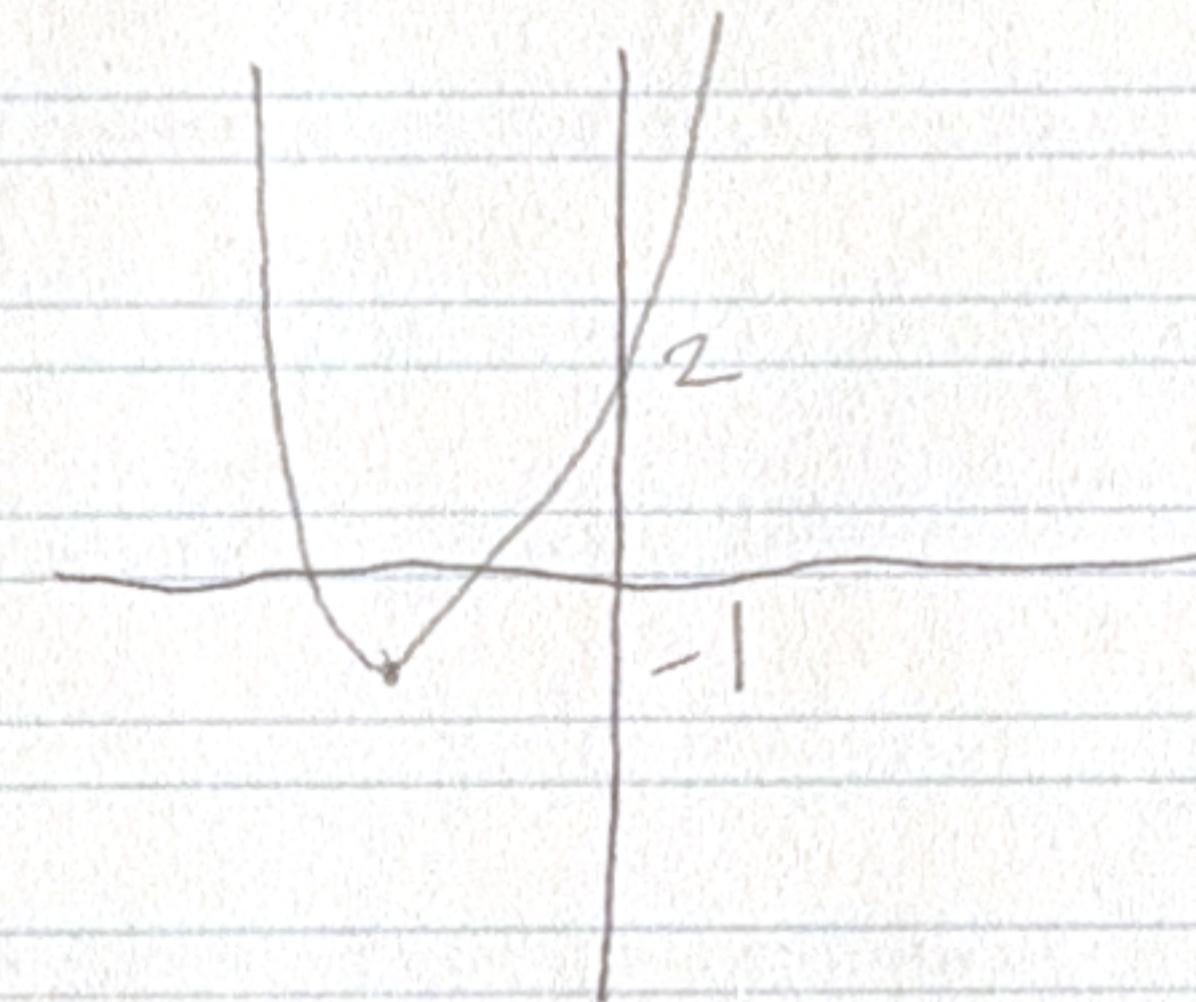
