

## Tomorrow's Quiz

Determine the position, velocity, and acceleration  
(including proper units)

Determine speed and average velocity  
(including proper units)

When is a particle moving to the right? Left?  
at rest? changing direction? Justify.

Position      feet

Velocity      feet/sec

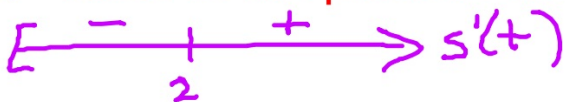
Acceleration      feet/sec<sup>2</sup>

Practice

$$s(t) = 2t^3 - 3t^2 - 12t \quad t \geq 0$$

$$s'(t) = 6t^2 - 6t - 12 = 6(t - 2)(t + 1)$$

a) when is the particle moving to the right? Left? Justify



Right:  $(2, \infty)$  because  $s'(t) > 0$

Left:  $(0, 2)$  because  $s'(t) < 0$

b) When is the particle changing direction? Justify

$t = 2$  because  $s'(t)$  changes signs

c) What is the velocity at  $t = 2$ ? acceleration at  $t = 2$ ?

$$s'(2) = 0$$

$$s''(t) = 12t - 6$$

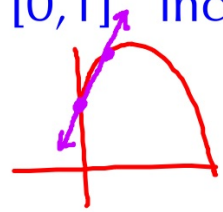
$$s''(2) = 18$$

A rock is thrown upward and its position is modeled by  
 $s(t) = -16t^2 + 48t + 64$  ;  $s'(t) = -32t + 48$

where  $t$  is measured in seconds and  $s(t)$  is measured in feet

a) What is the <sup>slope</sup> average velocity on the interval  $[0, 1]$ . Include units of measure  $(0, 64)$   $(1, 96)$

$$\frac{96 - 64}{1 - 0} = 32 \text{ ft/sec}$$



b) When will the rock hit the ground? Find the velocity at that time. Include units  $0 = s(t)$ ;  $0 = -16(t^2 - 3t - 4)$   
 $t = 4 \text{ sec}$ ;  $s'(4) = -80 \text{ ft/sec}$   $0 = -16(t - 4)(t + 1)$

c) What is the speed at  $t = 2$ ? Include units  $|s'(2)| = 16 \text{ ft/sec}$

$$s(t) = 2\cos 2t \quad s'(t) = -4\sin(2t)$$

velocity at  $t = \frac{\pi}{4}$   $s'(\frac{\pi}{4}) = -4\sin(\frac{\pi}{2}) = -4$

acceleration at  $t = \frac{\pi}{4}$   $s''(t) = -8\cos(2t)$

$$s''(\frac{\pi}{4}) = 0$$

$$9.) s(t) = \frac{3t}{1+t^2}$$

$$s'(t) = \frac{(1+t^2)3 - 3t(2t)}{(1+t^2)^2}$$

$$= \frac{-3t^2 + 3}{(1+t^2)^2}$$

$$= \frac{-3(t^2 - 1)}{(1+t^2)^2}$$

$$\begin{aligned} -3(t^2 - 1) &= 0 \\ t &= \pm 1 \end{aligned}$$



Changing direction at  $t = 1$  because  $s'(t)$  changes signs

Moving to the right  $(0, 1)$  because  $s'(t) > 0$ ; moving to the left  $(1, \infty)$  because  $s'(t) < 0$

$$4.) s(t) = -\frac{1}{t} \quad [1, 2] \quad s(t) = -1 \cdot t^{-1}$$

$$a.) \quad (\underline{1}, -1) \quad (\underline{2}, -\frac{1}{2})$$

Avg  
vel.

$$\frac{-\frac{1}{2} - (-1)}{2 - 1}$$
$$\frac{1}{2}$$

$$b.) s'(t) = t^{-2} = \frac{1}{t^2}$$

$$s'(1) = 1$$

$$s'(2) = 1/4$$

$$\textcircled{6} \quad s(t) = 5t^4 - 4t^2 + 3t - 2 ; t=0$$

$$a.) \quad s'(t) = 20t^3 - 8t + 3$$

$$b.) \quad s'(0) = 3$$

$$c.) \quad s''(t) = 60t^2 - 8$$

$$d.) \quad s''(0) = -8$$

$$\textcircled{7} \quad s(t) = \frac{3}{5t} - 2$$

$$s(t) = \frac{3}{5}t^{-1} - 2$$

$$s'(t) = -\frac{3}{5}t^{-2}$$

$$= -\frac{3}{5t^2}$$



$$8.) \quad s'(t) = 6t^2 + 18t - 60$$

$$0 = 6(t^2 + 3t - 10)$$

$$6(t+5)(t-2)$$

