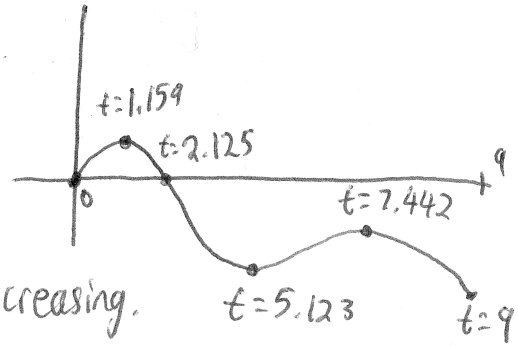
Motion and Sign Charts Review

$v(t) = -x + 5\sin(\frac{1}{2}x)\cos(\frac{1}{2}x)$

1. A particle moves along the x-axis so that its velocity for [0,9] is given by ~~$v(t) = x + e^{\sin(x)}(\cos(x))$~~. CALC OK.

a) At t=6, is the particle moving to the right, left, or neither? Explain.

At t=6, the particle is moving left b/c v(6) is negative.



b) At t=0.5, is the particle's acceleration positive or negative? Justify your answer.

At t=1, the particle's acceleration is positive b/c v(t) is increasing.

c) On what intervals from [0, 9] is the velocity of the particle positive? Justify your answer.

Velocity is positive when v(t) is above the t-axis: (0, 2.125)

from t=0 to t=2.125

d) On what intervals from [0, 9] is the acceleration of the particle negative? Justify your answer.

Acceleration is negative when v(t) is decreasing: (1.159, 5.123) and (7.442, 9)

e) On what interval(s) is the particle at rest on the interval [0, 10]? Justify your answer.

The particle is at rest when v(t)=0: t=0 and t=2.125

f) Stretch: At what times on [0, 9] is the acceleration of the particle zero? Justify your answer.

Acceleration is zero when v(t) is not increasing or decreasing:

t=1.159, 5.123, 7.442

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2. A particle moves along the x-axis in such a way that its position at time t for t ≥0 is given by $s(t) = 5\cos(x) + \frac{1}{2}x + 1$. The velocity of the particle is given by $v(t) = -5\sin(x) + \frac{1}{2}$. CALC OK.

a) Initially, is the particle moving to the right, left, or neither? Explain.

Initially means when $t=0$

$v(0)=0.5$ $v(0)$ is positive, so the particle is moving right.

b) Initially, is the particle to left or the right of the origin? Justify your answer.

$s(0)=6$. Since $s(0)$ is positive, the particle is to the right of the origin.

c) Initially, is the particle moving toward or away from the origin? Justify your answer.

Since the velocity and position are both positive initially, the particle is moving away from the origin (to the right and moving right).

d) On what intervals from [0, 10] is the acceleration of the particle negative? Justify your answer.

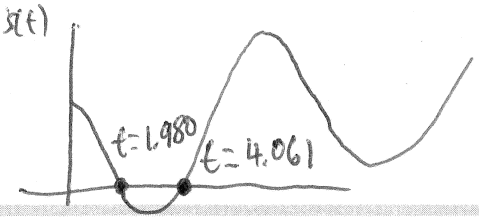
Acceleration is negative when velocity is decreasing: $(0, 1.571)$ and $(4.712, 7.854)$

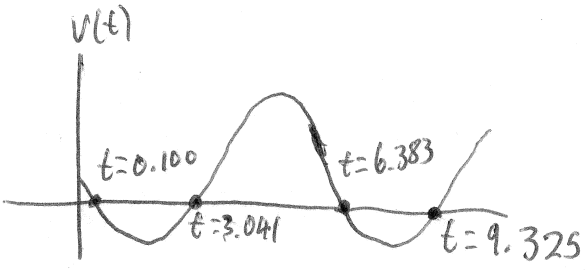
e) On what interval(s) is the particle moving to the right on the interval [0, 10]? Justify your answer.

Particle is moving right when $v(t)$ is positive: $[0, 0.100)$, $(3.041, 6.383)$, $(9.325, 10]$

f) At what times is the particle at the origin?