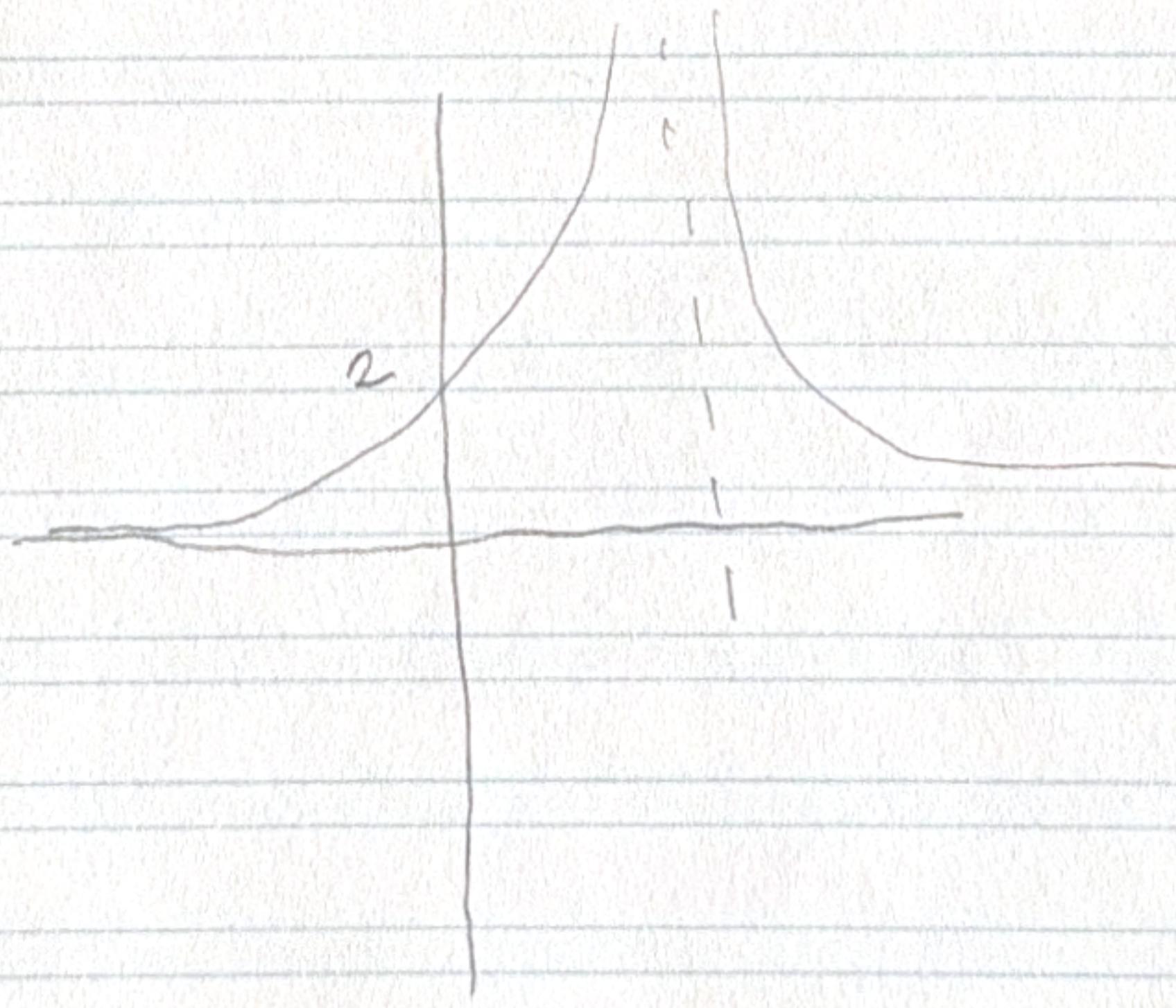


