

# Quiz 2

Name: \_\_\_\_\_

1. (a) Suppose that  $s(t)$  is the position of a particle at time  $t$ , with time measured in seconds and position measured in meters from the origin. What is the formula for computing the *instantaneous velocity* of the particle at time  $t_0$ ?

At time  $t_0$ , the instantaneous velocity is

$$\lim_{h \rightarrow 0} \left( \frac{s(t_0 + h) - s(t_0)}{h} \right).$$

- (b) For a concrete example, let  $s(t) = 2t^2 + 3t$ . Compute the instantaneous velocity of the particle when  $t = 1$ .

Using the formula above, the instantaneous velocity of the particle when  $t = 1$  is

$$\begin{aligned} \lim_{h \rightarrow 0} \left( \frac{s(1+h) - s(1)}{h} \right) &= \lim_{h \rightarrow 0} \left( \frac{(2(1+h)^2 + 3(1+h)) - (2(1) + 3(1))}{h} \right) \\ &= \lim_{h \rightarrow 0} \left( \frac{(2(1+2h+h^2) + 3(1+h)) - (5)}{h} \right) \\ &= \lim_{h \rightarrow 0} \left( \frac{(2+4h+2h^2+3+3h) - 5}{h} \right) \\ &= \lim_{h \rightarrow 0} \left( \frac{7h+2h^2}{h} \right) \\ &= \lim_{h \rightarrow 0} (7+2h) \\ &= 7. \end{aligned}$$