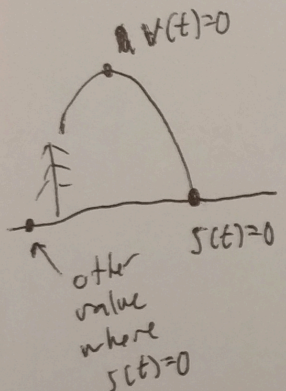
Math 16A: Short Calculus I
Fall 2017, Section 3
Homework Sheet 6
Due: ~~Monday, November 13, 2017~~ Wednesday, November 15, 2017

Submit your solutions to the following problems in lecture on the due date above. Present your work in a clean and organized fashion, either on a printed copy of this document (preferred) or a separate sheet of paper. As stated in the syllabus, late submissions will **not** be accepted.

1. Suppose a monkey is sitting at the top of a 10ft tree throws a banana up in the air with an initial velocity of 32ft/sec.

   (a) Find an equation for $s(t)$, the height of the banana above the ground at time t.

   $s(t) = -16t^2 + 32t + 10.$



   (b) For what values of t is the function $s(t)$ valid?

   $s(t) = 0$

   $-16t^2 + 32t + 10 = 0$

   use quadratic formula

   $t = \frac{-32 \pm \sqrt{32^2 - 4 \cdot 10 \cdot (-16)}}{2(-16)}$

   $= \frac{-32 \pm \sqrt{1664}}{-32}$

   For "−", result is negative, so

   $t = \frac{-32 + \sqrt{1664}}{-32}$

   Valid range: $\boxed{0 \le t \le \frac{-32 + \sqrt{1664}}{-32}}$

   (c) What is the maximum height the banana will reach?

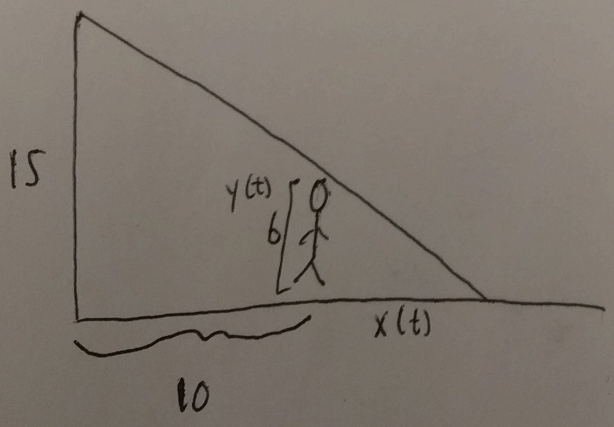
   Need $v(t) = 0$.

   $v(t) = s'(t) = -32t + 32 = 0$

   $t = 1$ ← time banana hits max height

   $s(1) = -16(1)^2 + 32(1) + 10 = \boxed{26 \text{ ft}}$

2. A man 6 ft tall is standing 10 ft from a lightpole with a light that is 15 ft above the ground. The man then drinks a potion which causes him to shrink at a rate of 1 ft/sec. How fast is the man's shadow shrinking when he is 3 ft tall?



   $x(t)$ = length of shadow *

   $y(t)$ = height of person *

   * = changing with t

   $\frac{x(t) + 10}{15} = \frac{x(t)}{y(t)}$

   when height = 3 ft, shadow is:

   $\frac{10 + x}{15} = \frac{x}{3}$

   $30 + 3x = 15x$

   $30 = 12x$

   $x = 2.5$

   $x(t)y(t) + 10y(t) = 15x(t)$

   $y(t)\frac{dx}{dt} + x(t)\frac{dy}{dt} + 10\frac{dy}{dt} = 15\frac{dx}{dt}$

   $(3)\frac{dx}{dt} + (2.5)(1) + 10(1) = 15\frac{dx}{dt}$

   $12.5 = 12\frac{dx}{dt}$

   $\boxed{\frac{dx}{dt} = \frac{12.5}{12} \text{ ft/sec}}$