1.A. Graphing

$$1.b) y = 3u^2 + 6u + 2 = 3(u^2 + 2u) + 2 = 3(u+1)^2 - 1$$



$$2.b) y = \frac{2}{(u-1)^2}$$



$$3.a) f(-u) = \frac{(-u)^3 + 3(-u)}{1 - (-u)^4} = -\frac{u^3 + 3u}{1 - u^4} = -f(u) \text{ odd}$$

$$3.b) f(-u) = \sin^2(-u) = \sin^2(u) = f(u) \text{ even}$$

$$3.c) f(-u) = \int_0^u ((-v)^2) dv = \int_0^u (v^2) dv = f(u) \text{ even}$$

$$6.b) \sin u - \cos u = \sqrt{2} \left(\sin u \frac{\sqrt{2}}{2} - \cos u \frac{\sqrt{2}}{2} \right) = \sqrt{2} \sin \left(u - \frac{\pi}{4} \right)$$

$$7.b) -4 \cos \left(u + \frac{\pi}{2} \right) = 4 \sin(u) \text{ Period } 2\pi, \text{ amplitude } 4, \text{ phase angle } 0^\circ$$

1B. Velocity and rates of change

$$1.a) \frac{64 - 0}{2} = 32 \text{ feet/sec} \text{ rather } \frac{400 - 64 - 400}{2} = -32 \text{ ft/sec}$$

$$1.b) \frac{h(5) - h(3)}{2} = \frac{0 - 400 + 144}{2} = \frac{-256}{2} = -128 \text{ ft/sec}$$

$$1.c) s(t) = 16t^2 \Rightarrow s'(t) = 32t = v(t) \Rightarrow v(5) = 160 \Rightarrow -160 \text{ ft/sec}$$

7. C. Slope and derivative

$$1.a) \lim_{\Delta r \rightarrow 0} \frac{\pi(r + \Delta r)^2 - \pi r^2}{\Delta r} = \frac{\pi r^2 + 2\pi r \Delta r + \pi (\Delta r)^2 - \pi r^2}{\Delta r} = \pi r^2$$

$$3.a) \lim_{\Delta n \rightarrow 0} \frac{1}{(2(n + \Delta n) + 1)\Delta n} - \frac{1}{(2n + 1)\Delta n} = \frac{-2}{(2n + 1)^2}$$

$$3.b) \lim_{\Delta n \rightarrow 0} \frac{2(n + \Delta n)^2 + 5(n + \Delta n) + 4 - 2n^2 - 5n - 4}{\Delta n} \\ = 4n + 5$$

