Q2. The altitude of a rocket in the first half-minute of its ascent is given by x = bt2, where x is the altitude and b = 2.90 m/s2 is a constant.

a) Find a general expression for the rocket's velocity as a function of time.

b) Find the rocket's instantaneous velocity at t = 20 s.

c) Find an expression for the average velocity of the rocket. Find the average velocity after during the first 20 seconds.

d) Compare your two velocities (instantaneous and average). Is there a difference and if so why?

Solution:

Such as $v = \frac{dX}{dt}$

$v = (bt^2)' = 2bt$

$v = 2.9 * 2t = 5.8t$

$v(t = 20s) = 5.8 * 20 = 116 \ m/s$

$v(average) = \frac{v_0 + v_t}{2}$

$v(average \ t = 20) = \frac{v_0 + v(t=20)}{2} = \frac{0 + 116}{2} = 58 \ m/s$

Answers: $v = 5.8t, v = 116 \ m/s, v(average) = \frac{v_0 + v_t}{2}, v(average \ t = 20) = 58 \ m/s$

The instantaneous and average velocities are different.