1. a) $v_a(6) \Rightarrow$ neg

$a_a(6) \rightarrow$ pos ($v_a(t)$ is inc at $t=6$)

The speed of Particle A is dec because at $t=6$ $v_a(t)$ and $a_a(t)$ have opp signs. +1 ans +1 justification

b) Speed $= |v(t)|$

The speed of particle A equals 1 m/sec whenever $v_a(t)=1$ or $v_a(t)=-1$. This occurs Twice according to the graph of $v_a(t)$
+1 ans with justification

c) Particle A changes directions at $t=4$, $t=7$ and $t=9$ because $v_a(t)$ changes signs
+1 answer +1 just.

d) $s_b(t)$ is diff, so $s_b(t)$ is cont.

$s_b(0) = 2$

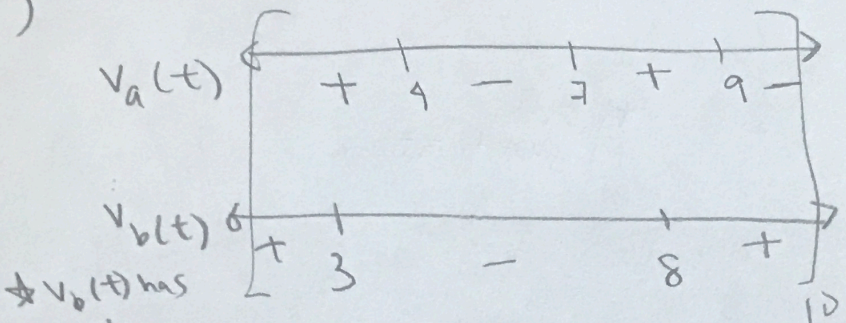
$s_b(1) = 8$

$s_b(0) < 7 < s_b(1)$ +1 $s_b(0) < 7 < s_b(1)$

Therefore, by the IVT, there must be a t in $(0,1)$ such that $s_b(t) = 7$
conclusion with +1 IVT

e) $\frac{s_b(10)-s_b(0)}{10-0} = \boxed{\frac{18-2}{10-0}\ m/s}$ $\frac{8}{5}\ m/s$ +1 answer/units

f)



* $v_b(t)$ has exactly 2 zeros

The two particles travel in the same direction on $[0,3) \cup (4,7) \cup (8,9)$ since their velocities have the same sign

+2 answer

g) $\frac{v_a(10)-v_a(8)}{10-8} \rightarrow$ negative

$\frac{v_b(10)-v_b(8)}{10-8} = \frac{5-0}{2} \rightarrow$ pos

The avg accel of Particle B is greater on $[8,10]$

+1 ans +1 justification

h) $v_b(t)$ is diff, so $v_b(t)$ is cont.

$\frac{v_b(10)-v_b(7)}{10-7} = \frac{5-(-1)}{10-7} = \frac{6}{3} = 2$ +1 sec slope

By the MVT, there must be a t in $(7,10)$ such that $v_b'(t) = a_b(t) = 2$

+1 conclusion w/ MVT

2 a) pt: (3, 1)

Slope $\frac{dy}{dx} = \frac{1}{16}(1)(1^2-9) = -\frac{1}{2}$ +1 $\left.\frac{dy}{dx}\right|_{(3,1)}$

$y - 1 = -\frac{1}{2}(x-3)$ +1 tan line eqn

$f(3.2) \approx -\frac{1}{2}(3.2-3)+1$ +1 approx

$-.1+1$

$.9$

b) $\frac{d^2y}{dx^2} = \frac{1}{16}y\left(2y\frac{dy}{dx}\right) + (y^2-9)\frac{1}{16}\frac{dy}{dx}$ +1 $\frac{d^2y}{dx^2}$

$\frac{d^2y}{dx^2} = \frac{1}{16}y\left(2y\left(\frac{1}{16}y(y^2-9)\right)\right) + (y^2-9)\left(\frac{1}{16}\left(\frac{1}{16}y(y^2-9)\right)\right)$

$\frac{d^2y}{dx^2} = \frac{1}{16^2}y(y^2-9)\left[2y^2+y^2-9\right]$

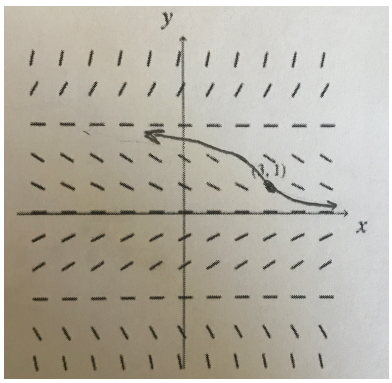
$\frac{d^2y}{dx^2} = \frac{1}{16^2}y(y^2-9)\left[3y^2-9\right]$

From drawing in the solution curve $y=f(x)$ in the slope field through pt(3,1), $0<f(x)<1$ on $(3,3.2)$ $\frac{d^2y}{dx} \rightarrow \frac{1}{16^2}(y)(y^2-9)(3y^2-9)$

