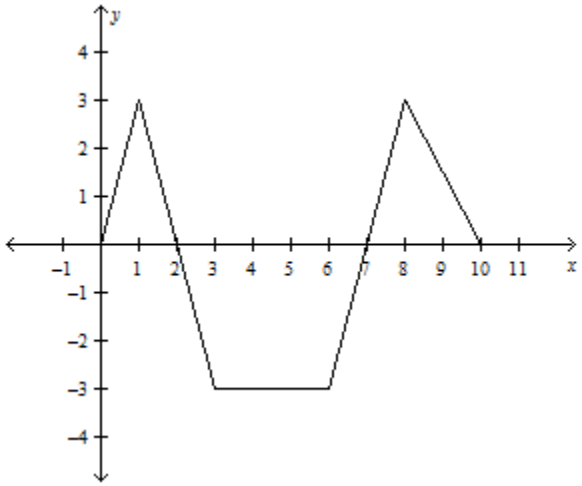
AP Calculus
Unit 5 – Applications of the Derivative – Part 2

Day 6 Notes: More on Particle Motion (Finding Net & Total Distance)

The graph below represents the velocity, $v(t)$ which is measured in meters per second, of a particle moving along the x – axis.



At what value(s) of t does the particle have no acceleration on the interval (0, 10)? Justify your answer.

Express the acceleration, $a(t)$, as a piecewise-defined function on the interval (0, 10).

For what value(s) of t is the particle moving to the right? To the left? Justify your answer.

Find the average acceleration of the particle on the interval [1, 8]. Show your work.

Definition of Net Distance:

Definition of Total Distance:

If a particle is moving in the same direction the entire amount of time, what can be said about the net distance and the total distance?

To Find the Net Distance a Particle Travels on an Interval

To Find the Total Distance a Particle Travels on an Interval

The position of a particle is given by the function $p(t) = 2t^3 - 6t^2 + 8t$ where $p(t)$ is measured in centimeters. Find the net and total distance the particle travels from $t = 1.5$ seconds to $t = 4$ seconds.

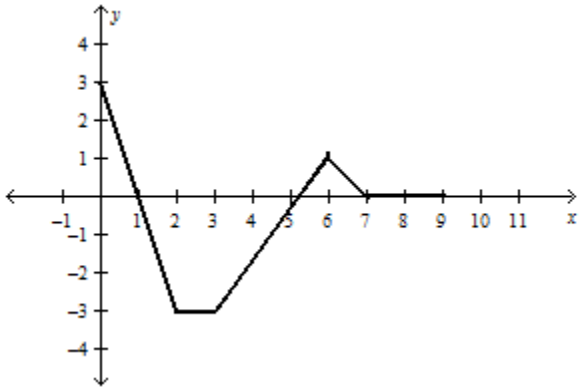
The position of a particle is given by the function $p(t) = e^{2t} - 8t$ where $p(t)$ is measured in feet. Find the net and total distance the particle travels from $t = 0.5$ minutes to $t = 1.5$ minutes.

The position of a particle is given by the function $p(t) = t + 2\sin t$ where $p(t)$ is measured in feet. Find the net and total distance the particle travels from $t = \frac{\pi}{6}$ minutes to $t = \frac{5\pi}{4}$ minutes.

AP Calculus AB **Name: _____**
Unit 5 – Day 6 – Assignment

The function whose graph is pictured below, represents the velocity, $v(t)$, of a particle for $t = 0$ to $t = 9$ seconds moving along the x – axis. Use the graph to complete exercises 1 – 4.

1. On what interval(s) is the particle moving to the right? Left? Justify your answer.

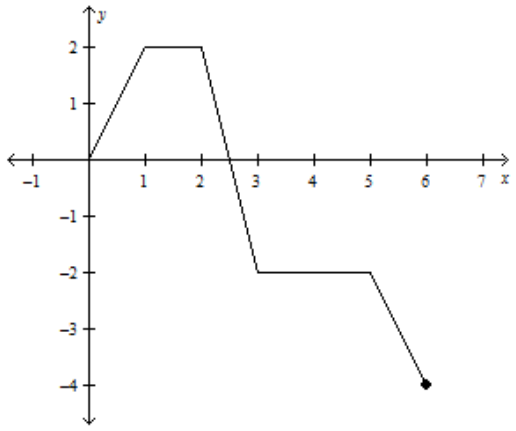


2. On what interval(s) is the particle slowing down? Speeding up? Justify your answer.

3. At what value(s) of t is the particle momentarily stopped and changing directions? Justify your answer.

4. On what interval of the time is the acceleration 0? Justify your answer.

The graph below represents the position, $p(t)$, of a particle that is moving along the x – axis on the interval $0 \leq t \leq 6$. Use the graph to complete exercises 5 – 9. $p(t)$ is measured in centimeters and t is measured in seconds.



5. For what interval(s) of time is the particle moving to the right? Justify your answer.

6. For what interval(s) of time is the particle moving to the left? Justify your answer.

7. Express the velocity, $v(t)$, as a piecewise-defined function on the interval $0 < t < 6$.

8. At what value(s) of t is the velocity undefined on the interval $1 < t < 6$? Graphically justify your reasoning.

9. Find the average velocity of the particle on the interval $1 \leq t \leq 6$.

A particle moves along the x – axis so that at any time $0 \leq t \leq 5$, the velocity, in meters per second, is given by the function $v(t) = (t-2)^2 \cos 2t$. Use a graphing calculator to complete exercises 10 – 13.

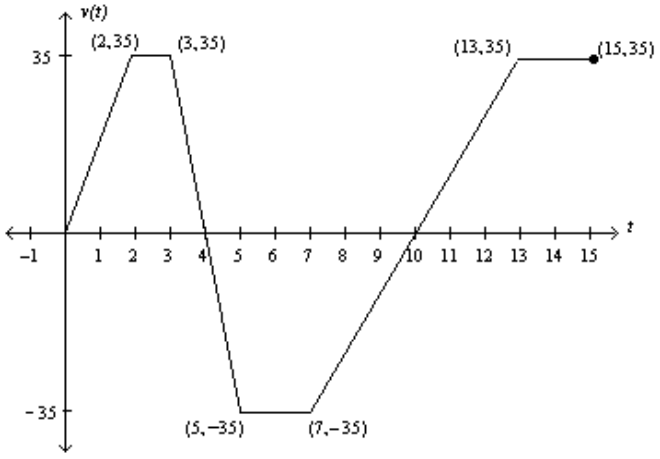
10. On the interval $0 \leq t \leq 5$, at how many times does the particle change directions? Give a reason for your answer.

11. Using appropriate units, what is the value of $v'(2)$. Describe the motion of the particle at this time. Justify your answer.

12. Using appropriate units, what is the average acceleration between $t = 1$ and $t = 3.5$ seconds?

13. What is the acceleration of the particle the first time that the velocity is 0?

Jeff leaves his house riding his bicycle toward school. His velocity $v(t)$, measured in feet per minute, on the interval $0 \le t \le 15$, for t minutes, is shown in the graph to the right. Use the graph to complete exercises 14 – 17.



14. Find the value of $v'(4)$. Explain, using appropriate units, what this value represents.

15. On the interval $0 \le t \le 5$, is there any interval of time at which $a(t) = 0$? Explain how you know.

16. On the interval $0 \le t \le 5$, does Rolle's Theorem guarantee that there will be a value of t such that $a(t) = 0$? Justify your answer.

17. At some point, Jeff realizes that he forgot something at home and has to turn around. After how many minutes does he turn around? Give a reason for your answer.