HW #1
MATH 143

Section 1.1

(7) (a) $x < 0$ (b) $y \geq 0$ (c) $q \leq \pi$ (d) $2 < d < 4$

(e) $t \geq 5$ (f) $-z \leq 3$ (g) $\frac{p}{q} \leq 7$ (h) $\frac{1}{w} \geq 9$

(i) $|x| > 7$

(13) (a) $|4-\pi| = 4-\pi$ b/c $4-\pi > 0$ (b) $|\pi-4| = 4-\pi$ b/c $4-\pi < 0$ (c) $|\sqrt{2} - 1.5| = 1.5 - \sqrt{2}$ b/c $\sqrt{2} - 1.5 < 0$

(15) $A = 3$, $B = 7$, $C = -5$

(a) $d(A,B) = |3-7| = |-4| = 4$ (b) $d(B,C) = |7-(-5)| = |12| = 1$

(c) $d(C,B) = |-5-7| = |-12| = 12$ (d) $d(A,C) = |3-(-5)| = |8| = 8$

(21) $d(x,-3) \geq 8$

$|x-(-3)| \geq 8$

$|x+3| \geq 8$

(27) $|2-x| = 2-x$ if $x < 2$, Since in this case $2-x>0$

(29) $|a-b| = b-a$ if $a<b$, since in this case $a-b<0$.

Section 3.1

(11) $A(-5,0)$, $B(-2,-2)$

$$d(A,B) = \sqrt{(-5-(-2))^2 + (0-(-2))^2}$$
$$= \sqrt{(-3)^2 + 2^2}$$
$$= \sqrt{9+4}$$
$$= \sqrt{13}.$$

(27) Points on the y-axis are of the form $(0,a)$.
We want points of the form $Q(0,a)$ that are distance 6 from $P(5,3)$.

$$d(P,Q) = 6$$

$$\sqrt{(5-0)^2+(3-a)^2} = 6$$

$$\left(\sqrt{25+9-6a+a^2}\right)^2 = (6)^2$$

$$34-6a+a^2 = 36$$
$$-36 \qquad -36$$

$$a^2-6a-2 = 0$$

You may use completing the square or quadratic formula to solve for a.

$$a = \frac{6 \pm \sqrt{36-4(1)(-2)}}{2(1)} = \frac{6 \pm \sqrt{44}}{2} = 3 \pm \sqrt{11}$$

So there are two points that are distance 6 from $P(5,3)$ and on the y-axis. They are $(0, 3+\sqrt{11})$ and $(0, 3-\sqrt{11})$.

(29) Consider $Q(2a,a)$ and $P(1,3)$. We want to find a so that Q is in the 3rd quadrant and is distance 5 from P.

$$d(Q,P) = 5$$

$$\sqrt{(2a-1)^2+(a-3)^2} = 5$$

$$\sqrt{4a^2-4a+1+a^2-6a+9} = 5$$ square both sides

$$5a^2-10a+10 = 25$$ subtract 25

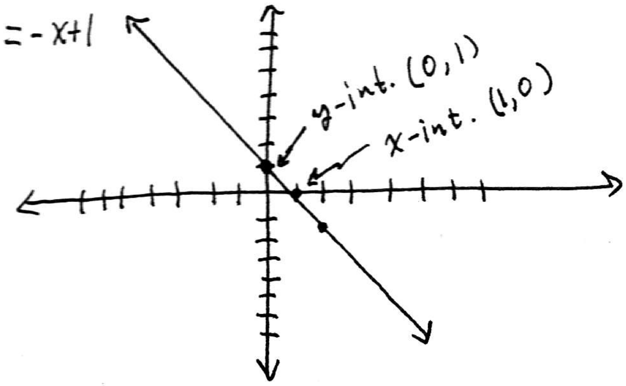
$$\frac{5a^2}{5} - \frac{10a}{5} - \frac{15}{5} = \frac{0}{5}$$ divide everything by 5

$$a^2-2a-3 = 0$$
$$(a-3)(a+1) = 0$$
$$a = 3 \text{ or } -1.$$

So we have two possible points. $(6,3)$ and $(-2,-1)$.
Only $(-2,-1)$ is in the 3rd quadrant, so this is the point we want.

