CALCULUS BC
Particle Motion

<u>Ex.</u> A particle moves along a horizontal line so that its position at any time $t \geq 0$ is given by

$s(t) = 2t^3 - 7t^2 + 4t + 5$, where s is measured in meters and t in seconds.

(a) Find the velocity at time t and at $t = 1$ second.

(b) When is the particle at rest? Moving right? Justify your answers.

(c) Find the acceleration at time t and at $t = 1$ seconds.

(d) Find the displacement of the particle between $t = 0$ and $t = 1.7$ seconds. Explain the meaning of your answer.

(e) Find the distance traveled by the particle between $t = 0$ and $t = 1.7$ seconds.

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by $s(t) = 2t^3 - 7t^2 + 4t + 5$, where s is measured in meters and t in seconds.

(f) When is the particle speeding up? Justify your answer.

(**Hint:** Since speed is the absolute value of velocity, the particle is:

    1) Speeding up when the velocity and acceleration have the same sign (both positive or both negative)

    2) Slowing down when the velocity and acceleration have opposite signs (one positive and one negative)
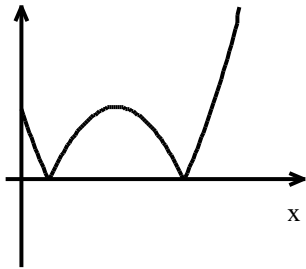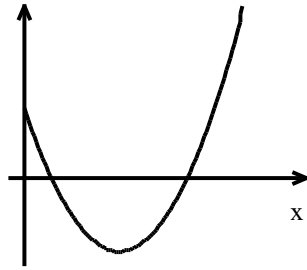
Graph of Speed   Graph of Velocity

To answer part (f), draw a double sign chart, showing both the signs of the velocity and the signs of the acceleration.

$v(t) = 6t^2 - 14t + 4 = 2(3t^2 - 7t + 2) = 2(3t - 1)(t - 2) = 0$ when $t =$

$a(t) = 12t - 14 = 0$ when $t =$

$v(t)$
_____
$a(t)$

<u>Ex</u>. (Multiple Choice) A particle moves along the x-axis so that at any time $t \geq 0$, its velocity is given by $v(t) = 3 + 4.1\cos(0.9t)$. What is the acceleration of the particle at time $t = 4$?

(A) -2.016 (B) -0.677 (C) 1.633 (D) 1.814 (E) 2.978

Ex 7. (2013 AB #2, Calc)

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

$$v(t) = -2 + \left(t^2 + 3t\right)^{\frac{6}{5}} - t^3.$$

(a) Find all values of t in the interval $2 \leq t \leq 4$ for which the speed of the particle is 2.

(b) Write an expression involving an integral that gives the position $s(t)$. Use this expression to find the position of the particle at $t = 5$.

(c) Find all times t in the interval $0 \leq t \leq 5$ at which the particle changes direction. Justify your answer.

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

HW #22: Review for Exam on HW 17-21 (25 problems)

HW #23: Worksheet on Particle Motion (Due day after exam)