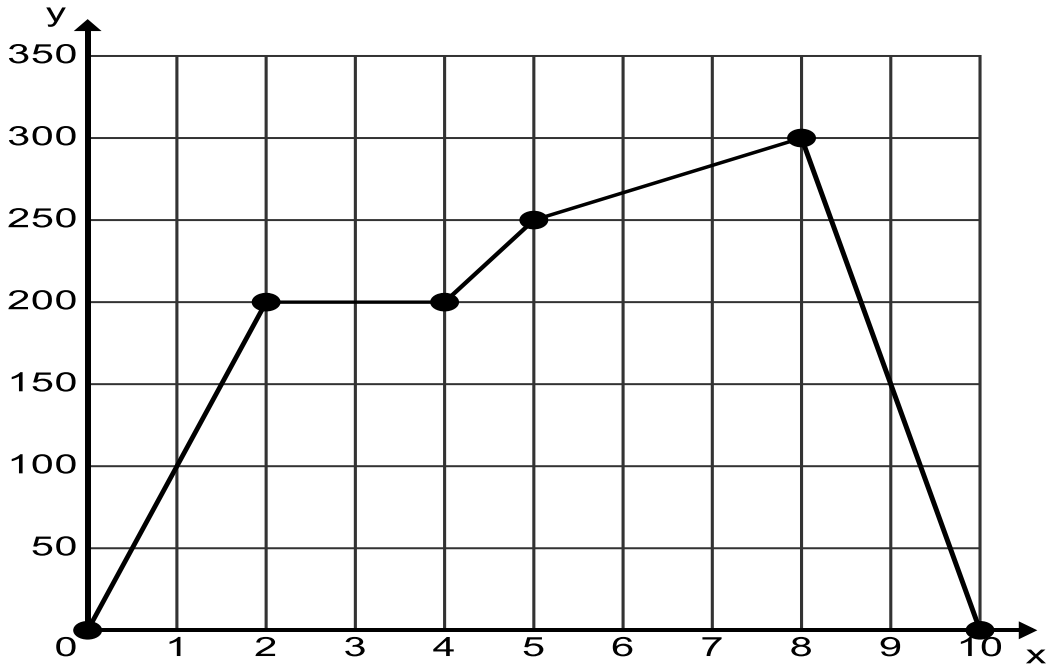
Review of 3.4 – Position, Velocity, Acceleration

1. Below is a graph of Ms. Orloff's position from home on a walk. The graph gives her position in feet with respect to time in minutes.



$v(t)<0$ $v(t)>0$ $v(t)=0$

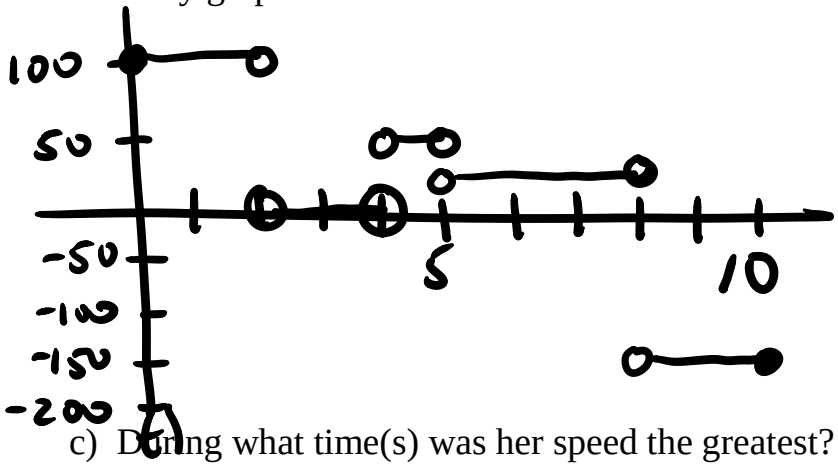
a) When is Ms. Orloff moving to the left? To the right? Standing still?

Right: $0<t<2$sec., $4<t<8$sec. Standing still: $2<t<4$sec.

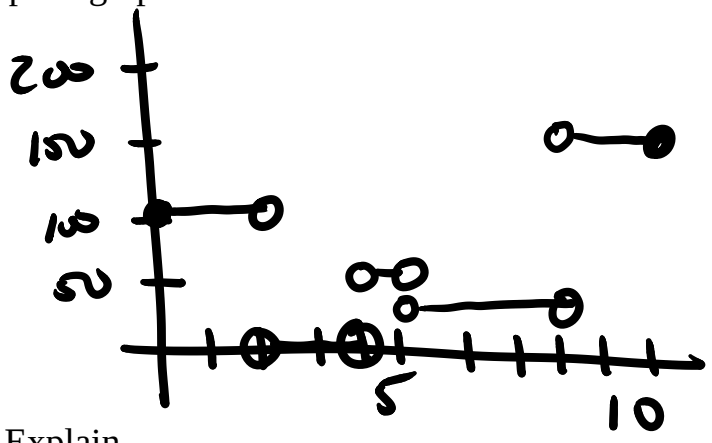
Left: $8<t<10$sec.

b) Sketch the graphs of Ms. Orloff's velocity and speed below.

