

*Section 3.4:
Velocity and Other
Rates of Change*

- * Consider an object moving along a straight line, either horizontally or vertically. As an object moves, its position is a function of time, which we denote as _____.
- * When an object moves, its position changes over time. The _____ function, or _____, is the change of position over time. Since this is a rate of change, you can find this function by _____.
- * Speed is not the same as velocity. Speed will not indicate the direction of travel, so we define speed as _____.
- * As an object moves, its velocity changes over time as well. This change is called an object's _____, or _____. Again, since this is a rate of change, you can find this function by _____.

Let's think about your car for a minute.

- ✱ What two objects do you use to change your velocity?

- ✱ If we think of something accelerating the object to be some external force, what could be two examples of those for that force?

- ✱ If an object's acceleration is zero, can the object be moving? _____ What device do you have on your car to keep the car's acceleration equal to zero?

Let's think about the following situations. Decide if you are **speeding up** or **slowing down** in each scenario.

- * You are walking to the right ($v > 0$) and a strong gust of wind starts to blow to the right ($a > 0$). You would _____.
- * You are walking to the left ($v < 0$) and a strong gust of wind starts to blow to the left ($a < 0$). You would _____.
- * You are walking to the right ($v > 0$) and a strong gust of wind starts to blow to the left ($a < 0$). You would _____.
- * You are walking to the left ($v < 0$) and a strong gust of wind starts to blow to the right ($a > 0$). You would _____.

So . . . In summary. . .

An object is **speeding up** if velocity and acceleration have

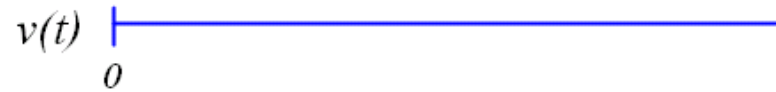
_____.

An object is **slowing down** if velocity and acceleration have

_____.

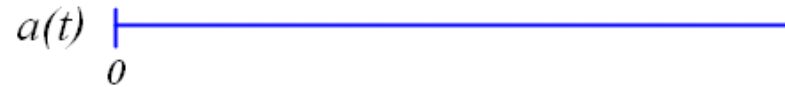
A particle is moving along a horizontal line with position function $s(t) = t^2 - 6t + 5$. Do an analysis of the particle's direction (right, left), acceleration, and motion (speeding up, slowing down).

$v(t) =$ _____



so, $v(t) = 0$ at $t =$ _____.

$a(t) =$ _____



does $a(t) = 0$? _____



Let's make a critical distinction right now. I can ask you for two types of velocity and acceleration and you need to know the difference between them.

Average Velocity (uses _____ data points):

Instantaneous Velocity (uses _____ data points):

Average Acceleration (uses _____ data points):

Instantaneous Acceleration (uses _____ data points):

A particle moves along a line so that its position at any time $t \geq 0$ is given by the function $s(t) = t^2 - 3t - 10$, where t is measured in seconds and s is measured in feet.

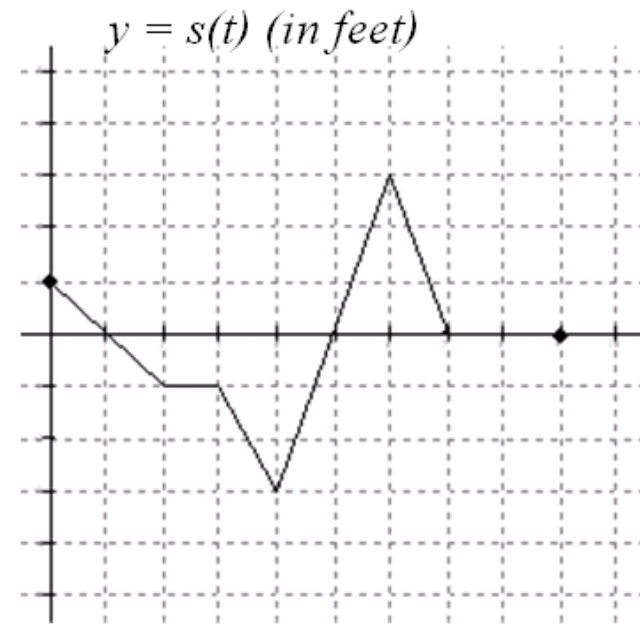
1. Find the average velocity for the first 3 seconds.
2. Find the instantaneous velocity at $t = 4$ seconds.
3. Find the acceleration of the particle at $t = 4$ seconds.
4. When does the particle change direction?
5. What is the particle's displacement for the first 5 seconds?
Total distance?

