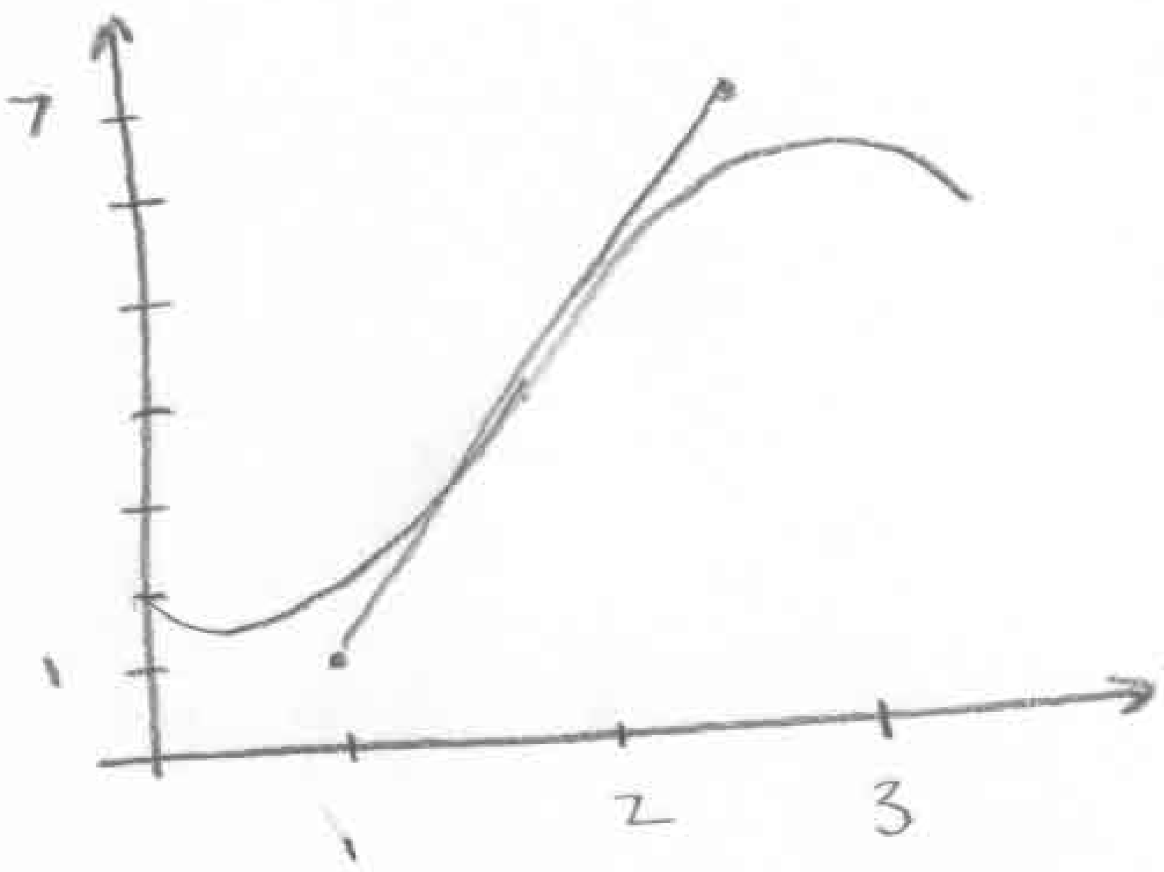
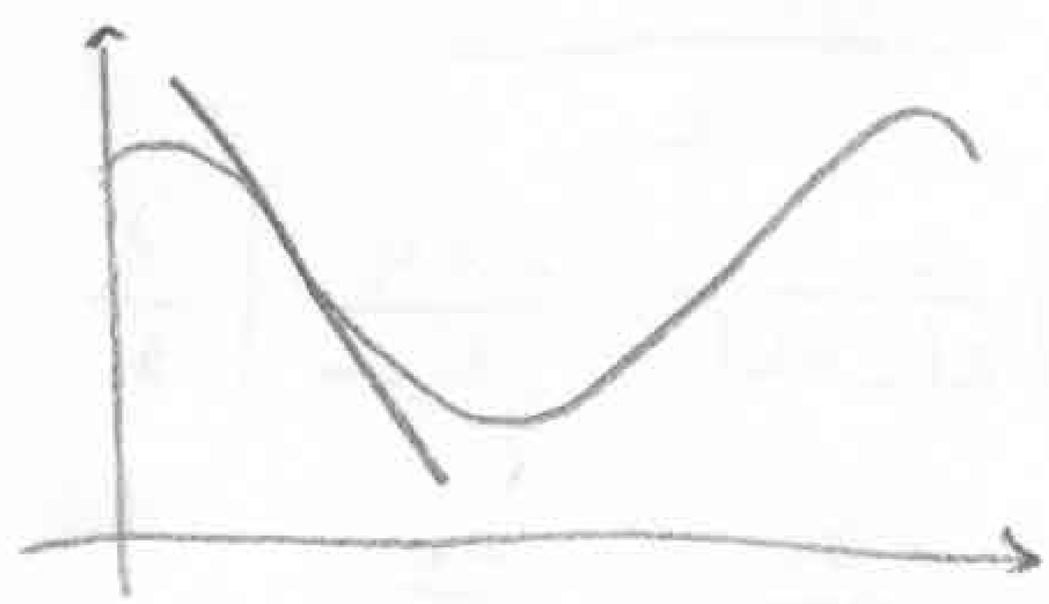
MATH 1210: HOMEWORK SOLUTIONS §2.1

