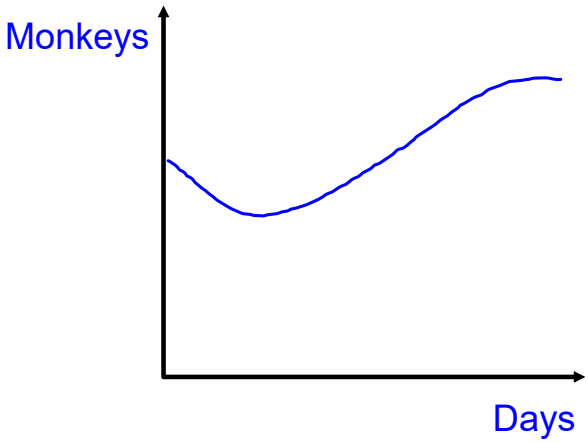


Derivative - slope of the tangent line (rate of change of the function) at a point.

Units - vertical divided by horiz.

Integral - area of the region between the function and the horizontal axis.

Units - vertical times horizontal

(Explain Calculator Functions)

May 20-3:19 PM

Physics Connection:

You are given the velocity function of a particle, where the velocity, in meters per second, is related to the time, in seconds.

What is the physical meaning of the derivative function?

What is the physical meaning of the integral function?

May 20-3:25 PM

For time, in seconds, the velocity, in meters per second, of a particle is given by the function: $v(t) = \sin t + 6$

a) At 7 seconds, what is the acceleration of the particle?

b) At 10 seconds, how fast is the particle going?

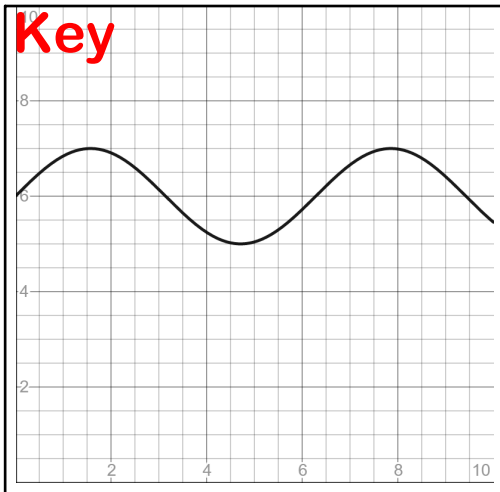
c) How far will the particle travel between 0 and 6 seconds?

d) How far will the particle travel between 6 and 10 seconds?

e) Without using your calculator an further, can you determine how far the particle will have traveled between 0 and 10 seconds?

May 20-3:27 PM

Key



a) $v'(7)$ = 0.753902254343

b) $v(10)$ = 5.45597888911

c) $\int_0^6 v(t)\,dt$ = 36.0398297133

d) $\int_6^{10} v(t)\,dt$ = 25.7992418157

e) Yes, sum answers c) and d).

Key

Key

Key

Apr 15-8:52 AM

8. *Sky Diver's Acceleration Problem:* Phoebe jumps from an airplane. While she free-falls, her downward velocity, v, in feet per second, as a function of t, in seconds since the jump, is

$$v(t) = 251(1 - 0.88^{t})$$

a. Plot the velocity, v, and acceleration, a, on the same screen. Use an x-window (actually a t-window) of 0 s to 30 s, and use your grapher's numerical derivative function. Sketch the results.

b. What is Phoebe's acceleration when she first jumps? Why do you suppose the acceleration decreases as she moves faster and faster?

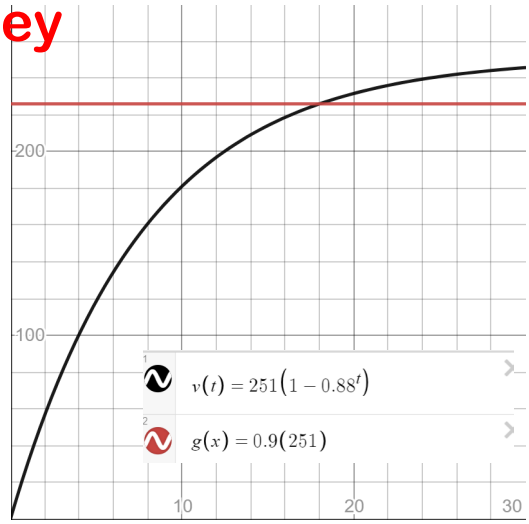
c. What does the limit of $v(t)$ seem to be as t approaches infinity? (This limit is called the *terminal velocity*.)

d. How many seconds does it take Phoebe to reach 90% of her terminal velocity? Explain how you found your answer.