Velocity graph:



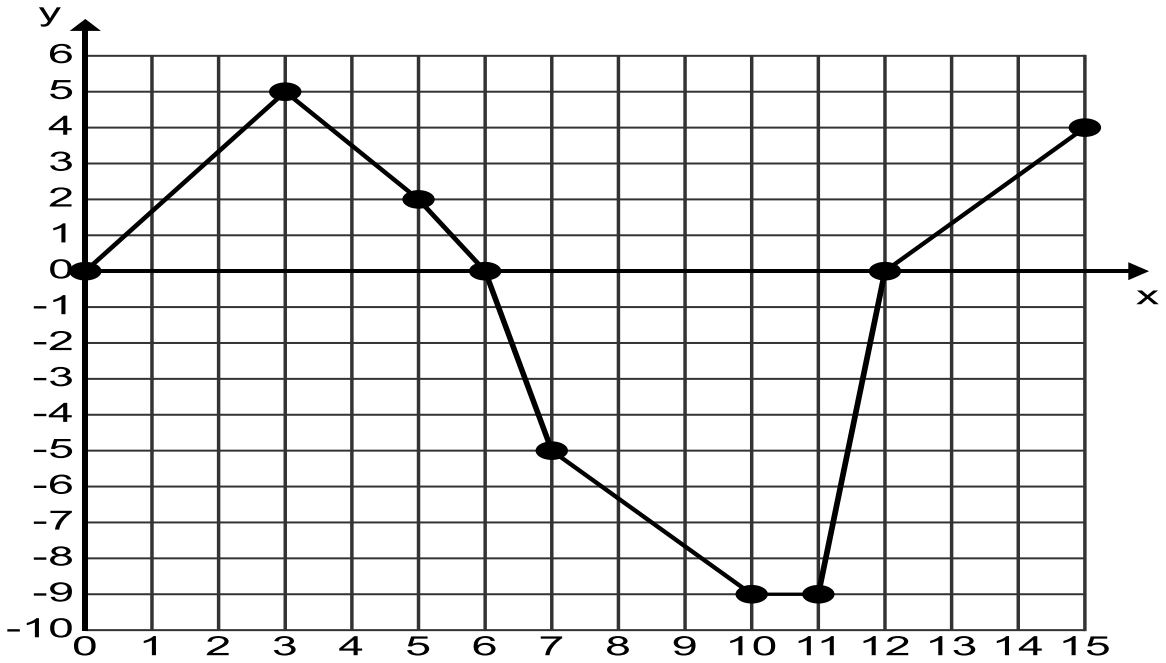
Speed graph:



c) During what time(s) was her speed the greatest? Explain.

The speed was greatest at $8<t<10$sec. since her speed was 150 ft/min.

2. The velocity of an object moving up and down on the y-axis is given below. The velocity is graph in meters per second and time is in seconds.



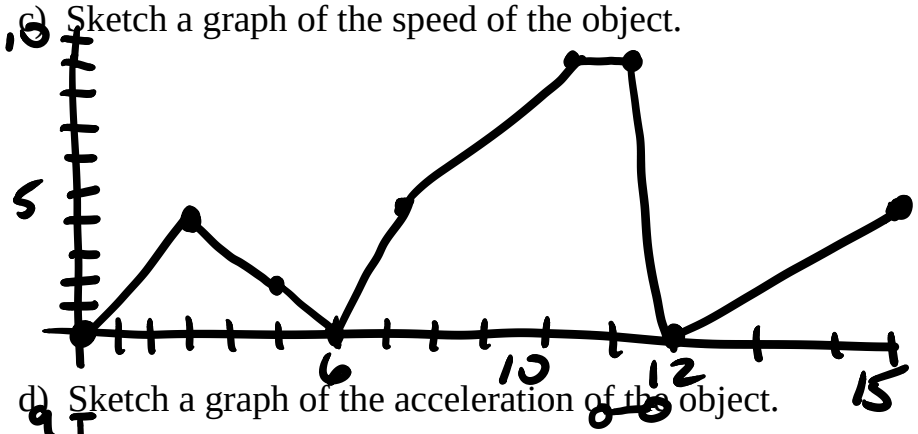
a) When does the object change direction? $t = 6\text{sec}$ and $t = 12\text{sec}$.

b) When is the object moving upwards? Moving downwards?