1.



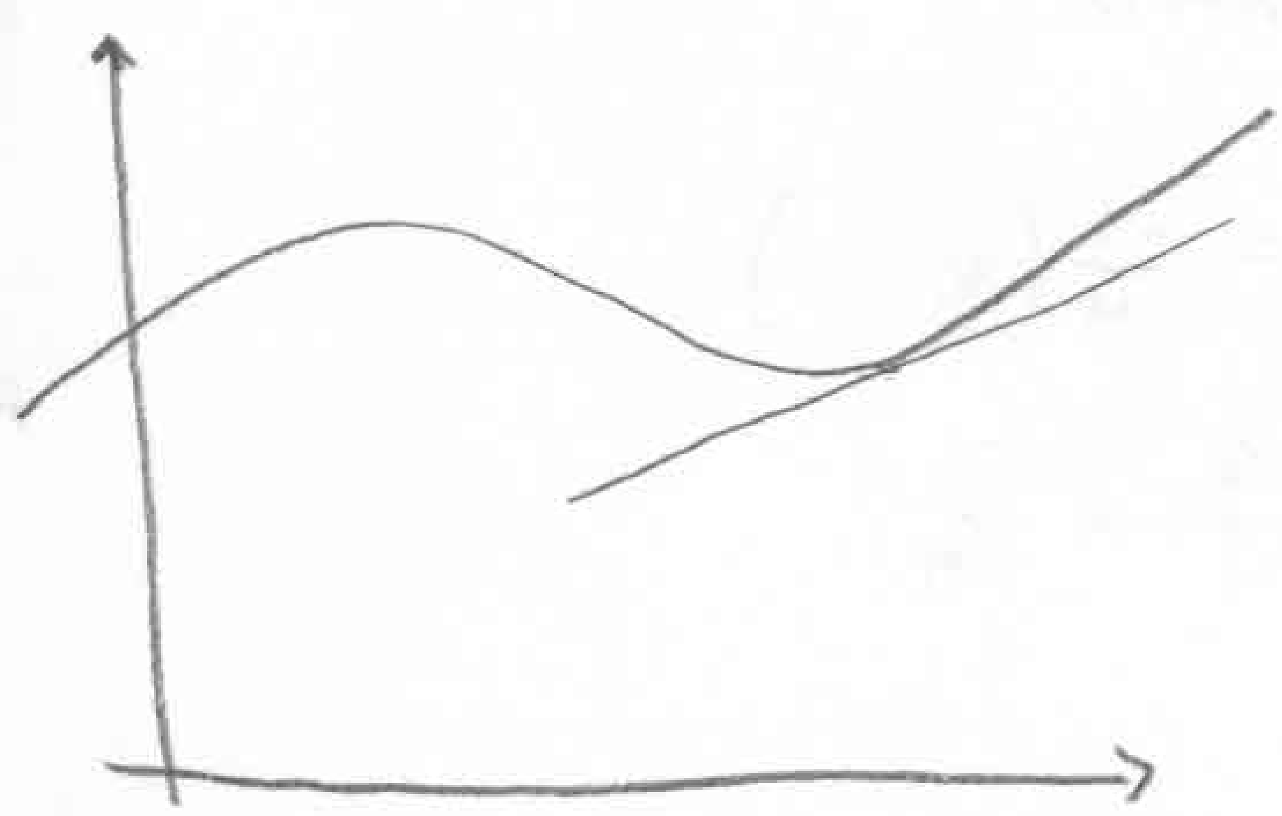
$$\frac{\text{rise}}{\text{run}} = \frac{7-1}{2.5-1} = \frac{6}{1.5} = 4$$

