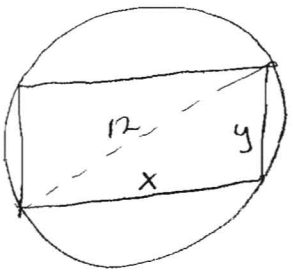
4.4 # 2, 4, 8, 20, 22, 24, 28, 43, 46, 54, 56

2)



$x^2+y^2=12^2$

$y^2=144-x^2$

$y=\sqrt{144-x^2}$

a) $P=2x+2y$

$=2x+2\sqrt{144-x^2}$

(b) $A=xy$

$=x\left(\sqrt{144-x^2}\right)$

4) (a) $A=\frac{1}{2}xy$

$=\frac{1}{2}x\sqrt{x}$

(b) $h^2=x^2+y^2$

$h^2=x^2+(\sqrt{x})^2$

$h=\sqrt{x^2+x}$

Perimeter $=x+\sqrt{x}+\sqrt{x^2+x}$

8) $xy=16$

$y=\frac{16}{x}$

$x^2+y^2=$ sum of squares

$x^2+\left(\frac{16}{x}\right)^2=$ Sum of $\square$s

16)

not on HW

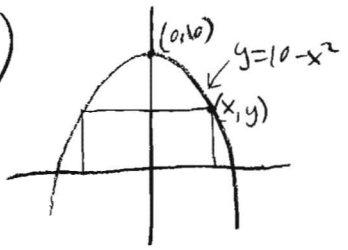
$h=2r$

$V=h(\pi r^2)$

$V=2r(\pi r^2)$

$V=2\pi r^3 \rightarrow \sqrt[3]{\frac{V}{2\pi}}=r$

20)



$A=2xy$

$A=2x(10-x^2)$

22) (a) $y^2=1-x^2$

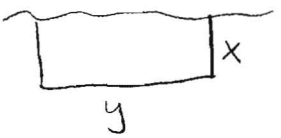
$y=\sqrt{1-x^2}$

$A=\frac{1}{2}x\left(\sqrt{1-x^2}\right)$

(b) $P=x+y+1$

$=x+\sqrt{1-x^2}+1$

24)



$500=2x+y$

$500-2x=y$

$A=xy$

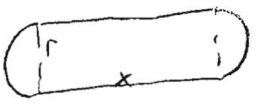
$=x(500-2x)$

28) (a) no, cubic

(b) 1 turning pt.

(c) max

43)



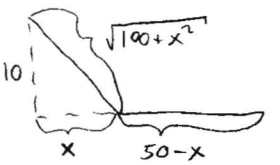
$\frac{1}{4}=2\pi r+2x$

$2x=\frac{1}{4}-2\pi r$

$x=\frac{1}{8}-\pi r$

$A=2r\left(\frac{1}{8}-\pi r\right)+\pi r^2$

46) (a)



Cost $=8000\left(\sqrt{100+x^2}\right)+2000(50-x)$

(b)

x	0	10	20	30	40	50
cost	180,000	193,100	238,900	293,000	349,900	407,900

(c) increasing, lowest at $x=0$

(d)

x	0	4	8	12	16	20
cost	180000	178200	186400	201000	218900	238900

(e) neither lowest at $x=4$.

54) cost $4800=16y+24x$

$4800-24x=16y$

$300-\frac{3}{2}x=y$

$A=x\left(300-\frac{3}{2}x\right)=-\frac{3}{2}x^2+300x$

$=-\frac{3}{2}\left(x^2-200x\right)$

$=-\frac{3}{2}\left(x^2-200x+100^2\right)-\frac{3}{2}(100)^2$

$=-\frac{3}{2}(x-100)^2+15000$

opens down $\cap$

$x=100$ gives max area $=15000$

56)

$r^2+x^2=R^2 \rightarrow x^2=R^2-r^2$

$A=\pi R^2-\pi r^2$

$=\pi(R^2-r^2)$

$=\pi x^2$

4.5 # 2, 6, 12, 14, 16, 20, 34, 35

2) $x+y=20$

$y=20-x$

$x^2+(20-x)^2$ = sum of □s

$x^2+400-40x+x^2$

$2x^2-40x+400$

min when $x=\frac{-(-40)}{2(2)}$

$x=10$

$y=20-10=10$

6) 

