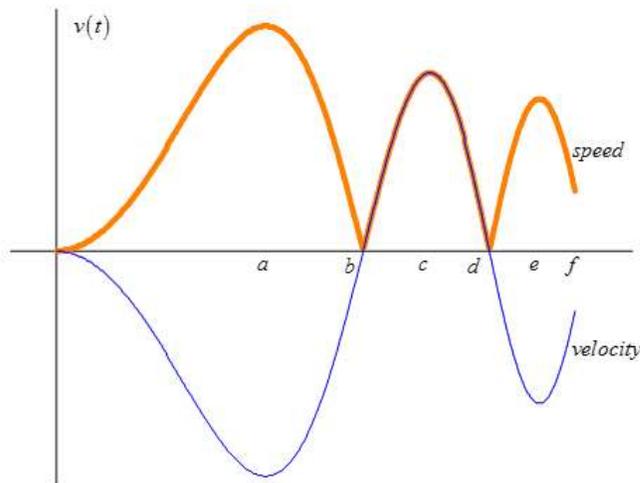


## Speed Activity

### Part 1:

The figure below shows the graph of the velocity  $v(t)$  (thin graph) of a particle moving on the interval  $0 \leq t \leq f$ . The thick graph is speed,  $|v(t)|$ , the intervals on which  $v(t) < 0$  are reflected over the  $x$ -axis. (The graphs overlap on  $[b, d]$ .) It is quite easy to see when the speed is increasing:  $[0, a]$ ,  $[b, c]$  and  $[d, e]$ . Fill in the table below the graph. Recall that the acceleration is the slope of the velocity graph.



Interval	Velocity Positive or Negative	Acceleration Positive or Negative	Speed Increasing or decreasing
$[0, a]$			
$[a, b]$			
$[b, c]$			
$[c, d]$			
$[d, e]$			
$[e, f]$			

1. What are the values of  $t$  at which the speed obtains its the local and absolute maximum(s)?
2. When do the minimum speeds occur? What are they?

## Speed Activity

### Part 3

1. You did either part 1 or part 2 of this activity. Find someone who did the other part, explain what you did, and compare your answers. Discuss and similarities or differences.
2. Make a general statement about whether the speed is increasing based on the velocity and acceleration:

If \_\_\_\_\_, then the speed is increasing.

3. Make a general statement about whether the speed is decreasing based on the velocity and acceleration:

If \_\_\_\_\_, then the speed is decreasing.

4. Answer the following questions from recent AP Calculus exams:

2003 AB 2 (Calculator allowed)

A particle moves along the  $x$ -axis so that its velocity at time  $t$  is given by

$$v(t) = -(t + 1)\sin\left(\frac{t^2}{2}\right).$$

At time  $t = 0$ , the particle is at position  $x = 1$ .

- (a) Find the acceleration of the particle at time  $t = 2$ . Is the speed of the particle increasing at  $t = 2$ ? Why or why not?

2013 AB 2 (Calculator allowed)

A particle moves along a straight line. For  $0 \leq t \leq 5$ , the velocity of the particle is given by

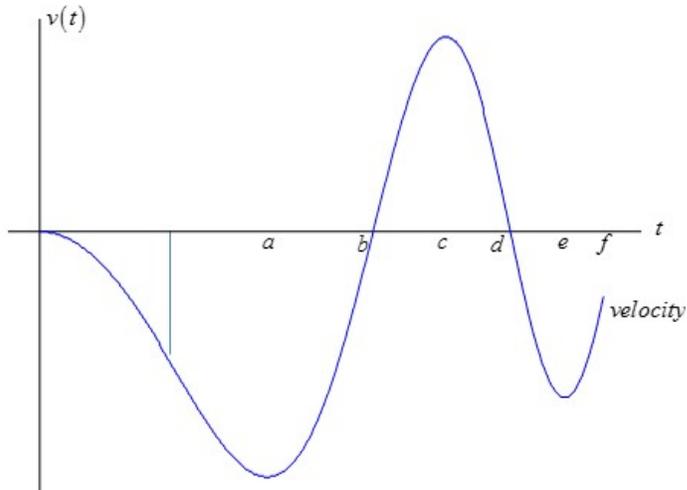
$$v(t) = -2 + (t^2 + 3t)^{6/5} - t^3, \text{ and the position of the particle is given by } s(t). \text{ It is known that } s(0) = 10.$$

- (d) Is the speed of the particle increasing or decreasing at time  $t = 4$ ? Give a reason for your answer.

## Speed Activity

### Part 2:

Speed is the non-directed length of the vertical segment from the velocity's graph to the  $t$ -axis. Picture the segment shown moving across the graph. When it is getting longer (either above or below the  $t$ -axis) the speed is increasing. Use this idea to complete the table below the graph.



Interval	Velocity Positive or Negative	Acceleration Positive or Negative	Speed Increasing or decreasing
$[0, a]$			
$[a, b]$			
$[b, c]$			
$[c, d]$			
$[d, e]$			
$[e, f]$			

1. What are the values of  $t$  at which the speed obtains its the local and absolute maximum(s)?
2. When do the minimum speeds occur? What are they?

## Speed Activity

### Part 3

5. You did either part 1 or part 2 of this activity. Find someone who did the other part, explain what you did, and compare your answers. Discuss and similarities or differences.
6. Make a general statement about whether the speed is increasing based on the velocity and acceleration:

If \_\_\_\_\_, then the speed is increasing.

7. Make a general statement about whether the speed is decreasing based on the velocity and acceleration:

If \_\_\_\_\_, then the speed is decreasing.

8. Answer the following questions from recent AP Calculus exams:

2003 AB 2 (Calculator allowed)

A particle moves along the  $x$ -axis so that its velocity at time  $t$  is given by

$$v(t) = -(t + 1)\sin\left(\frac{t^2}{2}\right).$$

At time  $t = 0$ , the particle is at position  $x = 1$ .

- (a) Find the acceleration of the particle at time  $t = 2$ . Is the speed of the particle increasing at  $t = 2$ ? Why or why not?

2013 AB 2 (Calculator allowed)

A particle moves along a straight line. For  $0 \leq t \leq 5$ , the velocity of the particle is given by

$$v(t) = -2 + (t^2 + 3t)^{6/5} - t^3, \text{ and the position of the particle is given by } s(t). \text{ It is known that } s(0) = 10.$$

- (d) Is the speed of the particle increasing or decreasing at time  $t = 4$ ? Give a reason for your answer.