3.



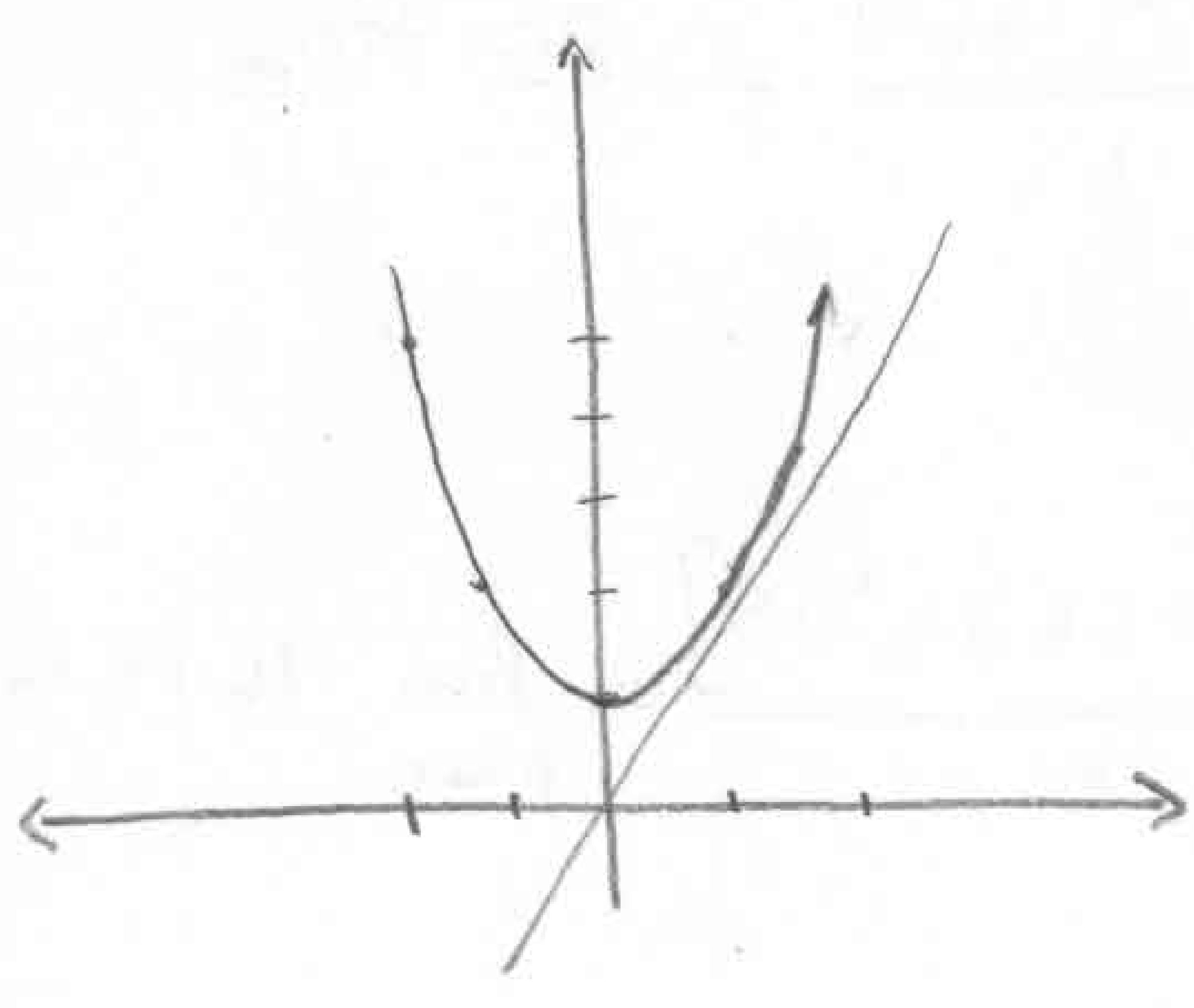
slope ≈ -2

5.



slope ≈ 1

7.



slope ≈ 2

9. $y = x^2 - 1$

$$m_{tan} = \lim_{h\to 0} \frac{(x+h)^2 - 1 - (x^2-1)}{h} = \lim_{h\to 0} \frac{2xh + h^2}{h}$$

