1. (2 points) **Fill-in-the-Blank. No partial credit available**  
A particle moves according to the law of motion \( s = \frac{30}{t + 2}, \ t \geq 0 \), where \( t \) is measured in seconds and \( s \) is in feet.

(a) The average velocity over the interval \([0 \, , \, 3]\) is: \(-3\) \(\frac{\text{ft}}{\text{sec}}\)

**Solution:** Find the slope of the secant line between \( t = 0 \) and \( t = 3 \):

\[
\frac{s(3) - s(0)}{3 - 0} = \frac{6 - 15}{3} = -3
\]

(b) The velocity at \( t = 1 \) seconds is: \(-\frac{10}{3}\) \(\frac{\text{ft}}{\text{sec}}\)

**Solution:** The instantaneous velocity is the derivative, which is

\[
s'(t) = \frac{-30}{(t + 2)^2}
\]

At \( t = 1 \), this is

\[
s'(1) = \frac{-30}{(1 + 2)^2} = \frac{-30}{9} = \frac{-10}{3}
\]

(c) For \( t \geq 0 \) the particle is moving in the negative direction during: \([0, \infty)\)

**Solution:** We already saw that \( s'(t) = \frac{-30}{(t + 2)^2} \), which is always negative. So the particle is *always* moving in the negative direction.
2. (3 points) A ball is thrown upwards, and its height in feet at time \( t \) (in seconds) is given by

\[ h(t) = 5 + 4t - 16t^2 \]

(a) What is the velocity of the ball at time \( t = \frac{1}{4} \)?

**Solution:** The velocity is the derivative of \( h \):

\[ h'(t) = 4 - 32t \]

So the velocity at \( t = \frac{1}{4} \) is

\[ h' \left( \frac{1}{4} \right) = 4 - \frac{32}{4} = -4 \]

(b) At what time does the ball attain its maximum height?

**Solution:** The maximum height happens when \( h'(t) = 0 \). So we solve \( 4 - 32t = 0 \) to get \( t = \frac{1}{8} \).

(c) What is the acceleration of the ball at time \( t = \frac{1}{2} \)?

**Solution:** The acceleration is the second derivative of \( h \):

\[ h''(t) = -32 \]

Since \( h'' \) is constant, it is always \(-32\) feet per second per second. In particular, it is \(-32\) when \( t = \frac{1}{2} \).