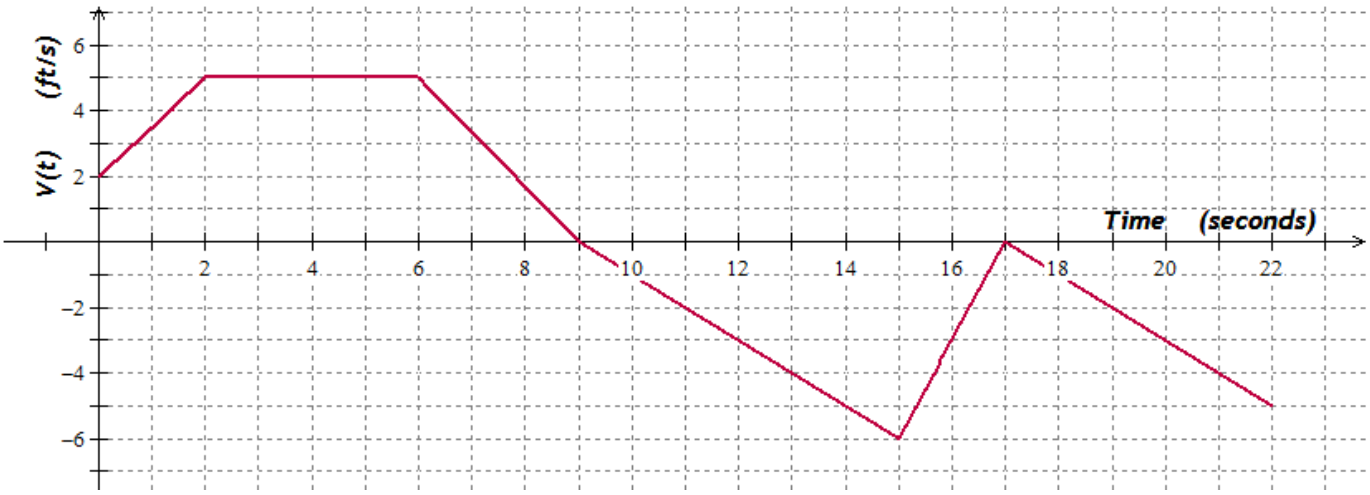
Particle Motion 1



A particle moves along the x-axis with velocity shown in the graph. Its position x(t) at t = 0 is 5.

1. At t = 0 is the particle moving left or right? Justify your answer.
2. When is the particle at rest?
3. When does the particle change direction?
4. When is the speed of the particle the greatest?
5. What is the acceleration of the particle at t = 1?
6. Is the particle speeding up or slowing down at t = 7 and t = 12. Give a reason for your answer.
7. When is the acceleration zero?
8. What is the total distance traveled by the particle from t = 2 to t = 14?
9. What is the particle's position at t = 14.
10. When does the particle reach its maximum position?
11. What is the particle's minimum position? When does it occur?
12. Name the intervals that the speed of the particle is increasing.

Particle Motion

You will need a calculator for some of these questions Round to 3 decimal places.

1. The position of a body at time t seconds is given by $s(t)=t^3-6t^2+9t$ meters. Find the body's acceleration each time the velocity is zero.

2. A particle moves along a line so that its position at any time $t \geq 0$ is given by the function $s(t)=t^2-3t+2$, where s is measured in meters and t is measured in seconds.

   A. How much did the particle's position change during the first 5 seconds.
   B. Find the average velocity during the first 5 seconds.
   C. Find the instantaneous velocity when t = 4.
   D. Find the acceleration of the particle when t = 4.
   E. At what values of t does the particle change direction? JYA.
   F. Where is the particle when s is a minimum?

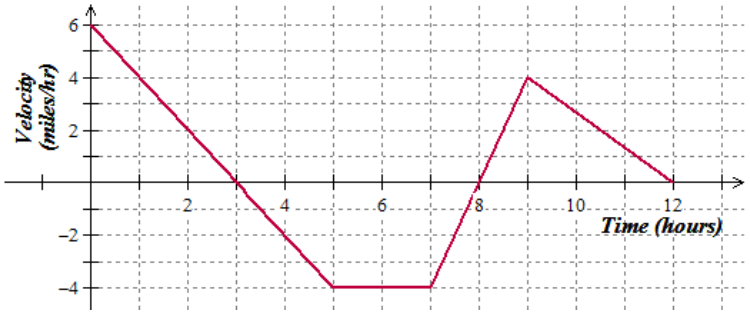
3. A body's velocity is given by $v(t)=2t^3-9t^2+12t-5$ m/s. Find the body's speed when the acceleration is zero.

4. The position (x-coordinate) of a particle moving on the line y=2 is given by $x(t)=2t^3-13t^2+22t-5$ where t is time in seconds.

