

**Anti-derivatives**

1. **Going from rate functions to amount functions** Be sure to check your answers.

(a) Given  $f'(x) = 3x^2$ , find possible equation(s) for  $f(x)$ .

(b) Given  $f'(x) = x^2$ , find possible equation(s) for  $f(x)$ .

(c) Given  $f'(x) = \sin(x)$ , find possible equation(s) for  $f(x)$ .

(d) Given  $f'(x) = \sin(2x)$ , find possible equation(s) for  $f(x)$ .

(e) Given  $f'(x) = \frac{1}{x}$ , find possible equation(s) for  $f(x)$ .

**Average Value**

For each question in this section, be sure to include equations that show how you arrive at your answers. Let's use  $a$  to represent *average value*.

2. With your group, write a definition of *average value*.

3. What is the *average value* of the numbers in this list:

1, 2, 2, 3

Make a sketch using dots to show a *geometric interpretation* of your answer.

4. Average Value of a Step-Function

$$f(x) = \begin{cases} 1 & \text{if } 0 \leq x \leq 1, \\ 2 & \text{if } 1 < x \leq 3, \\ 3 & \text{if } 3 < x \leq 4. \end{cases}$$

(a) Draw a graph of  $f$  for  $x \in [0, 4]$ .

(b) What is the average value of  $f(x)$  for  $x \in [0, 4]$ .

(c) Color your graph to demonstrate a *geometric* visualization of the *average value* of  $f$  over the interval  $[0, 4]$ .

## 5. Average Value of another Step-Function

$$g(x) = \begin{cases} 1 & \text{if } 0 \leq x \leq 1, \\ 2 & \text{if } 1 < x \leq (2 + \sqrt{2}), \\ 3 & \text{if } (2 + \sqrt{2}) < x \leq 6. \end{cases}$$

- (a) Draw a graph of  $g$  for  $x \in [0, 6]$ .
- (b) What is the average value of  $g(x)$  for  $x \in [0, 6]$ .
- (c) Color your graph to demonstrate a *geometric* visualization of the *average value* of  $g$  over the interval  $[0, 6]$ .

6. Average Value of  $\sin(x)$  over the interval  $[0, \pi]$ .

- (a) Draw a graph of  $\sin(x)$  for  $x \in [0, \pi]$ .
- (b) What is the average value of  $\sin(x)$  for  $x \in [0, \pi]$ ? [Hint:  $\int_0^\pi \sin(x) dx = 2$ ]
- (c) Annotate your graph to get a *geometric* visualization of the *average value* of  $\sin(x)$  over the interval  $[0, \pi]$

7. With your group, write a definition of *average value of a function*.