Calc AB

Lesson 54

10/20/15

Agenda: 10/20/15

Period 3

Period 4

HW leader:

lesson 54

Velocity and Acceleration

★ Quiz 6 on Friday

- Velocity is the instantaneous rate of change of position
- Acceleration is the instantaneous rate of change of velocity

★ we define positive velocities in the positive x-direction (right of 0) and call velocities in the opposite direction negative velocities (left of 0)

Ex. 54.2 The position of a particle moving along the x-axis at any time t (in seconds) is given by

$$x(t) = t^2 - 3t + 2$$

a) Find the times when the particle is at rest,

b) moving to the right

c) moving to the left

d) accelerating

e) decelerating

$$v(t) = x'(t) = 2t - 3$$

$$a(t) = v'(t) = x''(t) = 2$$

(a) When $v(t) = 0$ so $\boxed{t = \frac{3}{2} \text{ seconds}}$ the particle is at rest.

(b) When $v(t) > 0$ so $\boxed{t > \frac{3}{2} \text{ seconds}}$ the particle is moving right

(c) When $v(t) < 0$ so $\boxed{t < \frac{3}{2} \text{ seconds}}$ the particle is moving left

(d) When $a(t) > 0$ so $\boxed{\text{for all } t}$ the particle is accelerating

(e) When $a(t) < 0$ so never decelerating.

Calc AB

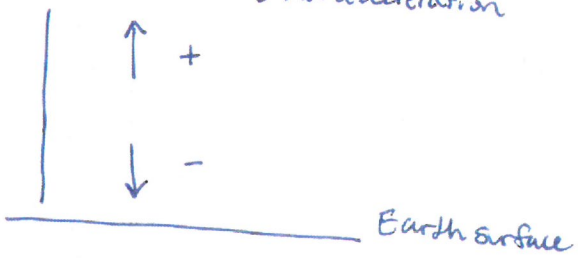
Lesson 54

10/20/15

Ex. 54.3 A ball is thrown vertically into the air with an initial velocity of 20 m/s 2 m off the ground. Its height is then modeled by

$$h(t) = 2 + 20t - 4.9t^2$$

Vertical velocity and acceleration



(a) Find the height of the ball and velocity 1 second after it is thrown.

(b) At what time is the ball the greatest distance from the ground?

(c) How high will the ball go?

(d) What is the greatest value of the acceleration?

$h(t) = 2 + 20t - 4.9t^2$

$v(t) = h'(t) = 20 - 9.8t$

$a(t) = -9.8$

(a) $h(1) = 2 + 20 - 4.9 =$ **17.1 m**

$v(1) = 20 - 9.8 =$ **10.2 m/s**

(b) maximize $h(t)$ when $v(t) = 0$: $t = \frac{20}{9.8} \approx$ **2.0408 seconds**

(c) $h(2.0408) \approx$ **22.4082 meters**

(d) **$-9.8\ m/s^2$**