$$3.e) a: n.e., \frac{\sqrt{2}-1}{2}, n.e. b: -1, \frac{-6}{4}, \frac{-5}{4}$$

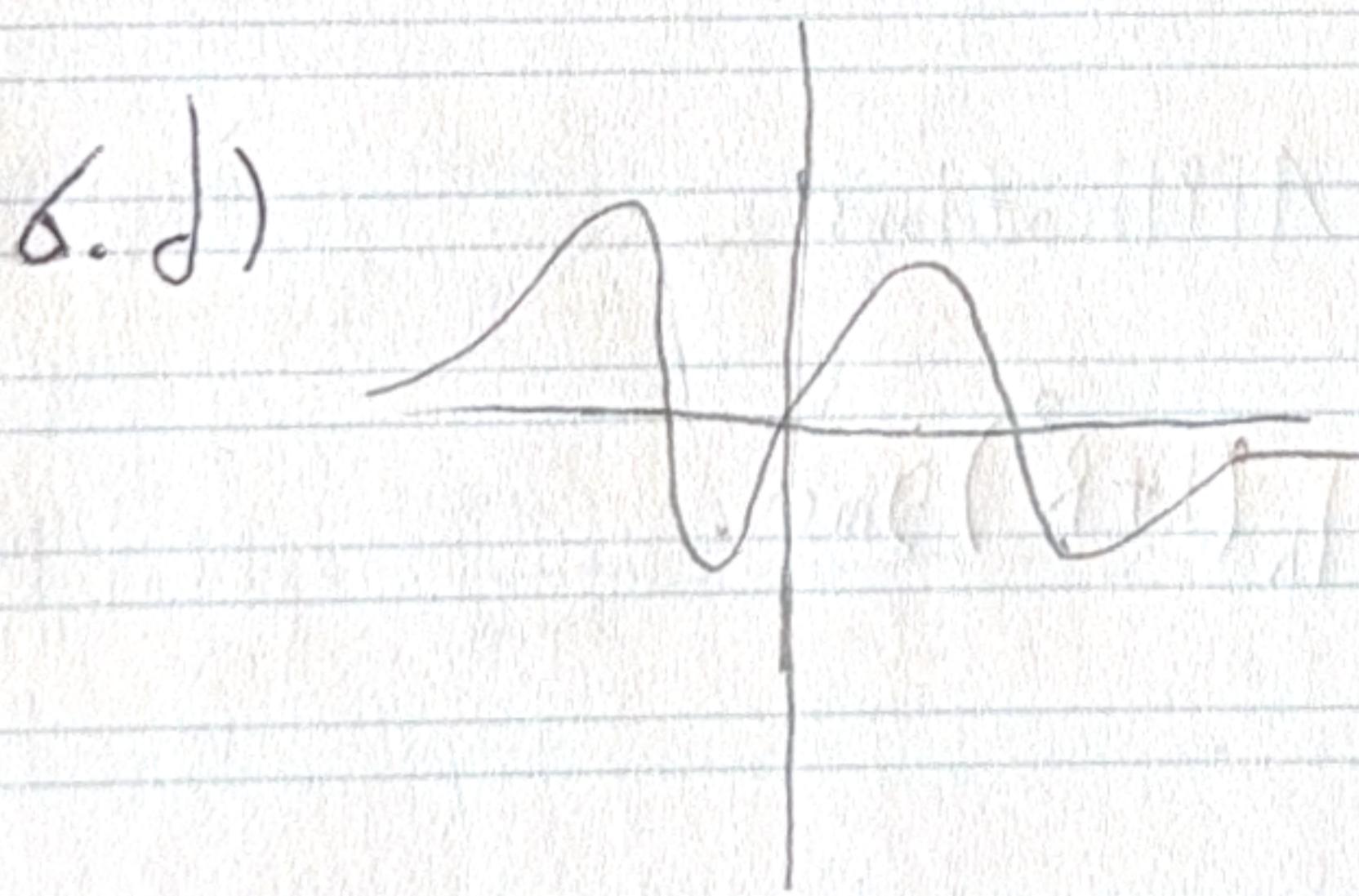
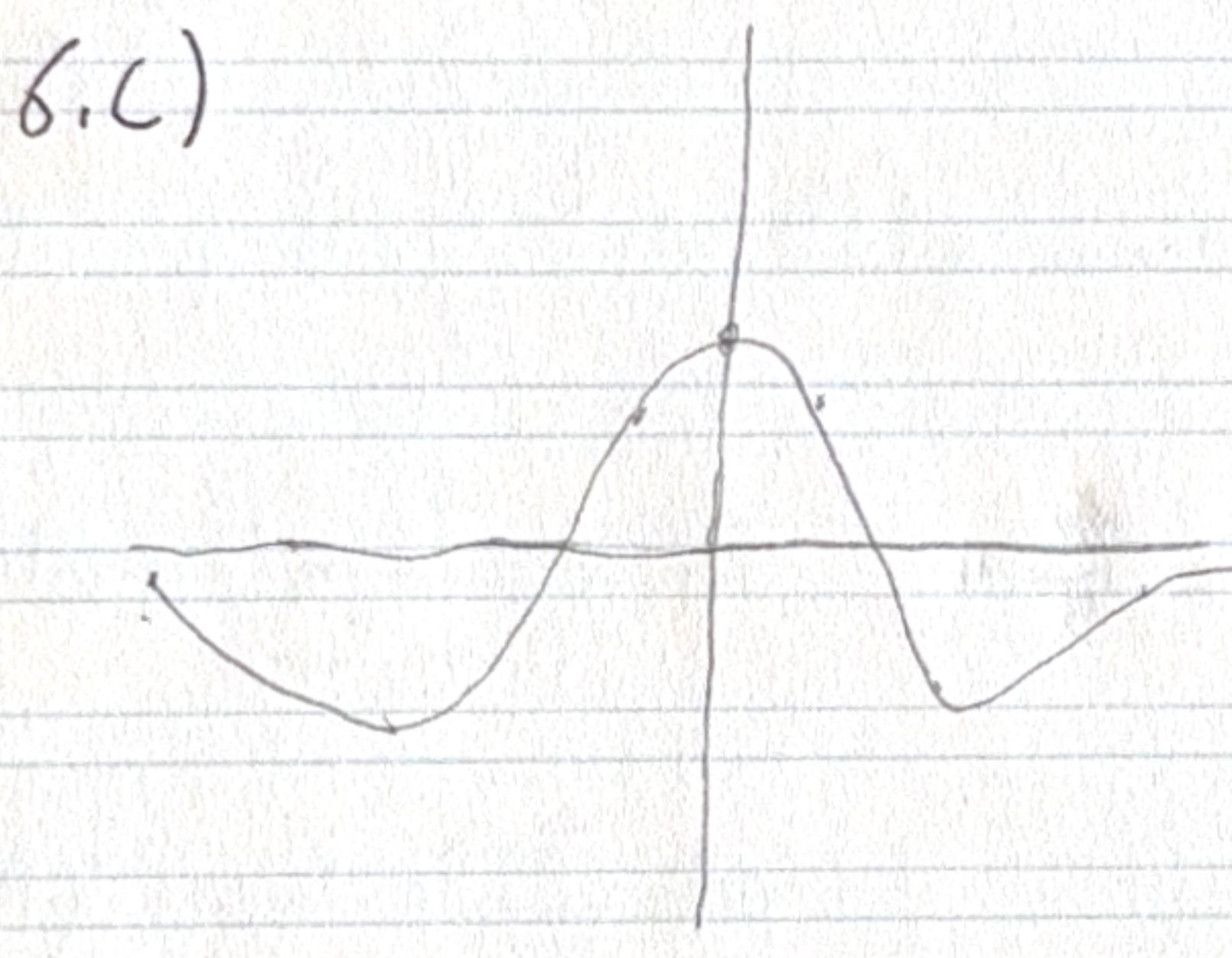
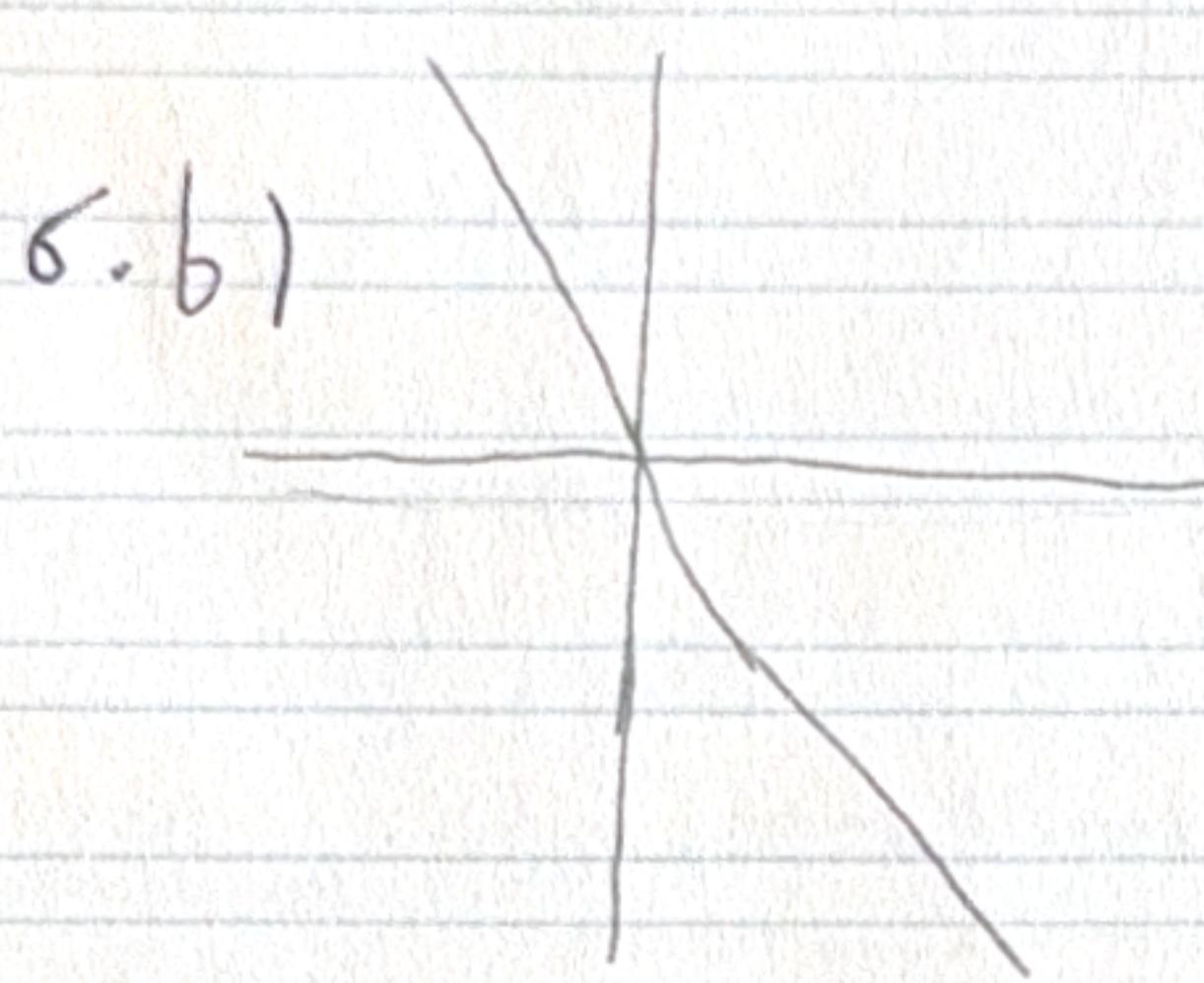