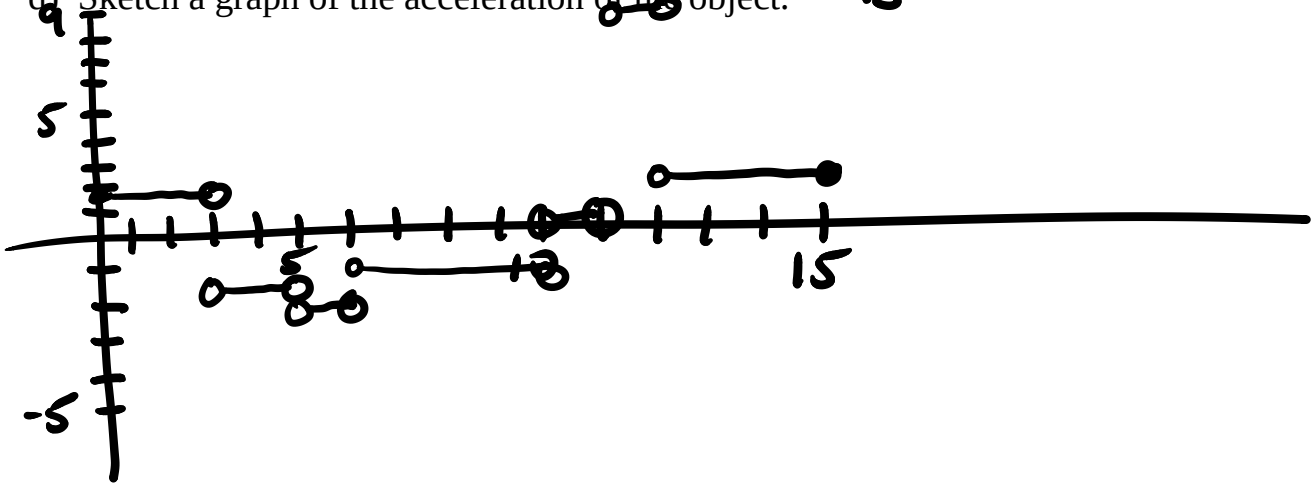
upwards: $0 < t < 6\text{sec}$., $12 < t < 15\text{sec}$.

Downwards: $6 < t < 12\text{sec}$.

c) Sketch a graph of the speed of the object.



d) Sketch a graph of the acceleration of the object.



e) When is the object speeding up? Slowing down? Staying the same speed?

Speeding up: $0<t<3$ sec., $6<t<10$ sec., $12<t<15$ sec.

Slowing down: $3<t<6$ sec., $11<t<12$ sec.

Same speed: $10<t<11$ sec.

f) When is the object moving the fastest? Explain.

From $10<t<11$ sec since the speed is 9 m/sec.

3. The position of an object as it moves back and forth on the x-axis is given as the function $s(t)=t^3-12t^2+36t+1$ where s is in feet and t is in seconds and $t \geq 0$.

a) Find the object's displacement over the first 5 seconds.

Disp. $= s(5)-s(0) = 6-1 =$ **5 ft**

b) Find the average velocity over the first 5 seconds.

Avg. velocity $= \frac{s(5)-s(0)}{5-0} = \frac{5}{5} =$ **1 ft/sec.**

c) Find the instantaneous velocity at t = 2 seconds.

$v(t) = 3t^2-24t+36$

$v(2) = 3(2)^2-24(2)+36 =$ **0 ft/sec.**

d) Find the acceleration at t = 2 seconds.

$a(t) = 6t-24$

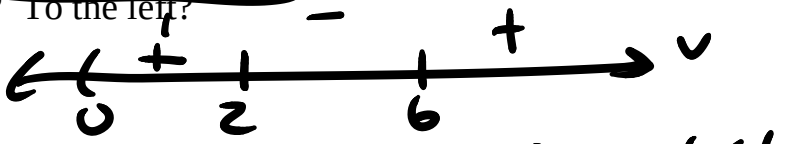
$a(2) = 6(2)-24 =$ **-12 ft/sec^2**

e) When is the particle moving to the right? To the left?

$3t^2-24t+36=0$

$3(t^2-8t+12)=0$

$3(t-2)(t-6)=0$



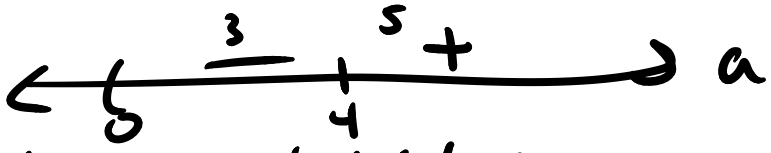
Right: $0<t<2$ sec., $6<t$

Left: $2<t<6$ sec.

f) When is the particle speeding up? Slowing down?

$a(t) = 6t-24 = 0$

$t = 4$



Slowing down: $0<t<2$ sec, $4<t<6$ sec.

Speeding up: $2<t<4$ sec., $6<t$