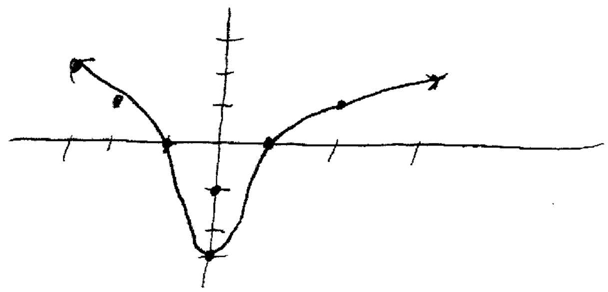
p. 91

1.

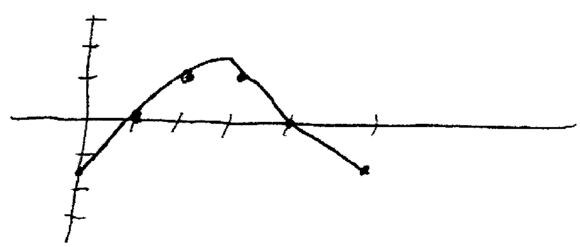
x	-3	-2	-1	0	1	2	3
$f'(x)$	2	1	0	-3	0	1	2



$y=f'(x)$

2.

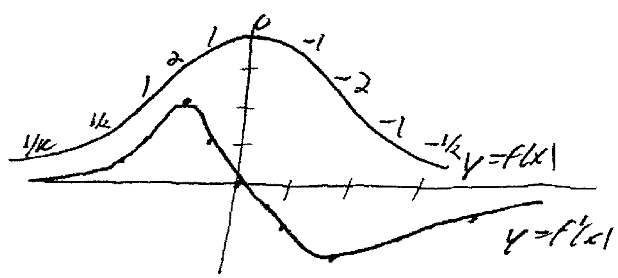
x	0	1	2	3	4	5
$f'(x)$	-1.5	0	1	1	0	-1



$y=f'(x)$

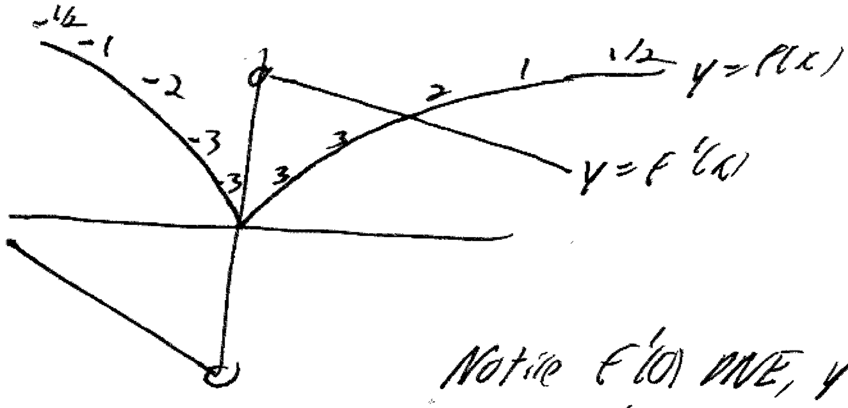
3. a. II b. IV c. I d. III

6.



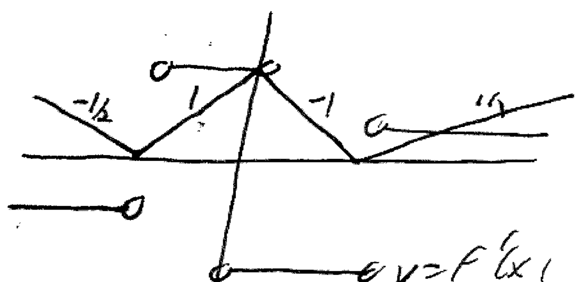
I will write my estimate for $f'(x)$ on the graph then sketch it

8.

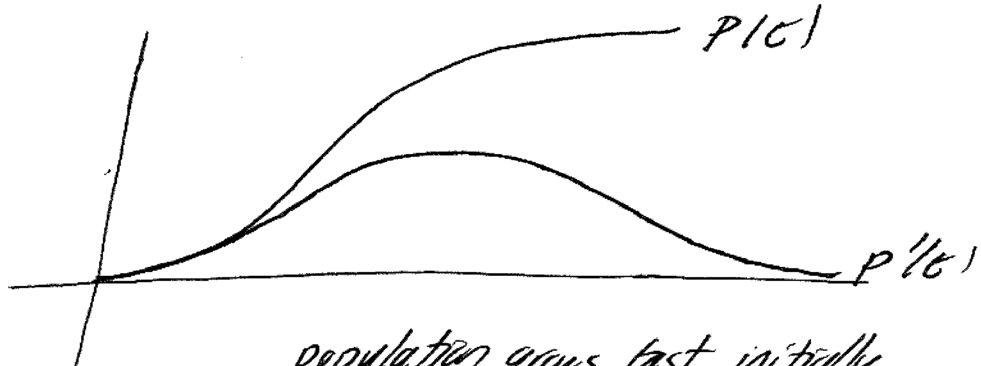


Notice $f'(0)$ DNE, $y = f(x)$ has a corner there

9.



12.



population grows fast initially, then rate of growth slows and approaches 0 as P(t) approaches its carrying capacity.