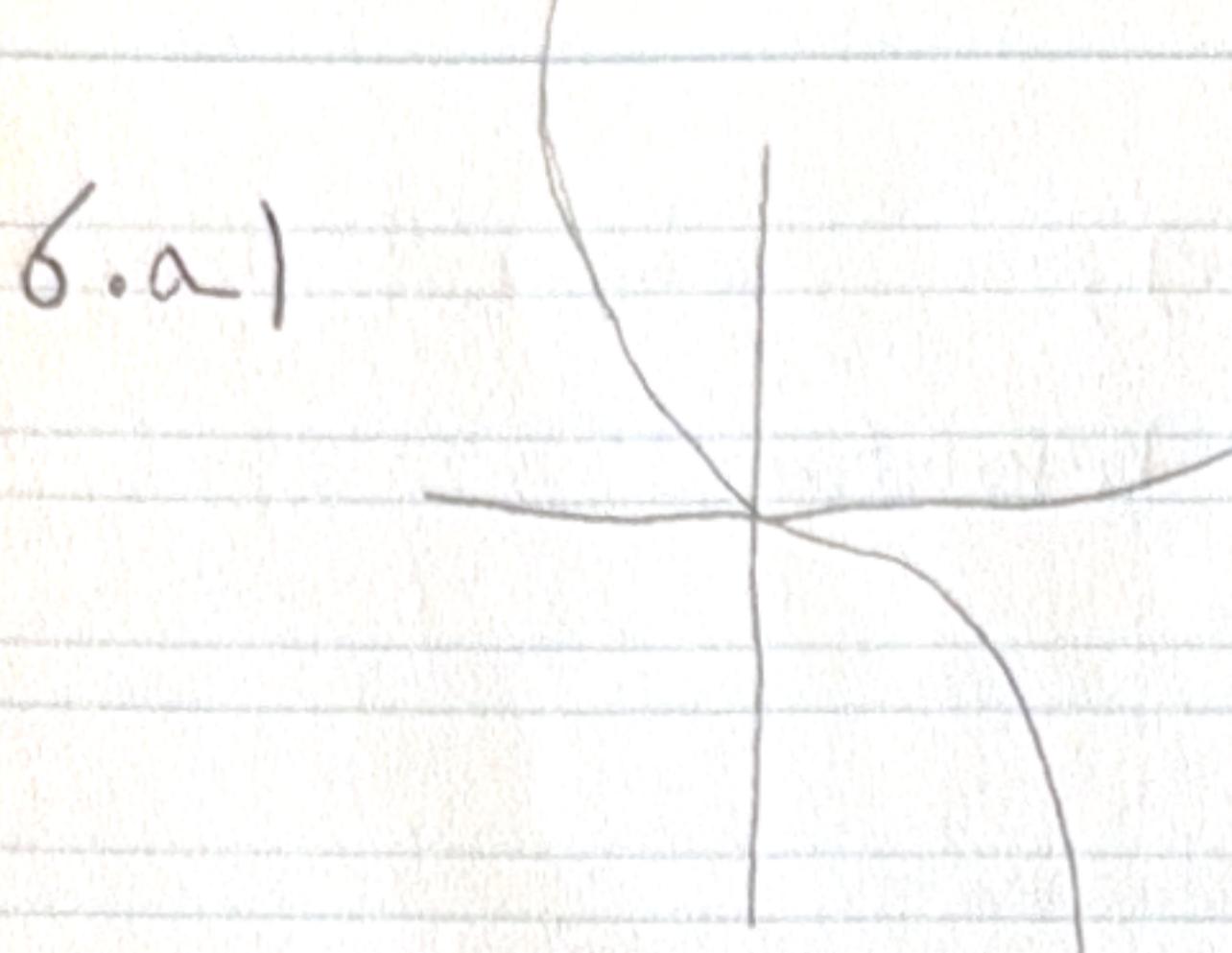
$$4.a) y - \frac{1}{3} = \frac{-2}{9}(n-1)$$

