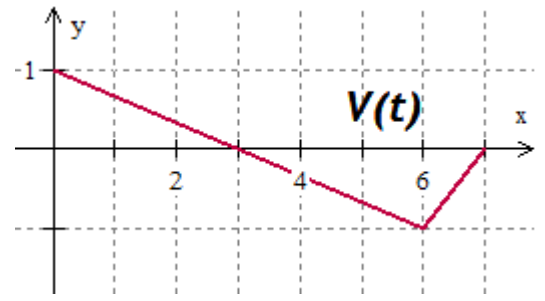
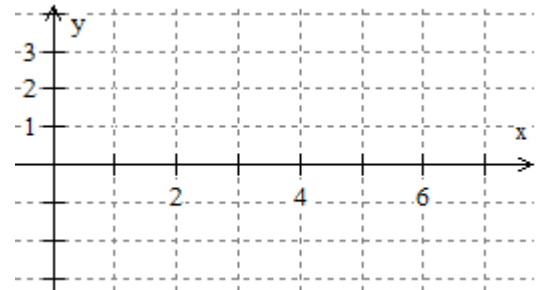


**PARTICLE MOTION – DAY 4 (THE FINAL DAY)**  
**AB CALCULUS – HARTER**

1. The velocity of a particle over 7 seconds is graphed below. The position of the particle at  $t = 0$  is 2.
  - a. When does the particle change directions?  
Justify your answer.
  - b. What is the acceleration at  $t = 2$ ?
  - c. Where is the speed of the particle decreasing?
  - d. What is the total distance that the particle travels over the 7 seconds?
  - e. What is the position of the particle at  $t = 3$  and  $t = 7$ .

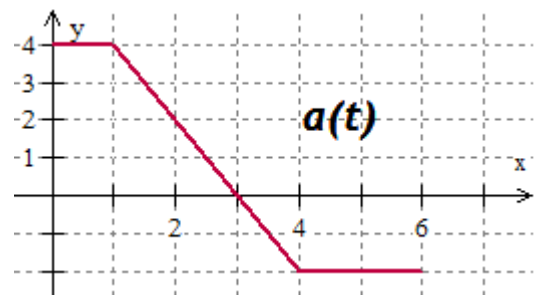


- f. Graph the acceleration of the particle on the grid at the right.
- g. Graph the SPEED of the particle on the grid at the right.
- h. What is the **average velocity** of the particle over the 7 seconds?
- i. What is the **average acceleration** over the 7 seconds?



2. The acceleration of a particle over 6 seconds is shown. The velocity of the particle at  $t = 0$  is -7.

- a. Find the velocity at  $t = 2$  and  $t = 6$ .
- b. Is the speed increasing or decreasing at  $t = 2$  and  $t = 6$ ? Why?
- c. Find the average acceleration over the 6 second time interval.
- d. At what time  $t$  is the particle's minimum velocity?
- e. At what time  $t$  is the particle's maximum velocity?



3. A particle moves along the x-axis so that its position is given by  $x(t) = 2t^3 - 15t^2 + 36t - 1$
- At what time is the particle at rest?
  - During what interval is the particle moving left? JYA
  - Find the position of the particle when the acceleration is 0.
  - What is the acceleration when the velocity is 36?
4. A particle moves along the x – axis in such a way that the acceleration at time t for  $t > 0$  is given by  $a(t) = t^2$ . When  $t = 0$ , the position of the particle is 1 and the velocity is 4.
- Write an equation for the velocity,  $v(t)$ .
  - Write an equation of the position,  $x(t)$ .
  - Find the position of the particle when the velocity is 13.
  - Find the average acceleration from  $t = 0$  to  $t = 2$ .
5. A particle moves along the x-axis so that its velocity at time t is given by  $v(t) = (t + 2)\sin\left(\frac{t^2}{3}\right)$ . At time  $t = 0$ , the particle is at position  $x = 1$ . (Round all answers to 3 decimal places).
- Find the acceleration of the particle at time  $t = 2.5$ . Is the speed increasing or decreasing at  $t = 2$ ? Why or why not?
  - Find all times t in the open interval  $0 < t < 4$  when the particle changes direction. Justify your answer.
  - Find the TOTAL DISTANCE the particle travels from time  $t = 0$  to time  $t = 4$ .
  - During the time interval  $0 \leq t \leq 4$ , what is the greatest distance between the particle a position of 20? Show the work that leads to your answer.
  - What is the average velocity from time  $t = 0$  to time  $t = 4$ ?
  - What is the average acceleration from time  $t = 0$  to time  $t = 4$ ?

## ANSWERS

1. -

- a. 3
- b.  $-1/3$
- c.  $(0,3), (6,7)$
- d. 3.5
- e. AT  $t=3$ : 3.5  
AT  $t=7$ : 1.5
- f. Back board
- g. Back board
- h.  $-1/14$
- i.  $-1/7$

2. -

- a. AT  $t=2$ : 0  
AT  $t=6$ : -4
- b.  $t=2$ : Neither! Velocity is ZERO!  
 $t=6$ : Neg velocity, neg acceleration = speed  
is increasing!
- c.  $\frac{1}{2}$
- d.  $T = 0$
- e.  $T = 3$

3. -

- a.  $t = 2, 3$

b.  $(2,3)$  .... Make a chart!!

c.  $x(2.5) = 26.5$

d.  $a(0) = -30$   
 $a(5) = 30$

4. -

a.  $v(t) = \frac{1}{3}t^3 + 4$

b.  $x(t) = \frac{t^4}{12} + 4t + 1$

c.  $79/4$

d.  $4/3$

5. -

a.  $a(2) = -2.806$   
 $v(2) = 3.922$   
slowing down since is velocity positive and  
acc is negative

b. at  $t = 3.070$

c.  $\int_0^4 |v(t)| dt = 9.777$

d. Farthest is 19  
Closest is 12.900

e. 0.606

f. -1.220