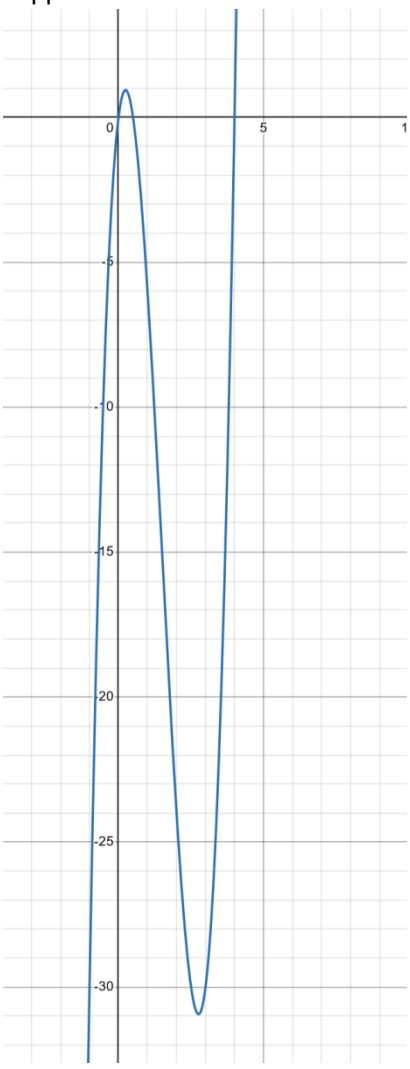
A) Find the velocity of the particle at time t. What is the velocity at t = 0?

The velocity equation for something is the derivative of the position equation. The derivative of $s(t) = t^4 - 6t^3 + 4t^2 + 3$ is $s'(t) = 4t^3 - 18t^2 + 8t$ meaning that the equation for the velocity of the particle at time t is $s'(t) = 4t^3 - 18t^2 + 8t$ plugging in 0 to get the velocity at time 0 gets us 0.

B) Determine, using algebraic analysis, when the particle is moving in a positive direction, a negative direction, and when it is at rest.

The first step to finding this is to find the zeros of the derivative. To do that we factor out a 2t and get $2t(2t^2 - 9t + 4)$ which can be further factored into $2t(2t - 1)(t - 4)$ getting us the zeros of $0, \frac{1}{2}$, and 4. Now we know that it has a velocity of 0 at each of these locations. If we plug in a number just above and just below each of these numbers, we find out if that section is negative or positive. This gives us the interval of $(-\infty, 0) \cup (\frac{1}{2}, 4)$ being where the particle is moving in a negative direction and $(0, \frac{1}{2}) \cup (4, \infty)$ where the particle is moving in a positive direction. The graph is negative in the negative interval and positive in the positive interval. Showing that the graph supports this.



C) Find the total distance traveled by the particle in the first 6 seconds.

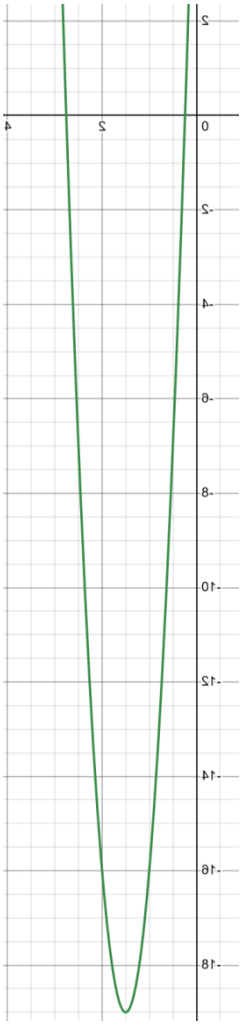
We can use the zeros we found in the last step in this one again which are 0, $\frac{1}{2}$, and 4 next, we plug any of these values that are between 0 and 6 into the position equation getting us 3, $\frac{53}{16}$, and -61 now we find the distance between each point getting us $\frac{5}{16}$ and $\frac{1029}{16}$ and a total distance of $\frac{517}{8}$ meters.

D) Find the acceleration of the particle at time t. What is the acceleration at t = 0?

This one is just the second derivative of the position equation. Which is $s''(t) = 12t^2 - 36t + 8$. Plugging in 0 for time gives us an acceleration of 8 $\frac{m}{s^2}$ at t = 0.

E) When is the particle speeding up and slowing down? Explain how you found your answers.

I did the exact same thing as I did to find the negative and positive direction. This showed that it was speeding up in the interval of $\left(-\infty, \frac{9-\sqrt{57}}{6}\right) \cup \left(\frac{9+\sqrt{57}}{6}, \infty\right)$ and slowing down over the interval of $\left(\frac{9-\sqrt{57}}{6}, \frac{9+\sqrt{57}}{6}\right)$ the graph shows this data as well



My solution process was just doing the stuff we have been doing in previous assignments in the class. The only problem I ran into was that I can't run word on the laptop I generally use for assignments because it has Linux on it. My solution to this was to go use my Windows PC. This assignment gave me no new skills or insights. Derivatives can be sued to calculate the profit and loss in business