$$4.b) y - (2a^2 + 5a + 4) = (4a + 5)(n-a)$$

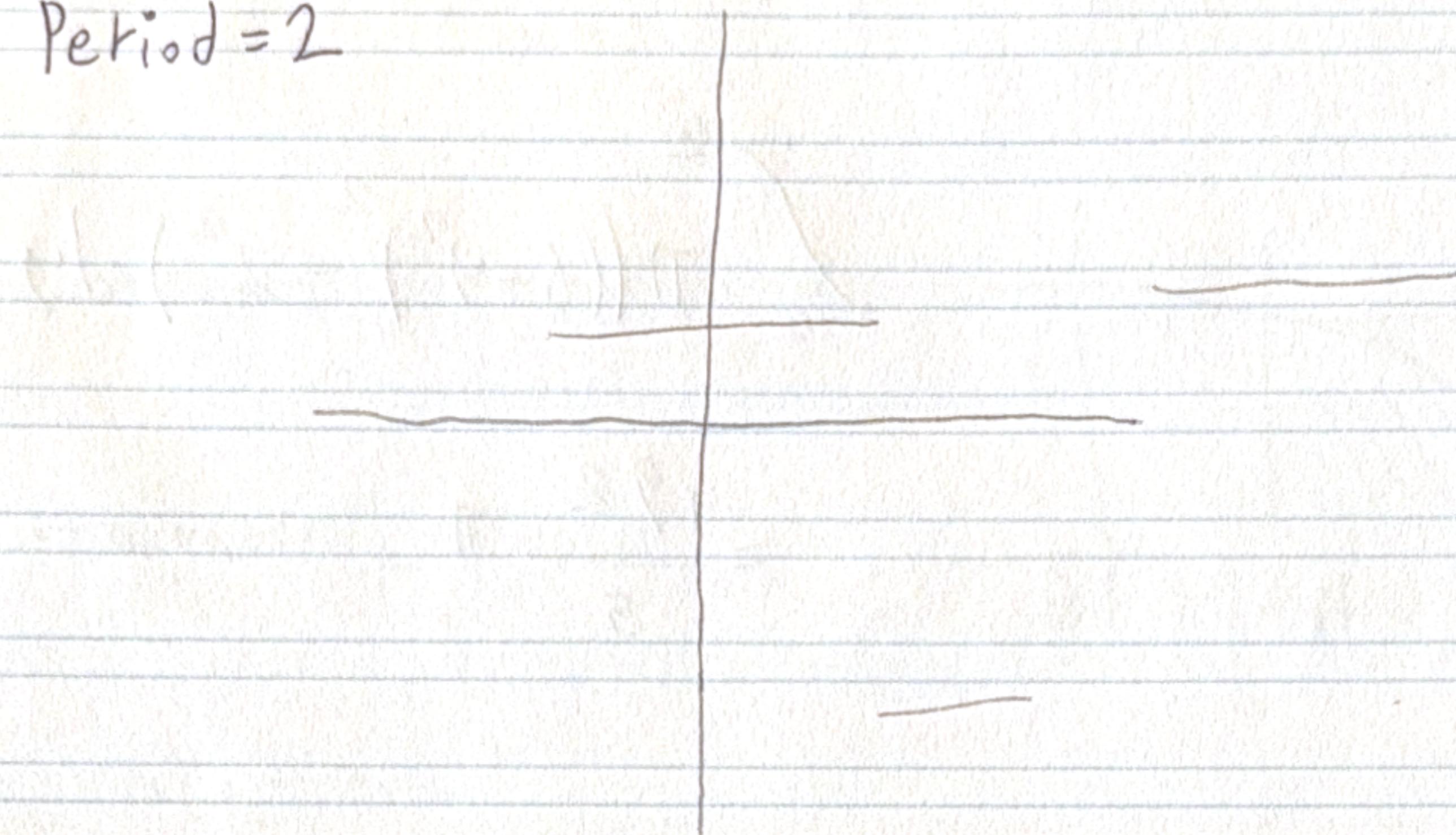
$$5) y = m n, y = 1 + (n-1)^2, m = 2(n-1) \Rightarrow 2n(n-1) = 1 + (n-1)^2$$

~~2D~~

$$\Rightarrow 2n(n-1) = 1 + (n-1)^2 \Rightarrow n^2 - 2 = 0 \Rightarrow n = \pm \sqrt{2} \Rightarrow y = \pm 2(\sqrt{2}-1)n$$



6.c) Period = 2



$$2) \lim_{\Delta n \rightarrow 0} \frac{(g(n+\Delta n) - g(n)) - (g(n-\Delta n) - g(n))}{\Delta n} = \frac{g(n)\Delta n}{\Delta n} = g(n)$$