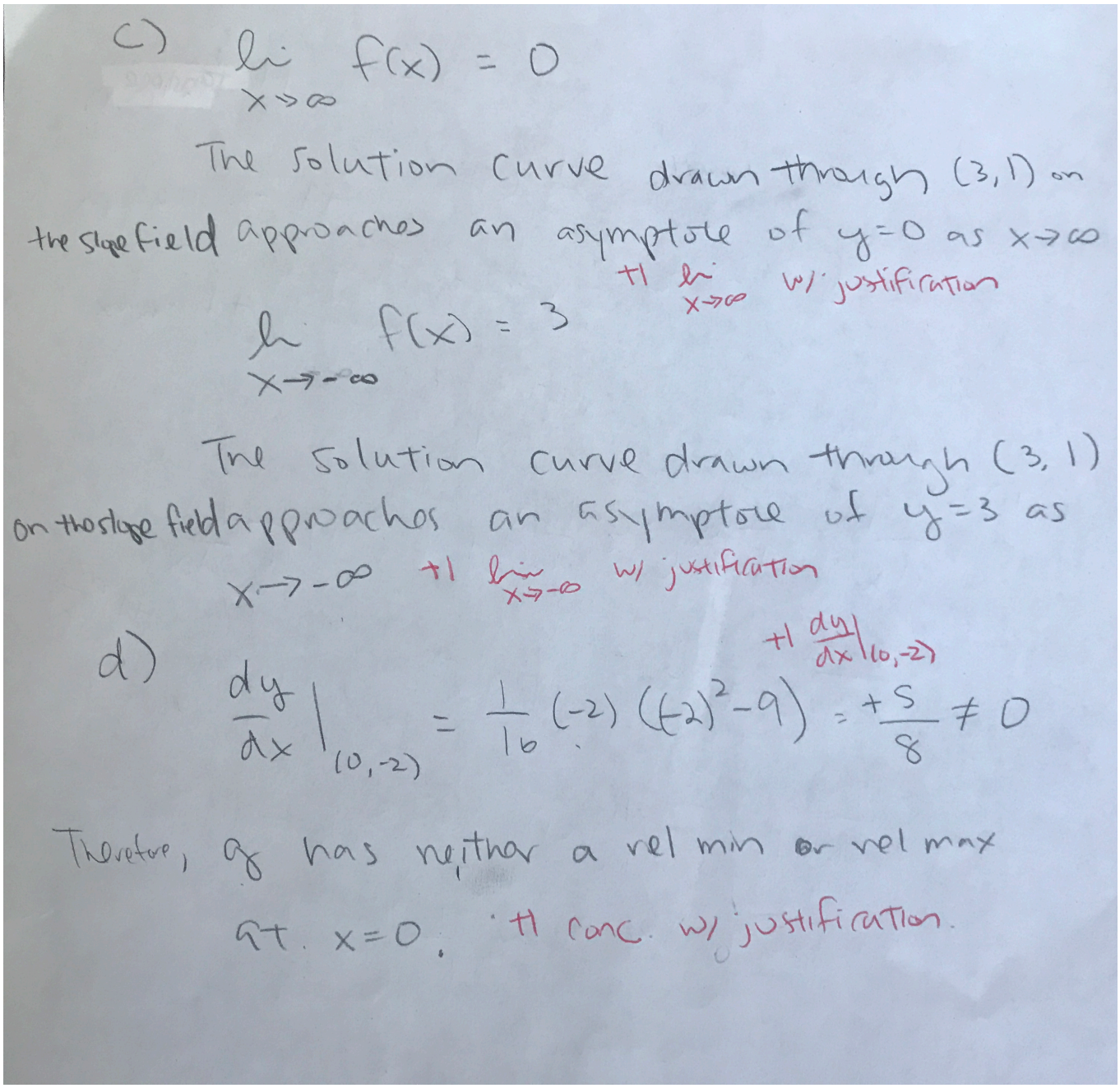
$\rightarrow$ (pos)(neg)(neg)

$\frac{d^2y}{dx^2}$ is pos on $(3,3.2)$ so $y=f(x)$ is conc up, which means the tangent line approx in part a would be an underestimate.

+1 understimate w/ reason



←What y=f(x) would look like based on the solution curve drawn through (3,1) on the slope field. While the question does not ask us to sketch the solution curve, we need this sketch's information for both part (b) and (c).



Suggested Scoring:

Raw Score:	Exam Score:
14-23	5
12-13	4
9-11	3
6-8	2
0-5	1

As previously mentioned, College Board has not predetermined the scores needed to earn a 3,4, or 5 for this year. The level of difficulty of the exam will evaluated with the goal of having scoring distributions to be similar to previous years. However, Q1 will be worth 60% of your overall score and Q2 will be worth 40%. This rubric is just a potential guide and meant to be a helpful tool to gauge your performance. It is not a guarantee of how many points questions will be worth and where the cuts off are.