1. When is the particle moving to the right?
Left? Stopped?

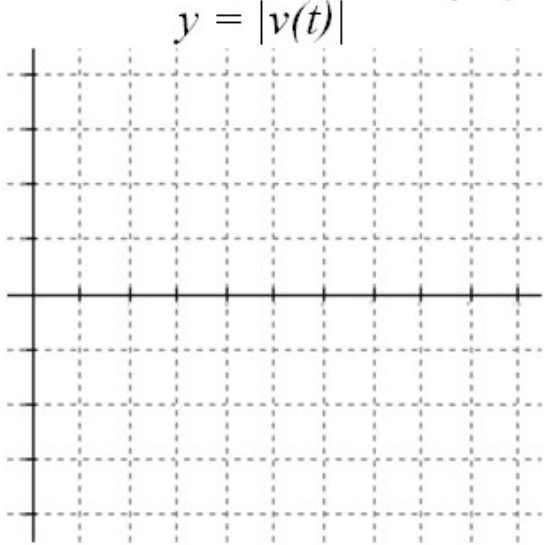
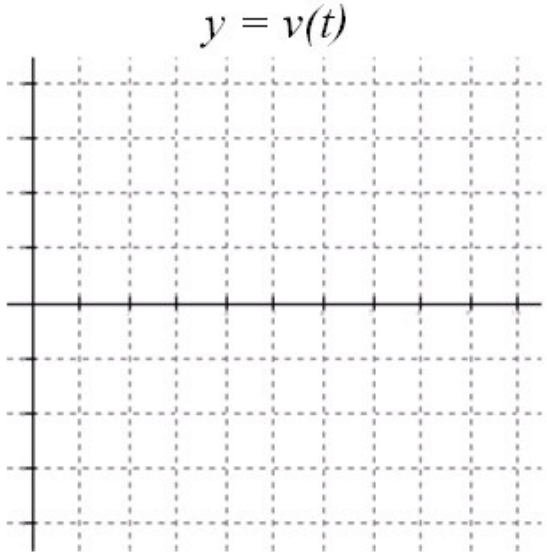
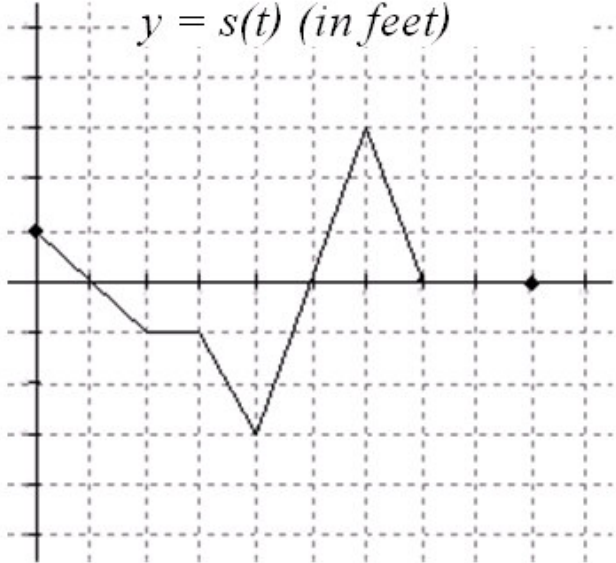
2. Where is the particle at 2 seconds? At 5
seconds?

3. What is the particle's velocity at these
times?

4. When does the particle move at its greatest speed?



Graph the particle's velocity and speed, making sure to label each axis.

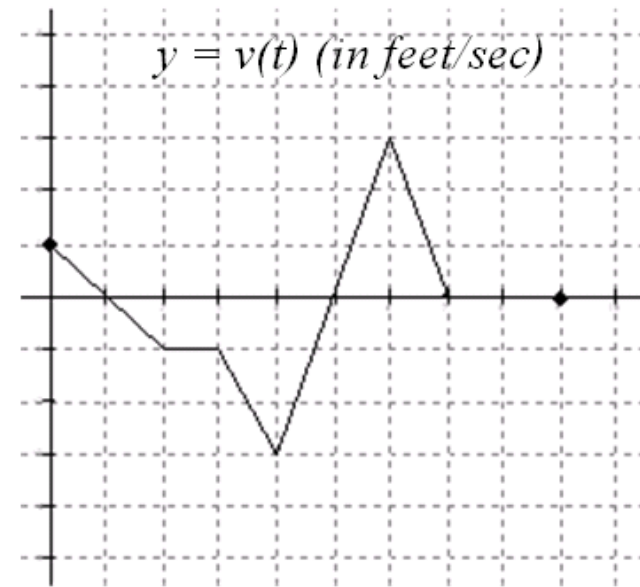


1. When is the particle moving to the right?
Left? Stopped?

2. When is the particle's acceleration positive?
Negative? Zero?

3. What is the particle's velocity at 2 seconds?
At 5 seconds?

4. What is the particle's acceleration at these
times?



Graph the particle's speed and acceleration, making sure to label each axis.