$2x+2y=80$

$y=40-x$

$A=xy$

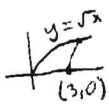
$=x(40-x)$

$=-x^2+40x$

max when $x=\frac{-40}{2(-1)}=20\text{cm}$

max area:

$A=20(40-20)=400\text{cm}^2$

12) 

$d=\sqrt{(x-3)^2+(y-0)^2}$

$=\sqrt{x^2-6x+9+(\sqrt{x})^2}$

$=\sqrt{x^2-5x+9}$

min when $x=\frac{+5}{2(1)}=\frac{5}{2}$

$y=\sqrt{\frac{5}{2}}$

closest point $\left(\frac{5}{2},\sqrt{\frac{5}{2}}\right)$

14) $\sqrt{(x-4)^2+(3x+1-0)^2}$

$\sqrt{x^2-8x+16+9x^2+6x+1}$

$\sqrt{10x^2-2x+17}$

min when $x=\frac{-(-2)}{10(2)}=\frac{1}{10}$

$y=3\left(\frac{1}{10}\right)+1=\frac{13}{10}$

closest point $\left(\frac{1}{10},\frac{13}{10}\right)$

16) 

$4x+2y=1800\text{m}$

$y=900-2x$

$A=x(900-2x)$

$=-2x^2+900x$

max when $x=\frac{-900}{2(-2)}=225\text{m}$

$y=900-(225)(2)=450\text{m}$.

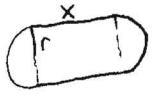
20) $R=-\frac{1}{5}x^2+200x$

max when $x=\frac{-200}{2(-\frac{1}{5})}=500$

max revenue

$=-\frac{1}{5}(500)^2+200(500)$

$=\$50000$

34) 

$P=2\pi r+2x=\frac{1}{4}$

$2x=\frac{1}{4}-2\pi r$

$x=\frac{1}{8}-\pi r$

$A_{\square}=2r\left(\frac{1}{8}-\pi r\right)$

$=\frac{1}{4}r-2\pi r^2$

max when

$r=\frac{-\frac{1}{4}}{2(-2\pi)}=\frac{1}{16\pi}$

$x=\frac{1}{8}-\pi\left(\frac{1}{16\pi}\right)=\frac{1}{16}$

35) $4800=16y+24x$

$y=300-\frac{3}{2}x$

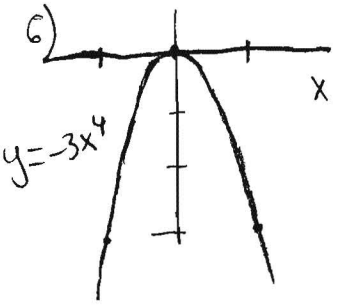
$A=x\left(300-\frac{3}{2}x\right)$

$=300x-\frac{3}{2}x^2$

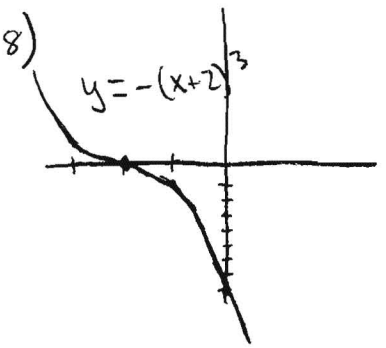
max at $x=\frac{-300}{2(-\frac{3}{2})}=100$

$y=300-\frac{3}{2}(100)=150$

4.6 #6, 8, 17-20, 28, 30, 38, 40, 44, 53, 58, 59a

6) 

x and y intercept $(0,0)$.

8) 

x-intercept $(-2,0)$

y-intercept $(0,-8)$

17) 4 turning points $(4>2)$

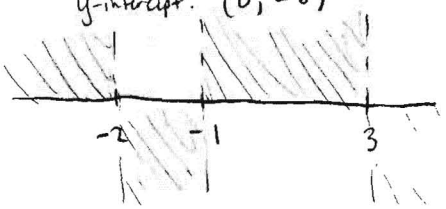
18) cusp

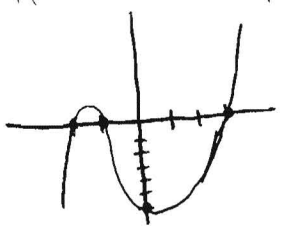
19) grows large and negative for $|x|$ large (needs to alternate)

20) break.

