Solving A Particle Motion Problem

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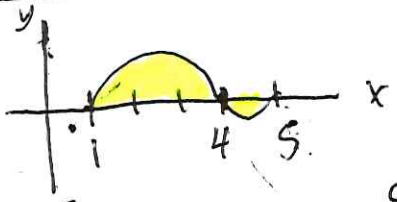
ES: Find the displacement and total distance of a particle's motion?

Example The velocity (in feet/second) of a particle moving along a line is

$$v(t) = t^3 - 10t^2 + 29t - 20$$

where t is the time in seconds.

(a) what is the displacement of the particle on the time interval $1 \le t \le 5$?



$$\int_1^5 v(t)\,dt = \int_1^5 \left(t^3 - 10t^2 + 29t - 20\right) dt$$

$$= \left[\frac{t^4}{4} - \frac{10t^3}{3} + \frac{29t^2}{2} - 20t\right]_1^5$$

$$= 2.083 - (-8.583)$$

$$= 10.667$$

The particle is displaced 10.667 feet to the right for the time interval $1 \le t \le 5$ seconds

(b) what is the total distance traveled by

$$\int_1^5 |v(t)|\,dt = \int_1^4 v(t)\,dt - \int_4^5 v(t)\,dt$$

Practice writing this on AP Exam

the particle on the time interval $1 \leq t \leq 5$?

(Positive Distance)

$= 11.25 - (-.583)$

$= 11.833.$

The total distance traveled is 11.833 feet on the time interval $1 \leq t \leq 5$ seconds.

Summary