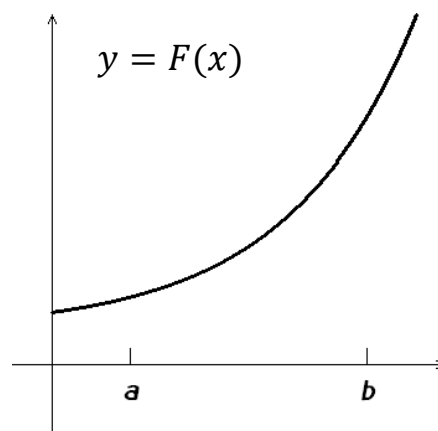
14. Water is leaking out of a tank at a rate $R(t)$ gallons/hour, where t is measured in hours.

- A. Write a definite integral that expresses the total amount of water that leaks out in the first two hours.
- B. Write an expression that represents the average amount of water that leaks out in the first two hours.



15. Assume $F' = f$, mark the following quantities on the graph of F at right.

- A. A slope representing $f(a)$.
- B. A length representing $\int_a^b f(x) dx$
- C. A slope representing $\frac{1}{b-a} \int_a^b f(x) dx$



16. The average value of $y = k(x)$ equals 4 for $1 \leq x \leq 6$ and equals 5 for $6 \leq x \leq 8$. Find the average value of $k(x)$ for $1 \leq x \leq 8$.

9. Over Spring Break our Calculus class went to Kennedy Space Center. I noticed Myles wore a rubberized suit and he was acting a little sketchy as he left his group. Somehow Myles found a way to the roof of the 526-foot-tall building to test out the “bounce factor” of his newly acquired suit by falling from the rooftop.



Photo: NASA Photo Archive public domain

A. How many seconds elapsed before Myles hit the ground?

B. With what velocity (in feet per second) does Myles hit the ground?

C. Convert your answer to miles per hour. (5,280 feet = 1 mile)

-
10. Now, more of the story. Myles wasn't even bruised, thanks to his suit. In fact, he struck the ground and rebounded straight back up into the air with a velocity of 84 feet/sec. How high does Myles fly into the air on the rebound? (Hint: Set $t = 0$ to represent when Myles is on the ground.)

-
11. You plan to join the swim team in the spring and compete in diving events.

A. With what velocity will you hit the water if you step off from a 10-meter dive platform?

B. With what velocity will you hit the water if you dive off the platform with an upward velocity of 2 meters per second?

13. The Student Council elections were held at school between 7:00 am and 3:00 pm. Students deposited their ballots in a special box located in the media center. The number of entries in the box t hours after 7:00 am is modeled by a differentiable function $E(t)$ for $0 \leq t \leq 8$. The table below shows the number of ballots, at various times t during the day.



t (hours)	0	3	5	6	8
$E(t)$ (ballots)	0	120	382	578	694

- A. At what rate are the ballots being deposited into the box at noon ($t = 5$)? Show your computations that lead to your answer.

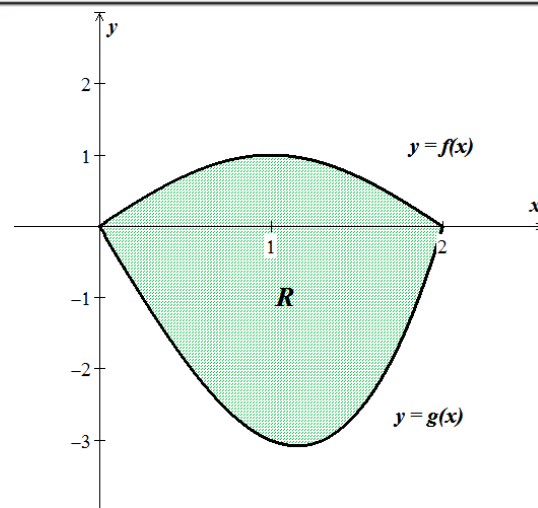
- B. Using a trapezoidal sum with four subintervals, approximate the value of the expression below. Then, using correct units in context of the scenario, explain the meaning of the expression .

$$\frac{1}{8} \int_0^8 E(t) dt$$

- C. At 3:00 pm, the student council election committee begins to count the ballots at a rate modeled by the function where $P(t) = \frac{250}{1 + (0.6t-5)^2}$ ballots per hour for $8 \leq t \leq 12$. According to the model, how many ballots remain to be counted by 6:00 p.m. ($t = 11$) ?

- D. The election committee tallied ballots from 3:00 pm to 7:00 pm. According to the model $P(t)$, from part [C] above, at what time $8 \leq t \leq 12$,were the ballots being counted at the fastest rate? Justify your answer.

Questions 10 – 15. Region R , shown at right, is bounded by $f(x) = \sin\left(\frac{\pi}{2}x\right)$ and $g(x) = x^3 - 4x$. Find the volume of the solids formed whose cross sections are the shapes indicated below. Each cross section is perpendicular to the x -axis. [*Calculator active*]



10. Square

11. Semi-Circle

12. Equilateral Triangle

13. Isosceles Right Triangle

14. Rectangle with height $h = 3$

15. Rectangle with height equal to twice the base.

8.6

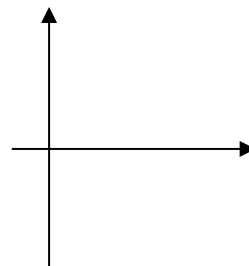
**Volumes by Disc & Washer
Methods Homework**

Name _____

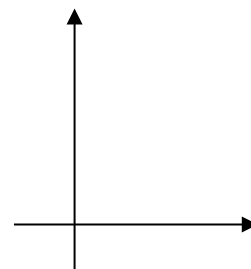
Date _____ Period _____

Problems 1 - 12, Find the volume of the region bounded by the given functions and revolved about the given axis.

1. $y = x^2 - 4x$; $y = 0$ about the x -axis



2. $y = x$; $y = 3$; $x = 0$ about the y -axis



3. $y = \sqrt{9 - x^2}$; $y = 0$; $x = 0$ about the x -axis