   A. Describe the motion of the particle for $t \geq 0$.
   B. When does the particle speed up? Slow down?
   C. When does the particle change direction?
   D. When is the particle at rest?
   E. Describe the velocity and the speed of the particle.
   F. When is the particle at the point (5,2)?

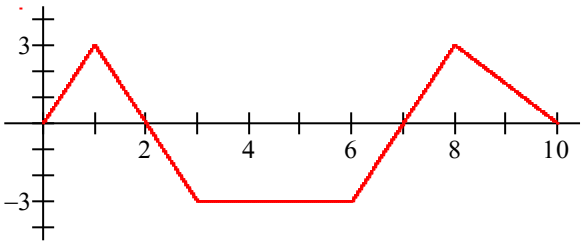
5. The velocity of a woman walking is show below. At time t = 0 she is at mile marker 6.

   A. What is the woman's acceleration at t=10?
   B. What is the total distance the girl travels during the 12 hours?
   C. What is the woman's location at t = 8 and t = 12.
   D. What is the woman's maximum position? When does it occur?



6. The figure at the right shows the velocity v = ds/dt of a particle on a line.

   A. When does the body reverse direction?
   B. When is the body moving at a constant speed?
   C. Graph the body's speed for $0 \leq t \leq 10$
   D. Graph the acceleration when defined.



Answers

Side 1

1. Right, since v(0) is positive.
2. 9, 17
3.
4. 15
5. $3/2 \ ft/s^2$
6. SLOWING DOWN at t =7 since velocity is positive and acceleration is negative.
   SPEEDING UP at t = 12 since velocity is negative and acceleration is negative.
7. $(2,6)$
8. 40 ft
9. 27 ft
10. t = 9, 39.5 ft
11. t = 22, 3 ft
12. $(0,2),(9,15),(17,22)$

Side 2

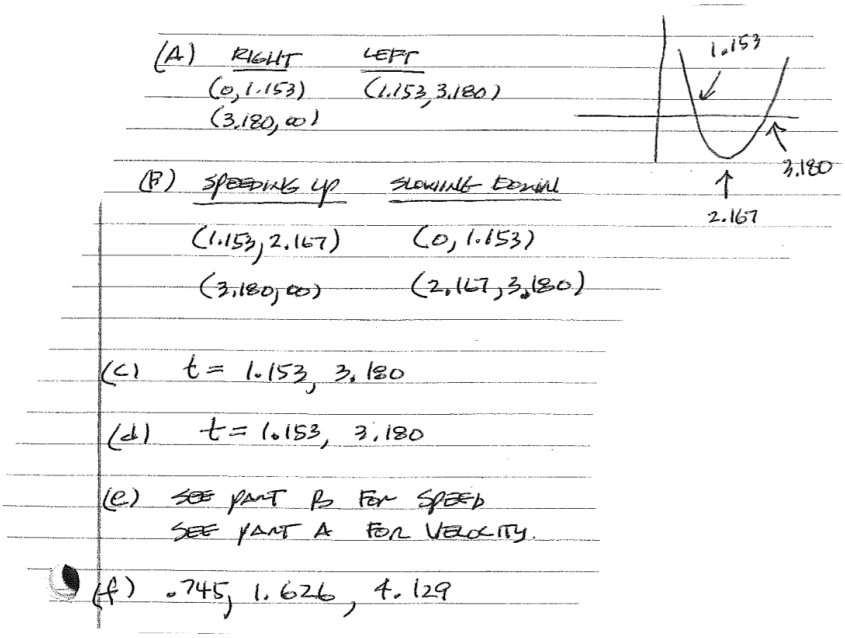
1. $s''(3)=6$
   $s''(1)=-6$
2. –
   a. $s(0)=2$, $s(5)=12$ ... $10m$
   b. 2 m/s
   c. $s'(t)=2t-3$
      $s'(4)=5 \ m/s$
   d. $s''(t)=2$
      $s''(4)=2 \ m/s^2$
   e. t = 3/2

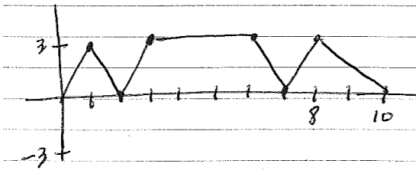
v	-	+
	LEFT	RIGHT

VELOCITY SWITCHES FROM NEGATIVE TO POSITIVE AT t = 3/2.

   f. There is a minimum at t=3/2.
      $s(3/2)=-0.25$

3. $a(t)=6t^2=18t+12=0$
   $=6(t-1)(t-2)=0$
   $t=1,2$
4. –



5. –
   a. $-4/3\ mi/hr^2$
   b. 31 miles
   c. At t=8, she is at mile marker 1
      At t=12, she is at mile marker 9
   d. Maximum is at t = 3, she is at mile marker 15
6. –
   a. t = 2, 7
   b. (3, 6)
   c. 

   d.