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Quiz for October 4, 2005

A rock is dropped from a height of 576 feet and falls toward Earth in a straight line. In t seconds the rock drops a distance of $s = 16t^2$ feet.

- (a) How many seconds after release does the rock hit the ground?
- (b) What is the average velocity of the rock during the time it is falling?
- (c) What is the average velocity of the rock for the first 3 seconds?
- (d) What is the instantaneous velocity of the rock when it hits the ground?

Don't forget to give **units**. It is **not** important to me that you use the definition of the derivative to find any derivatives that you need to use.

ANSWER: We set up our axis with $s = 0$ the point at which the rock is dropped and $s = 576$ the point at which the rock hits the ground. Now $s(t) = 16t^2$ gives the position of the rock at time t .

- (a) The rock hits the ground when $s(t) = 576$; that is, $16t^2 = 576$, so $t^2 = 36$, and $t = 6$ seconds.
- (b) The average speed of the rock during its flight is $\frac{s(6)-s(0)}{6-0} = \frac{576}{6} = 96$ feet/second.
- (c) The average speed of the rock during the first 3 seconds is $\frac{s(3)-s(0)}{3-0} = \frac{144}{3} = 48$ feet/second.
- (d) The instantaneous velocity of the rock when the rock hits the ground is $s'(6)$. We know that $s'(t) = 32t$. So, the answer is $s'(6) = 32(6) = 192$ feet/second.