Activity 1.4‡ – Integrals of Constant Functions

FOR DISCUSSION: *What does* $\int m\,dx$ *represent? What about* $\int_{x_0}^{x_1} m\,dx$ *?*

Explain the FTC (for constant functions) in your own words.

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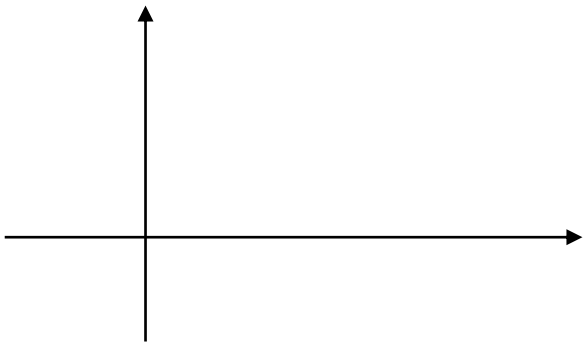
1. (a) Evaluate the indefinite integral to find a family of functions whose derivatives are 3.

$$\int 3\,dx =$$

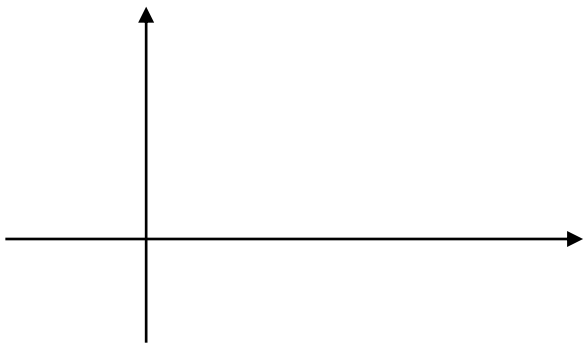
(a) Choose a few values for C and sketch these members of the family from Part (a).



(b) Evaluate the definite integral.

$$\int_{-1}^{4} 3\,dx =$$

(d) Sketch the geometrical interpretation of Part (c).



‡ This activity has supplemental exercises.

2. Evaluate each of the following indefinite and definite integrals. Show all work!

(a) $\int 1\,dx =$

(b) $\int 5.4\,dt =$

(c) $\int -62\,du =$

(d) $\int_2^5 -1\,dx =$

(e) $\int_0^3 4.32\,dx =$

(f) $\int_{-3}^2 -0.02\,dv =$

3. Suppose Bill and Sally are returning from a fishing trip at a constant velocity of $v(t) = -45$ mi/h (westbound). Let s be the distance from Bill's house at time t.

   (a) Evaluate the indefinite integral of the velocity function.

   $$\int v(t)\,dt =$$

   (b) Use the Fundamental Theorem of Calculus to evaluate the definite integral of the velocity function on the interval [0, 2]. Explain your answer in the context of the problem.

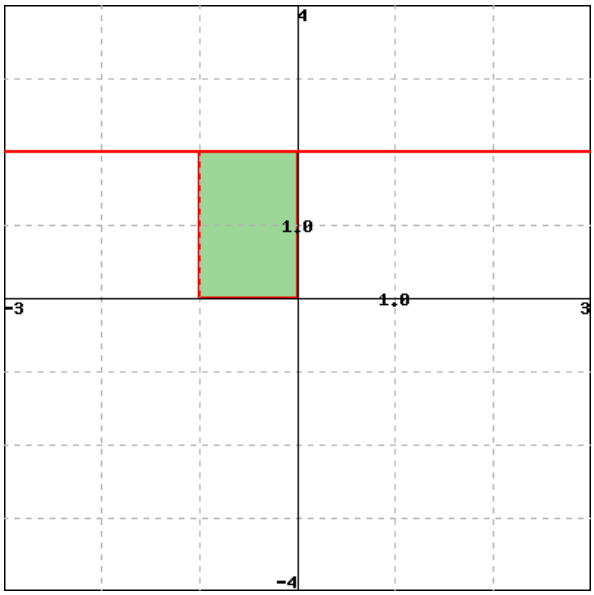
   $$\int_0^2 v(t)\,dt =$$

   (c) Can we determine how far Bill and Sally are from Bill's house after the first 2 hours of driving? What other information is needed?

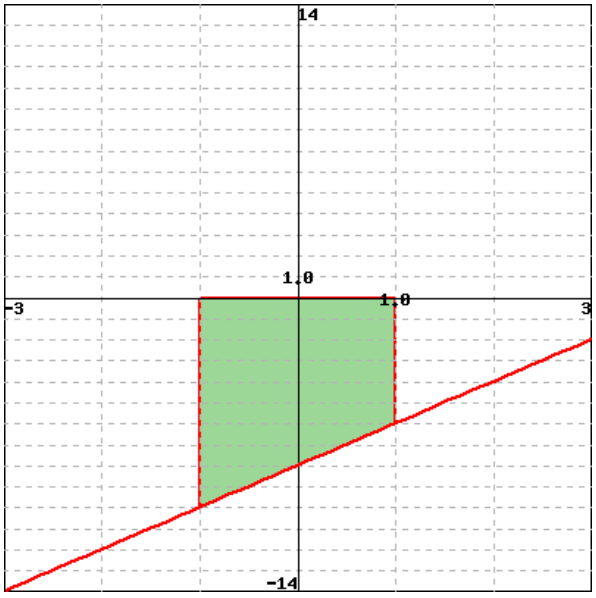
   (d) Suppose the initial distance from Bill's at time $t = 0$ is $s(0) = 200$ miles. Use your answer to Part (a) to find the specific antiderivative $s(t)$ satisfying this condition, and then use it to find how far Bill and Sally are from Bill's house after the first 2 hours. (This type of problem is called an *initial-value problem*).

   (e) Why are the answers to Parts (b) and (d) different?

4. Express the net area of the shaded region in the figure to the left with a definite integral. Then use the Fundamental Theorem to evaluate it.



5. Express the net area of the shaded region in the figure to the left with a definite integral. Then use geometry to compute it. (HINT: First find the equation of the line.)



6. The family of antiderivatives of a constant function $y' = m$ is an infinite family of linear functions $y = mx + C$. If a point in the plane (initial condition) is given, then exactly one member of the family passes through the point and is identified by the constant C.

   Suppose we know that $f'(x) = 2$. Determine the most general formula for f. Then find the member of the family that passes through the point (1, 7).