$$= \lim_{h\to 0} 2x + h = 2x$$

at $x=-2$, $m_{tan} = -4$

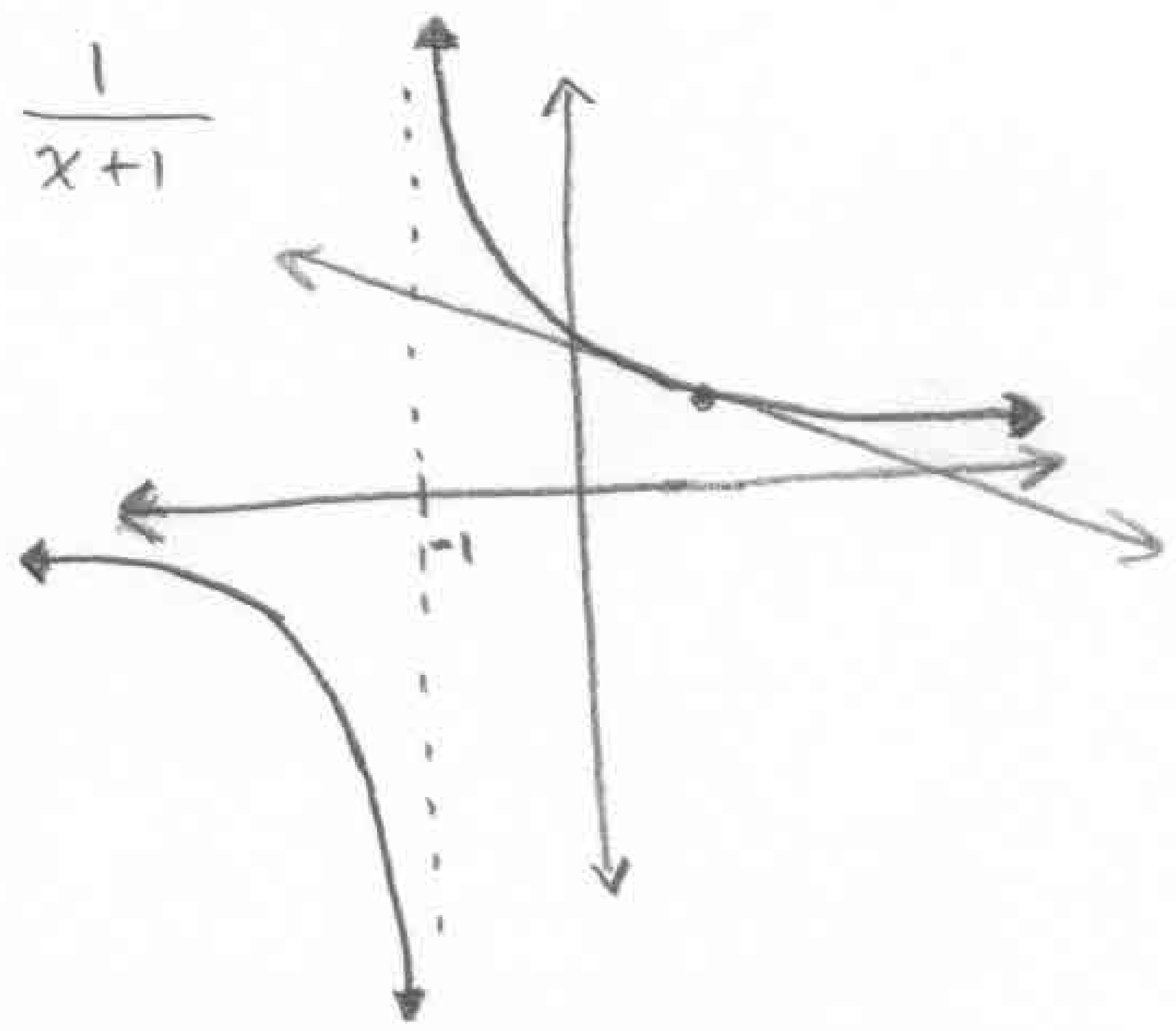
" $x=-1$, $m_{tan} = -2$

at $x=0$, $m_{tan} = 0$

at $x=1$, $m_{tan} = 2$

at $x=2$, $m_{tan} = 4$

11. $y = \frac{1}{x+1}$



$$m_{tan} = \lim_{h\to 0} \frac{\frac{1}{1+h+1} - \frac{1}{1+1}}{h}$$

$$= \lim_{h\to 0} \left[\frac{2}{2(2+h)} - \frac{2+h}{2(2+h)}\right]\frac{1}{h}$$

$$= \lim_{h\to 0} \frac{-1}{4+2h} = \frac{-1}{4}$$

tangent line: $y - \frac{1}{2} = \frac{-1}{4}(x-1)$

$$\Rightarrow y = \frac{-x}{4} + \frac{3}{4}$$

13. a) 16 ft

b) 48 ft

c) avg velocity $= \frac{\text{dist}}{\text{time}} = \frac{16(3)^2 - 16(2)^2}{1} = 80$ ft/sec

d) $\frac{16(3.01)^2 - 16(3)^2}{.01} = 96.16$

e) $\lim_{h\to 0} \frac{16(3+h)^2 - 16(3)^2}{h} = \lim_{h\to 0} \frac{16[9+6h+h^2-9]}{h} = \lim_{h\to 0} 16\cdot[6+h] = 96$ ft/sec

15. a) $s(t) = \sqrt{2t+1}$. At $t = a$,

