Motion Revisited

- Given position, find velocity and acceleration

Given s(t) , find v(t) = s'(t) and a(t) = v'(t) = s"(t)

- Given velocity, find position and acceleration

Given v(t), find $s(t)$: $\int v(t)dx = s(t) + C$ and a(t) = v'(t)

- Given acceleration, find velocity and position

Given a(t), find $v(t)$: $\int a(t)dx = v(t) + C$ and

$$s(t): \int [v(t) + C]dx = s(t) + Ct + D$$

Example 1

- A particle moves along a straight line with acceleration $a(t) = 6t + 4$. Its initial velocity is
  - 6 cm/sec and its initial position is 9 cm. Find its position at $t = 8$ sec.

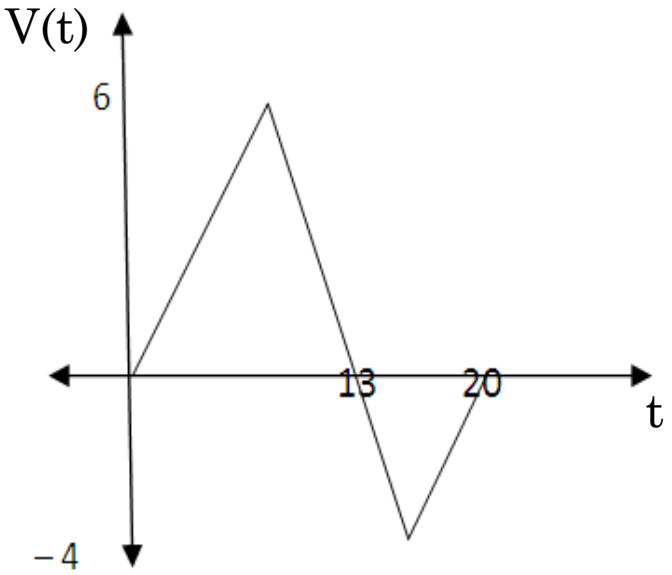
Example 2

- A ball is thrown upward with a speed of 48 ft/sec from the edge of a cliff 432 ft above the ground. Find its height t seconds later. When does the ball reach its maximum height? When does it hit the ground?

- **Displacement** is how far away from the starting point the particle is at the end of the time period. The sign of displacement tells you where in relation to the starting point you end up.

Negative, to the left of starting point;

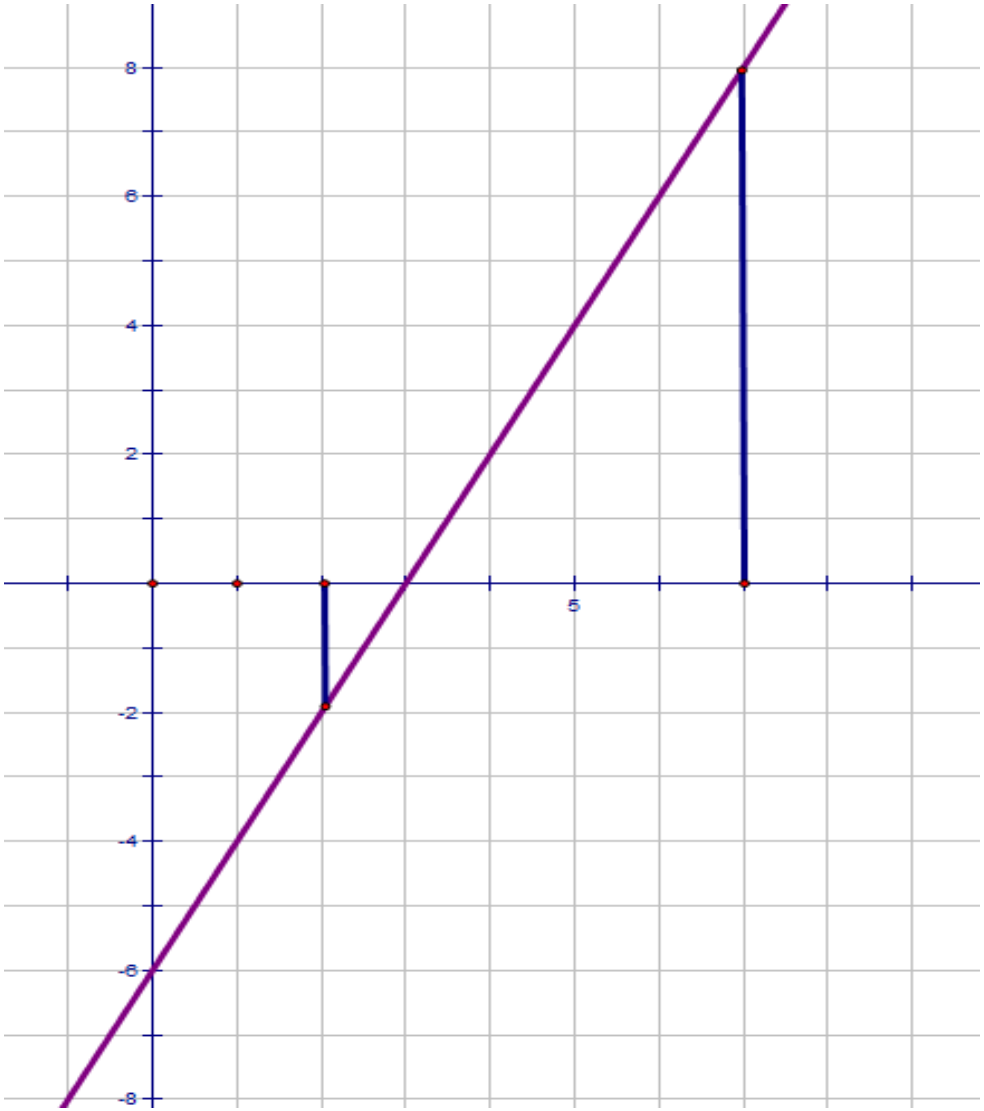
Positive to the right of starting point.



1. What is the displacement of the particle from 0 to 20 seconds?

2. What is the total distance traveled from 0 to 20 seconds?

- When evaluating integrals, area below the x-axis are negative.
- When finding total area, all areas are positive.
- Find displacement by integrating velocity. Displacement = $\int v(t)\,dt$
- Find total distance by integrating absolute value of velocity. Total distance = $\int |v(t)|\,dt$



Find displacement and total distance from t= 2 seconds to t = 7 seconds given v(t) = 2t – 6 .