23. $G(t) = \frac{4t}{t+1}$

$$G'(t) = \lim_{h\to 0} \frac{\frac{4(t+h)}{t+h+1} - \frac{4t}{t+1}}{h} = \lim_{h\to 0} \frac{4(t+h)(t+1) - 4t(t+h+1)}{h(t+1)(t+h+1)}$$

$$= \lim_{h\to 0} \frac{4t^2+4th+4t+4h-4t^2-4th-4t}{h(t+1)(t+h+1)}$$

$$= \lim_{h\to 0} \frac{4h}{h(t+1)(t+h+1)}$$

$$= \cancel{\left(\frac{4}{t+1}\right)^2} \quad \boxed{\frac{4}{(t+1)^2}}$$

Domain G = Domain G' = $\{t \neq -1\}$

27. $x = -4$ corner
$x = 0$ Not continuous

28. $x = 0$ discontinuous
$x = 3$ corner
$x = 6$ vertical tangent (?)

p.104

3. 5 4. $-40x^9$ 5. $3x^2-4$ 6. $3t^5-12t^3+1$

12. $-3t^{-8/5}$ 14. $y=\sqrt{x}(x-1)=x^{3/2}-x^{1/2}$

$\frac{dy}{dx}=\frac{3}{2}x^{1/2}-\frac{1}{2}x^{-1/2}$

18. $g'=\sqrt{2}+\frac{\sqrt{3}}{2}u^{-1/2}$

29. $f'(x)=4x^3-9x^2+16$

$f''(x)=12x^2-18x$

36. $f'(x)=3x^2+6x+1$

$3x^2+6x+1=0$

$x=\frac{-6\pm\sqrt{36-12}}{2}$

$=\frac{-6\pm\sqrt{24}}{2}$

$=\frac{-6\pm2\sqrt{6}}{2}=-3\pm\sqrt{6}$

p.104

7. $f'(x) = 1 - 3\cos x$

8. $y' = \cos t - \pi \sin t$

22. $y' = \frac{1}{2}\cos\theta - \frac{c}{\theta^2}$

25. $y = 6\cos x \quad (\pi/3, 3)$

$y' = -6\sin x$ so slope of tangent is

$-6\sin(\pi/3) = -6\left(\frac{\sqrt{3}}{2}\right) = -3\sqrt{3}$

slope of normal is $\frac{1}{3\sqrt{3}}$

tangent is $y - 3 = -3\sqrt{3}(x - \pi/3)$

normal is $y - 3 = \frac{1}{3\sqrt{3}}(x - \pi/3)$

26. $y = (1+2x)^2 = 4x^2 + 4x + 1$ at $(1, 9)$

$y' = 8x + 4$

tangent: $y - 9 = 12(x-1)$

normal $y - 9 = -\frac{1}{12}(x-1)$

31. $g(t) = 2\cos t - 3\sin t$

$g'(t) = -2\sin t - 3\cos t$

$g''(t) = -2\cos t + 3\sin t$

44. $f(t) = t^3 - 9t^2 + 15t + 10$

a. velocity $\boxed{v(t) = 3t^2 - 18t + 15}$

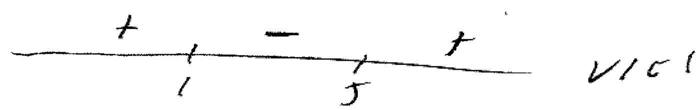
b. $v(3) = 3\cdot 9 - 18\cdot 3 + 15 = \boxed{-12 \text{ ft/sec}}$

c. Set $3t^2 - 18t + 15 = 0$

$t^2 - 6t + 5 = 0$ $\quad \boxed{t = 1, 5}$

$(t-1)(t-5) = 0$

d. Need $v(t) > 0$



From $0 \le t \le 1$ and $t \ge 5$

e. $f(0) = 10$ > positive dir.

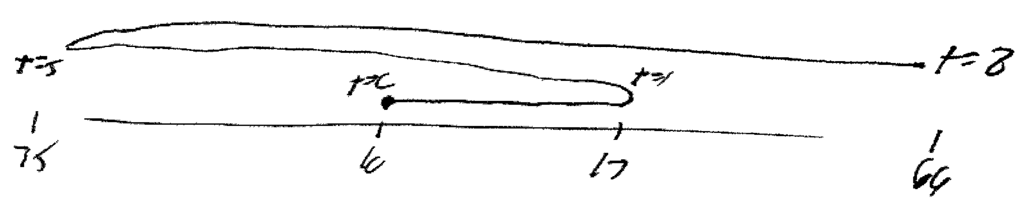
$f(1) = 17$ > neg dir

$f(5) = -15$

$f(8) = 512 - 576 + 120 + 10 = -64 + 130 = 66$

$64 \times 8 = 512$ $\quad$ $64 \times 9 = 576$

Total distance $= 7 + 32 + 81 = 120$ ft.



46. $s = 5t + 3t^2$

a. $\frac{ds}{dt} = 5 + 6t$ sec at $t = 2$ velocity is 17 m/s

b. $5 + 6t = 35$

$t = 5$ sec

56. $f(x) = \cos x$

$$f'(x) = \lim_{h \to 0} \frac{\cos(x+h) - \cos x}{h}$$

$$= \lim_{h \to 0} \frac{\cos x \cos h - \sin x \sin h - \cos x}{h}$$

$$= \lim_{h \to 0} \left(\frac{\cos x (\cos h - 1)}{h} - \frac{\sin x \sin h}{h} \right)$$

$$= \cos x \lim_{h \to 0} \frac{\cos h - 1}{h} - \sin x \lim_{h \to 0} \frac{\sin h}{h}$$

$$= \cos x \cdot 0 - \sin x$$

$$= -\sin x$$