Sep 12-2:00 PM

Key

a)



b) $v'(0)$ = 32.086176249

c) 251 ft/s

d) 18.012 sec

Key Key Key

Apr 15-8:58 AM

p. 102

. *Velocity from Displacement Problem:* If you place-kick a football, its displacement above the ground, d, in meters, is given by

$$d(t) = 18t - 4.9t^2$$

where t is time in seconds since it was punted (Figure 3-5g). (The coefficient 18 is the initial upward velocity in meters per second.)

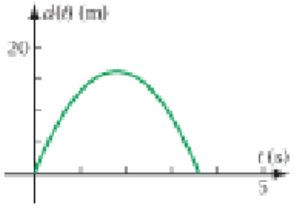


Figure 3-5g

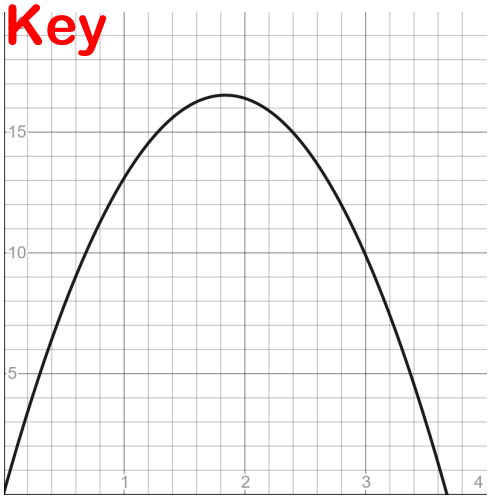
a. Find $d'(1)$ and $d'(3)$. What name from physics is given to d' ?

b. At times $t = 1$ and $t = 3$, is the football going up or down? How fast? How does the derivative tell you this? How do you know from this graph?

c. Use the d' equation to find the velocity at time $t = 4$. Explain why the answer has a meaning in the mathematical world but not the real world.

Sep 14-4:24 PM

Key



Key

a) $d'(1)$ = 8.2

$d'(3)$ = −11.4

velocity

b) at t=1 it is going up, because it is positive
at t=3 it is going down, because it is negative

c) $d'(4)$ = −21.2

because the football hits the ground at 3.673 seconds, this equation does not model reality after that point.

Key

Apr 15-9:05 AM

10. *Displacement from Velocity Indefinite Integral*

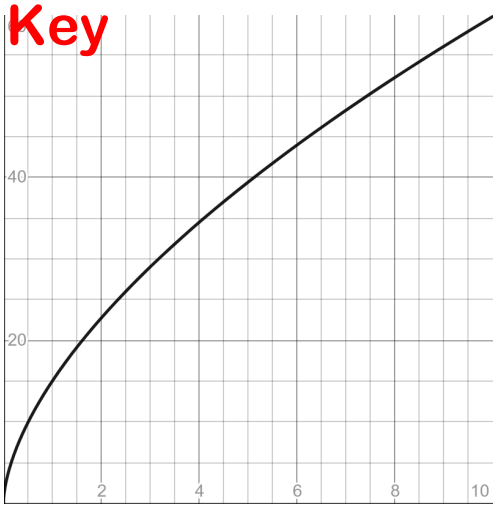
Problem: Recall that the velocity of a moving object is the derivative of the displacement. So the displacement is the *antiderivative*, or *indefinite integral*, of the velocity. Suppose a sports car accelerates in such a way that its velocity as a function of time is given by

$$v(t) = 15t^{0.6}$$

where $v(t)$ is in feet per second and t is in seconds. Find an equation for $x(t)$, the displacement of the car from a fixed point. Assume that the car is 50 ft from the fixed point at time $t = 0$. Use the equation for $x(t)$ to find the position of the car at $t = 10$ s. How far does it travel between $t = 0$ and $t = 10$ s?

Sep 14-4:27 PM

Key



Key

$$d(t) = \int v(t)\,dt + 50$$

$$d(t) = \int 9.375t^{1.6} + 50$$

$$\int_0^{10} v(t)\,dt + 50 = 423.225472394$$

$$\int_0^{10} v(t)\,dt = 373.225472394$$

Key

Key

Apr 15-9:11 AM