28) (a) x-intercepts: $(3,0)$, $(-2,0)$ and $(-1,0)$

y-intercept: $(0,-6)$

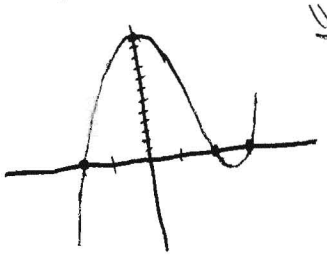


(b) 

30) $(x-3)(x-2)(x+2)$

x-intercepts $(0,3)$, $(0,2)$, and $(0,-2)$

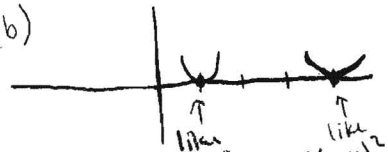
y-intercept $(0,12)$



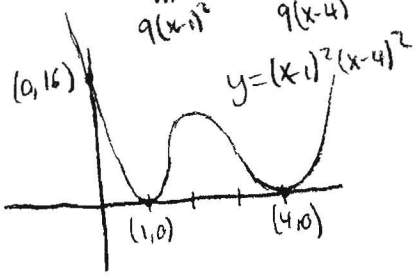
4.6 continued

38) x-intercepts (1,0) and (4,0)
y-intercept (0, 16)

(b)

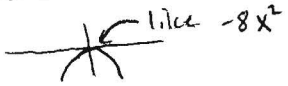


(c)

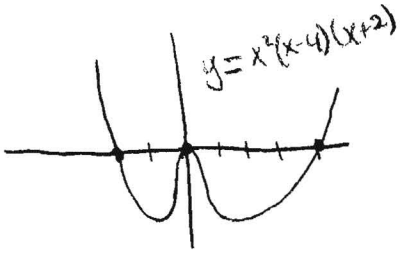


40) x-intercepts (0,0), (4,0) and (-2,0)
y-intercept (0,0)

(b)

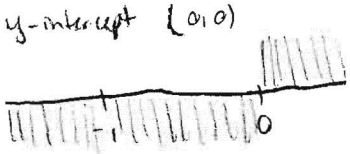


(c)

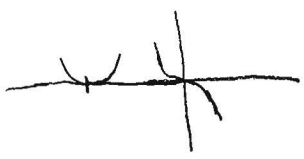


44) $y=-3x^3(x+1)^4$

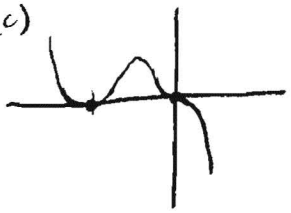
x-intercepts (0,0) and (-1,0)
y-intercept (0,0)



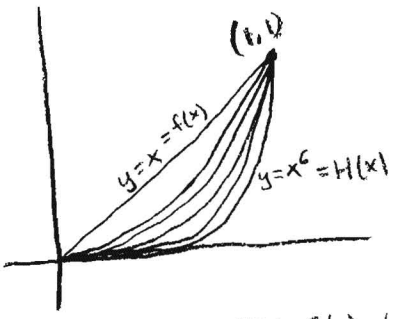
b) near (0,0) like $-3x^3$
near (-1,0) like $3(x+1)^4$



44) (c)



53)



f(x), g(x), h(x), F(x), G(x), H(x)

58) $t^4 = t^5 + t^6$

$0 = -t^4 + t^5 + t^6$

$0 = t^4(-1+t+t^2)$

$t^4 = 0$ or $-1+t+t^2=0$

$t=0$ $\qquad t^2+t-1=0$

$t = \frac{-1\pm\sqrt{1^2-4(1)(-1)}}{2}$

$= \frac{-1\pm\sqrt{5}}{2}$

t in $[0,1]$

so throw away $t=\frac{-1-\sqrt{5}}{2}$

Solutions: $t=0$ or $t=\frac{-1+\sqrt{5}}{2}$

59) (a) yes. (intersect again)