

MA 181 WORKSHEET (3.8)

Name \_\_\_\_\_

A particle moves along the x-axis, its position at time  $t$  is given by

$$x(t) = t/(1 + t^2), t \geq 0, \text{ where } t \text{ is measured in seconds and } x \text{ in meters.}$$

A. Find the velocity at time  $t$ .

B. When is the particle moving to the right?

C. When is the particle moving to the left? Since we would consider the particle to be moving backward when it moves to the left, an object moving to the left will have a negative velocity.

Solve for  $t$ ,  $x'(t) < 0$

- D. Find the total distance traveled during the first 4 seconds.

Whether the particle is moving forward (to the right) or backward (to the left), the distance traveled in both directions adds to the total distance traveled.

In part B we found that  $x'(t) > 0$  for  $0 < t < 1$ . The total distance the particle traveled to the right is

$$x(1) - x(0) =$$

In part C we found that  $x'(t) < 0$  for  $t > 1$ . The total distance traveled to the left in the first 4 seconds is

$$|x(4) - x(1)| =$$

TOTAL DISTANCE:

- E. Find the acceleration at time  $t$ . The acceleration is the rate of change of the velocity. Thus,  $a(t) = v'(t) = x''(t)$

$$v(t) = x'(t) = (-t^2 + 1)/(1 + t^2)^2$$

$$a(t) = v'(t) = x''(t) =$$

When is  $a(t) = 0$ ?

F. Graph the position, velocity and acceleration functions for  $0 \leq t \leq 4$ .

G. When is the particle speeding up?

H. When is the particle slowing down?

When  $x'(t) = v(t)$  and  $x''(t) = a(t)$  are opposite signs.