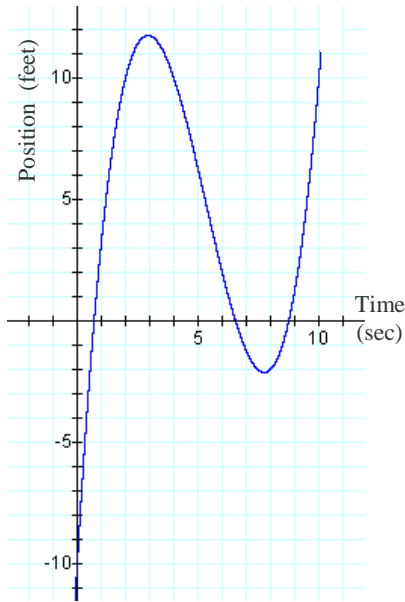




### Investigation 3.4

While sitting on his front porch on an evening late in October, Jack spotted a cat running on top of his fence. Jack made the following sketch of the cat's position along the fence.



Jack denoted the “origin” as the mailbox which is attached to the fence. Positions to the right (from Jack’s perspective) are positive valued, whereas positions to the left (from Jack’s perspective) are negatively valued.

1. Describe which direction the cat was moving at time  $t = 0$ .
2. Describe the motion of the cat during the first 10 seconds.
3. According to the graph, when did the cat change direction?
4. Describe the velocity of the cat during the first 10 seconds.
5. Estimate the average velocity of the cat over the first 10 seconds.
6. Approximate the velocity at  $t = 5$  seconds.
7. Describe the acceleration of the cat during the first 10 seconds.

Suppose that the graph Jack drew could be modeled by the function  $s(t) = 0.25t^3 - 4t^2 + 17t - 10$ .

8. Find  $\frac{ds}{dt}$  where  $s$  is position and  $t$  is time.
9. Explain the meaning of  $\frac{ds}{dt}$ .
10. Now find a more accurate answer to the question “When did the cat change direction?”
11. Calculate the average velocity of the cat during the first 10 seconds.
12. When is  $\frac{d^2s}{dt^2}$  positive? What was the cat doing during that time?
13. Use  $\frac{d^2s}{dt^2}$  to describe the acceleration of the cat during the first 10 seconds.
14. Write a quick paragraph/story of what Jack saw. Be sure to use the words *cat*, *changed direction*, *speed*, *velocity*, and *acceleration*.