Particle is at the origin when $s(t)=0$: $t=1.980$
$t=4.061$





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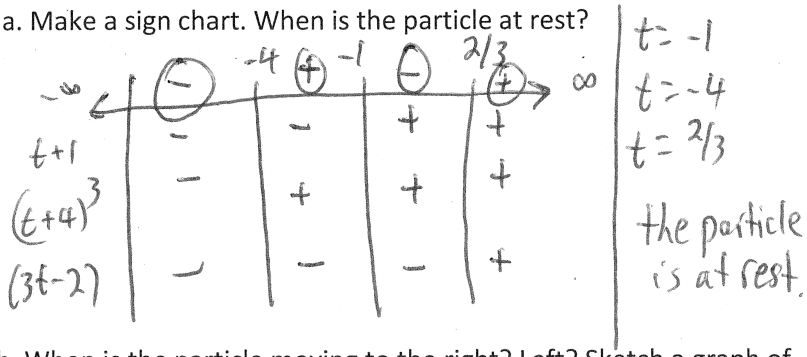
$t=-1 \quad t=-4 \quad t=2/3$

3. Let's use the function $v(t) = (t+1)(t+4)^3(3t-2)$. NO CALC.

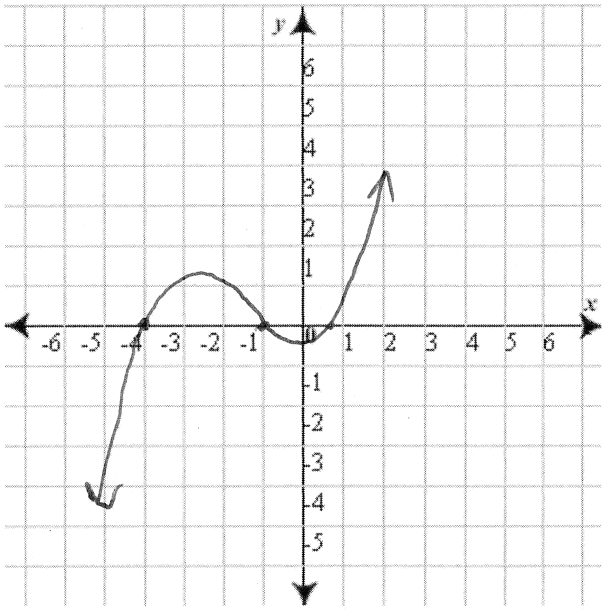
a. Make a sign chart. When is the particle at rest?



b. When is the particle moving to the right? Left? Sketch a graph of the velocity.

Right: $(-4,-1)$ and $(2/3,\infty)$

Left: $(-\infty,-4)$ and $(-1,2/3)$



4. Let's use the function $v(t) = e^t t^2 - 5te^t + 6e^t$

a. When is the particle at rest?

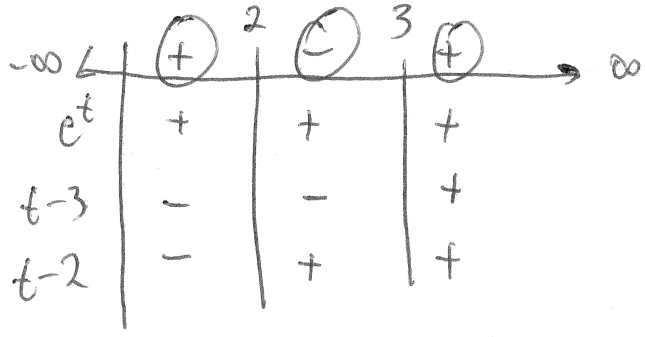
$v(t) = e^t(t^2-5t+6)$

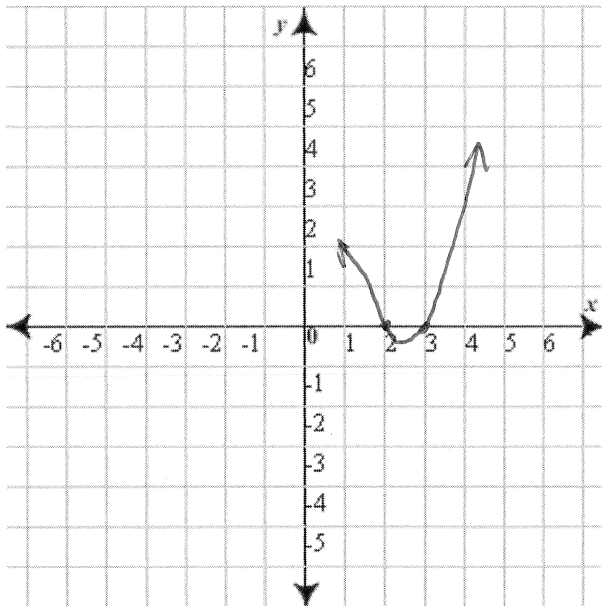
$= e^t(t-3)(t-2)$

No zero

$t=3 \quad t=2$

b. When is the particle moving to the right? Left?





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