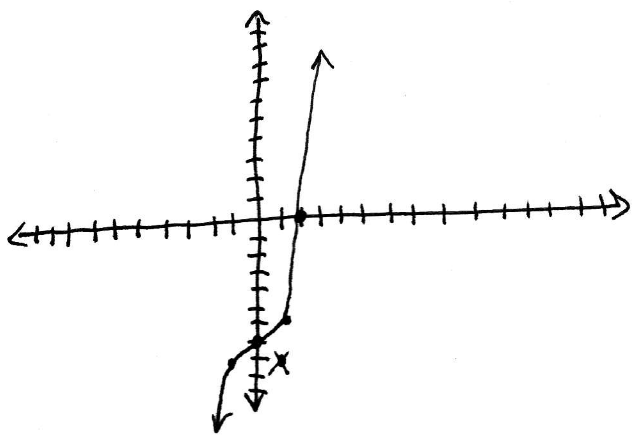
Section 3.2

3 $y = -x + 1$



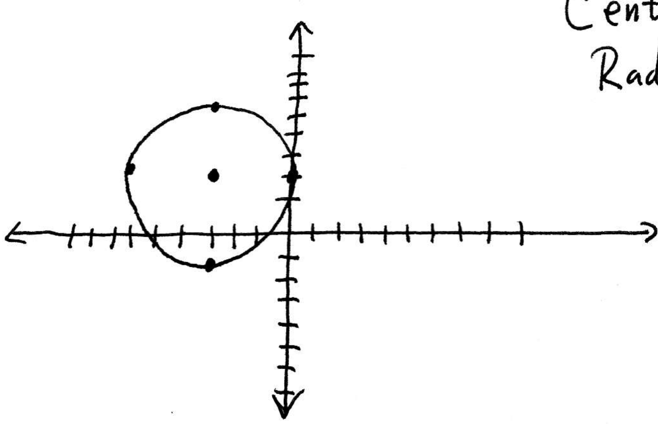
15 $y = x^3 - 8$

x	y
-2	-16
-1	-9
0	-8
1	-7
2	0
3	19



25 $(x+3)^2 + (y-2)^2 = 9$

Center: $(-3, 2)$
Radius: 3



35 Center $C(2,-3)$; Radius 5

$(x-2)^2 + (y+3)^2 = 25.$

(47) $x^2+y^2-4x+6y-36=0$

Move 36 to the Right.

$\left(\frac{-4}{2}\right)^2$ $(-2)^2$ 4

$x^2-4x+\underline{4}\ +y^2+6y+\underline{9} = 36+\underline{4}+\underline{9}$

$\left(\frac{6}{2}\right)^2 = 3^2 = 9$

$(x-2)^2+(y+3)^2 = 49$

Center: $C(2,-3)$ Radius: 7

Section 3.4

(3) $f(x)=\sqrt{x-4}-3x$

$f(4)=\sqrt{4-4}-3(4) = 0-12=-12$

$f(8)=\sqrt{8-4}-3(8)=\sqrt{4}-24=2-24=-22$

$f(13)=\sqrt{13-4}-3(13)=\sqrt{9}-39=3-39=-36$

(7) $f(x)=-x^2+4$

(a) $f(a)=-a^2+4$ (b) $f(-a)=-(-a)^2+4=-a^2+4$ (c) $-f(a)=-(-a^2+4)$
$=a^2-4$

(d) $f(a+h)=-(a+h)^2+4=-(a^2+2ah+h^2)+4=-a^2-2ah-h^2+4.$

(e) $f(a)+f(h)=-a^2+4+(-h^2+4)=-a^2+4-h^2+4=-a^2-h^2+8.$

(f) $\dfrac{f(a+h)-f(a)}{h}=\dfrac{(-a^2-2ah-h^2+4)-(-a^2+4)}{h}=\dfrac{\cancel{-a^2}-2ah-h^2+\cancel{4}+\cancel{a^2}-\cancel{4}}{h}$

$=\dfrac{-2ah-h^2}{h}=-2a-h$

(11) $g(x)=4x^2$

(a) $g\left(\frac{1}{a}\right)=4\left(\frac{1}{a}\right)^2=\frac{4}{a^2}$ (b) $\frac{1}{g(a)}=\frac{1}{4a^2}$ (c) $g(\sqrt{a})=4(\sqrt{a})^2=4a$

(d) $\sqrt{g(a)}=\sqrt{4a^2}=2a.$

(19) (a) $[-3,4]$ (b) $[-2,2]$ (c) $f(1)=0$ (d) $x=-1,\frac{1}{2},2$

(e) $[-1,1\frac{1}{2}) \cup [2,4]$.

(21) $f(x)=\sqrt{2x+7}$.

We don't want a negative under the square root. So we let

$$2x+7 \geq 0$$
$$2x \geq -7$$
$$x \geq -\frac{7}{2}$$

Domain: $[-\frac{7}{2},\infty)$

(25) $f(x)=\dfrac{x+1}{x^3-4x}$

We don't want 0 in the denominator, so we set

$$x^3-4x=0$$
$$x(x^2-4)=0$$
$$x(x-2)(x+2)=0$$
$$x=0 \text{ or } 2 \text{ or } -2.$$

~~Domain $(-\infty,0)\cup(0$~~

Domain $(-\infty,-2)\cup(-2,0)\cup(0,2)\cup(2,\infty)$.

(47) $f(x)=x^2-3x$

$$\frac{f(2+h)-f(2)}{h} = \frac{(2+h)^2-3(2+h)-(2^2-3(2))}{h}$$
$$= \frac{\cancel{4}+4h+h^2-\cancel{6}-3h-\cancel{(-2)}}{h}$$
$$= \frac{h+h^2}{h} = 1+h.$$