

**Particle Motion - for the last time!**

Here are all of the formulas from your reference sheet that you need to know and use for particle motion. Do you know them all??

Velocity:  $v(t) = s'(t)$

Acceleration:  $a(t) = v'(t) = s''(t)$

Speed:  $\text{speed} = |v(t)|$

Average Velocity: (given  $s(t)$ )  $\frac{s(b) - s(a)}{b - a}$

(given  $v(t)$ )  $\frac{1}{b - a} \int_a^b v(t) dt$

Average Acceleration: (given  $v(t)$ )  $\frac{v(b) - v(a)}{b - a}$

(given  $a(t)$ )  $\frac{1}{b - a} \int_a^b a(t) dt$

Displacement:  $\int_a^b v(t) dt$

Total Distance:  $\int_a^b |v(t)| dt$

Position at b:  $s(b) = s(a) + \int_a^b v(t) dt$

Justifications for Particle Motion:

Particle is moving right/up because  $v(t) > 0$  (positive).

Particle is moving left/down because  $v(t) < 0$  (negative).

Particle is speeding up (|velocity| is getting bigger) because  $v(t)$  and  $a(t)$  have same sign.

Particle is slowing down (|velocity| is getting smaller) because  $v(t)$  and  $a(t)$  have different signs.

The velocity of a moving particle on a coordinate line is  $v(t) = t^2 + 3t - 10$  . Find:

(a) the displacement by the particle during this interval and

(b) the total distance traveled during the interval.

(No calculator)

If the acceleration function is  $a(t) = -4$  and  $v(0) = 12$  during the interval  $0 \leq t \leq 8$ , find the total distance traveled by the particle.

The velocity function of a moving particle is  $v(t) = 3\cos(2t)$  for  $0 \leq t \leq 2\pi$  .

- (a) Determine when the particle is moving to the right;
- (b) Determine when the particle stops;
- (c) Find the total distance traveled by the particle.
- (d) If  $x(0) = 5$  , find  $x(6)$  .
- (e) Find when the particle is speeding up.

(Calculator)