$$v(a) = \lim_{h\to 0} \frac{s(a+h) - s(a)}{h} = \lim_{h\to 0} \frac{\sqrt{2(a+h)+1} - \sqrt{2a+1}}{h}$$

$$= \lim_{h\to 0} \frac{(2a+2h+1)-(2a+1)}{h\left[\sqrt{2(a+h)+1} + \sqrt{2a+1}\right]} = \lim_{h\to 0} \frac{2}{\sqrt{2(a+h)+1} + \sqrt{2a+1}}$$

$$= \frac{2}{2\sqrt{2a+1}} = \boxed{\frac{1}{\sqrt{2a+1}}}$$

b) $v(t) = \frac{1}{2}$ when $\frac{1}{\sqrt{2t+1}} = \frac{1}{2}$

$$\Leftrightarrow \quad 2t+1 = 4$$

$$\Leftrightarrow \quad t = \boxed{\frac{3}{2}}$$

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17. a) $b(t) = \frac{1}{2}t^2 + 1$. $b(2) = 3$, $b(2.01) = 3.02005$

The culture grew by .02005 between 2 & 2.01 hrs.

b) avg growth $= \frac{.02005}{.01} = \boxed{2.005}$

c) inst growth $= b'(2) = \lim_{h\to 0} \frac{b(2+h) - b(2)}{h}$

$$= \lim_{h\to 0} \frac{\frac{1}{2}(4+4h+h^2) + 1 - \left(\frac{1}{2}(2)^2 + 1\right)}{h} \boxed{= 2}$$