

Activity - Antiderivatives

Part 1.

1. Which of the following is the antiderivative of $f(x) = 3x^2 + 4x + 8$?

- (a) $F(x) = x^3 + 4x^2 + 8$
- (b) $F(x) = 3x^3 + 2x^2 + 8x - 7$
- (c) $F(x) = 3x^3 + 4x^2 + 8x$
- (d) $F(x) = x^3 + 2x^2 + 8x - 5$
- (e) None of the above.

2. Which of the following is the antiderivative of $f(x) = 4x^3 + 3x^2 + 7$?

- (a) $F(x) = x^4 + x^3 + 7x + 5$
- (b) $F(x) = x^4 + x^3 + 7x$
- (c) $F(x) = x^4 + x^3 + 7x + 2$
- (d) $F(x) = x^4 + x^3 + 7x - 7$

Find the most general antiderivative of the following functions:

3. $f(x) = x^5$

4. $f(x) = \sqrt{x}$

5. $f(x) = \frac{1}{x^7}$

6. $f(x) = \sqrt[5]{x^3}$

7. $f(x) = \frac{1}{x}$

8. $f(x) = \sec x \tan x$

9. $f(x) = 3x^4$

10. $f(x) = \sin 2x$

Part 2: Applications of Antiderivatives: Rectilinear Motion

Antidifferentiation is particularly useful in analyzing the motion of an object moving in a straight line.

1. If an object has the position function $s = f(t)$ where s is measured in meters and t is time in seconds, then define the velocity and the acceleration of the object as functions of t including the correct units for both equations.

2. The acceleration due to gravity on Earth is a constant 9.8 m/s^2 . We generally consider down to be the negative direction, so let $a(t) = -9.8$. Find the velocity and position functions for a moving object with acceleration $a(t) = -9.8$. Explain the meaning of any unknown constants in your functions.

3. Use the gravitational constant of 9.8 m/s^2 to answer the following:

a. If a stone is dropped off a 35 meter cliff find its velocity function $v(t)$.

b. What is the position function $s(t)$ for the stone?

c. How long will it take the stone to hit the ground?

d. At what speed will the stone hit the ground?

e. If instead of being dropped, the stone is thrown downwards at an initial velocity of 10 m/s , will the velocity and position functions change? If so, what are the new functions? At what speed will the stone hit the ground?

f. If the stone were thrown upwards at an initial velocity of 10 m/s , at what speed will it hit the ground?

4. The acceleration of gravity on the moon is 1.6 m/s^2 . If an object is dropped on the moon hits the ground at a speed of 6.8 m/s , from what height was it dropped?

5. What constant acceleration is required to increase the speed of a car from 30 mi/h to 50 mi/h in 5 seconds? Give your answer in feet per second.