1D. Limits and continuity

$$1.a) \lim_{n \rightarrow \infty} \frac{4}{n-1} = -4$$

$$1.g) \lim_{n \rightarrow \infty} \frac{4n^2}{n-2} - 4n =$$

$$1.c) \lim_{n \rightarrow -2} \frac{4n^2}{n+2} = \pm \infty$$

$$= \frac{8n}{n-2} = \frac{8}{1-\frac{2}{n}} = \infty$$

$$1.d) \lim_{n \rightarrow 2^+} \frac{4n^2}{2-n} = -\infty$$

$$1.f) \lim_{n \rightarrow \infty} \frac{4n^2}{n-2} = \frac{4n}{1-\frac{2}{n}} = \infty$$

3.a) removable at $x=2$

3.c) removable at $x=0$

3.d) removable at $x=0$

3.e) jump at $x=0$

6.a) $b=1$ cont; $a \neq 2$ diff

8.a) $b=0$ cont; $a \neq 2$ diff

1E. Differentiation formulas:

Polynomials, Products, Quotients

$$1.a) (x^6 + 3x^5 + 2x^3 + 7)' = 6x^5 + 15x^4 + 6x^2$$

$$1.c) \left(\frac{x}{2} + \pi^3\right)' = \frac{1}{2}$$

$$2.b) \frac{x^7}{7} + \frac{5}{6}x^6 + x + c$$

$$3. (n^3 + n^2 - n + 2)' = 3n^2 + 2n - 1 = 0 \Rightarrow n = \frac{1}{3} \text{ or } -1$$

4. b) $a+b=23$ cont; $a=36, b=-13$ diff

$$5.a) \left(\frac{n}{1+n} \right)' = \frac{(n)'(1+n) - (1+n)'n}{(1+n)^2} = \frac{1+n-2n}{(1+n)^2} = \frac{1-n}{(1+n)^2}$$

$$5. c) \left(\frac{n^2+2}{n^2-1} \right)' = \frac{(n^2+2)'(n^2-1) - (n^2+2)(n^2-1)'}{(n^2-1)^2} = \frac{(n^2-1) - (2n^2+4)}{(n^2-1)^2}$$

$$= \frac{-1-n^2+4n}{(n^2-1)^2}$$

15. Trigonometric functions

$$1.c) \frac{\sin u}{u} = \frac{\cos u - \sin u}{u^2}$$

$$2) \lim_{u \rightarrow \frac{\pi}{2}} \frac{\cos u}{u - \frac{\pi}{2}} = \frac{\cos \frac{\pi}{2} - \cos \frac{\pi}{2}}{\frac{\pi}{2} - \frac{\pi}{2}} = -\sin \frac{\pi}{2} = -1$$

1F. Chain rule, implicit differentiation

1.a) C rule: $2(u^2+2)(2u)$ P rule: $(u^2+2)2u + (u^2+2)2u$

1.b) C rule. $\log(u^2+2)^9 2u$

2) $\log(u^2+1)^{10} + u^{10} \log(u^2+1)^9 2u$

6) $f(-n) = f(n) \Rightarrow -f'(-n) = f'(n) \Rightarrow f'(-n) = -f'(n)$

$$7.b) \left(\frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} \right)' = \frac{m_0 v}{c^2 \left(1 - \frac{v^2}{c^2} \right)^{3/2}}$$

$$7.c) \left(\frac{m_0}{(1+r^2)^{3/2}} \right)' = \frac{-3m_0 r}{(1+r^2)^{5/2}}$$

1f). Trigonometric functions, (htd)

$$1.a) \cos(5\pi^2) \tan$$

$$1.K) 6 \tan(3\pi) \sec^2(3\pi)$$

$$1.m) \cos(2\pi) = -2 \sin(2\pi)$$

$$\begin{aligned} \cos^2(u) - \sin^2(u) &= -2 \sin u \cos u - 2 \sin u \cos u \\ &= -2 \sin(2u) \end{aligned}$$

$$2(\cos^2(u))' = -4 \cos u \sin u = -2 \sin(2u)$$

differ by c.

1.G. Higher derivatives

$$1.b) \frac{-10}{(n+5)^3}$$

$$1.c) \frac{-10}{(n+5)^3}$$

$$5.a) y' = u'v + v'u' \Rightarrow y'' = u''v + u'v' + v'u' + vv'$$