Appendix C

Answers to Odd Exercises

Section 1.1

1. negative
3. positive
5. positive
7. positive
9. negative
11. positive

Section 1.2

1. 8, `32∧(3/5) = 8.0`

3. $\frac{8}{27}$, $(16/81) \wedge (3/4) = .296296296 = .296$

5. 16, $4 \wedge 8/4 \wedge 6 = 16.0$

7. $\frac{27}{8}$, $81 \wedge (3/4) * 4 \wedge (-3/2) = 3.375$

9. $\dfrac{1}{27}$, $(27 \wedge (1/3) * 27 \wedge (5/3))/27 \wedge 3 = .037037037037 = .037$

11. $\dfrac{27}{8}$, $(4/9) \wedge (-3/2) = 3.375$

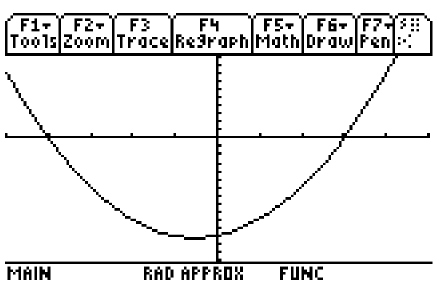
13. $\sqrt{}(\pi + \pi \wedge 2)/3 = 1.20236789779 = 1.202$

15. $e \wedge (\pi * \sqrt{}(67)/3) = 5280.0000089 = 5280.0$

Section 1.3

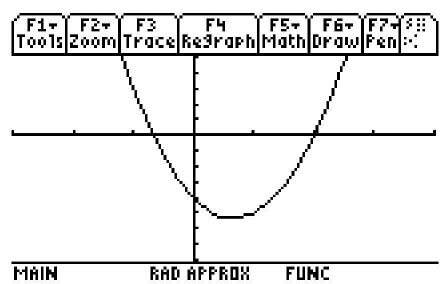
1. $(x+4)(x-3)$

$y_1 = x \wedge 2 + x - 12$
$y_2 = (x+4)(x-3)$
$[-5, 5]$ by $[-15, 10]$



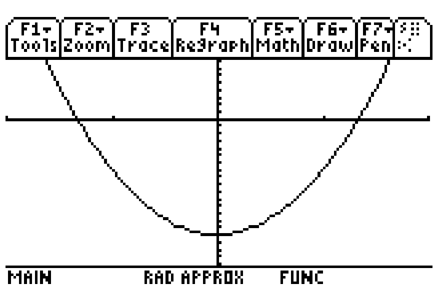
3. $(3x+2)(x-2)$

$y_1 = 3x \wedge 2 - 4x - 4$
$y_2 = (3x+2)(x-2)$
$[-3, 4]$ by $[-8, 5]$



5. $(3x-4)(3x+4)$

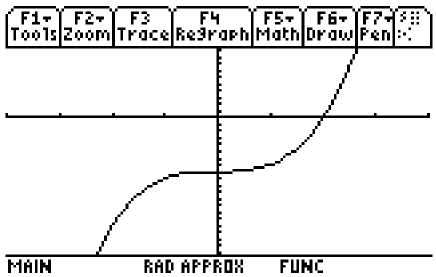
$y_1 = 9x \wedge 2 - 16$
$y_2 = (3x-4)(3x+4)$
$[-2, 2]$ by $[-20, 8]$



7. not factorable

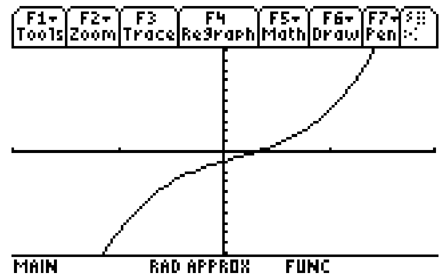
9. $(x-2)(x^2+2x+4)$

$y_1 = x \wedge 3 - 8$
$y_2 = (x-2)(x \wedge 2 + 2x + 4)$
$[-4, 4]$ by $[-20, 10]$



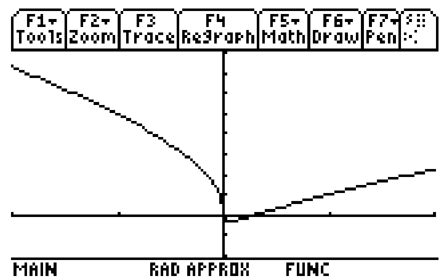
11. $(x^2+1)(3x-1)$

$y_1 = 3x \wedge 3 - x \wedge 2 + 3x - 1$
$y_2 = (x \wedge 2 + 1)(3x - 1)$
$[-2, 2]$ by $[-10, 10]$



13. $x^{\frac{1}{3}}(3x^{\frac{1}{3}} - 2)$

$y_1 = 3x \wedge (2/3) - 2x \wedge (1/3)$
$y_2 = x \wedge (1/3) * (3x \wedge (1/3) - 2)$
$[-2, 2]$ by $[-2, 8]$



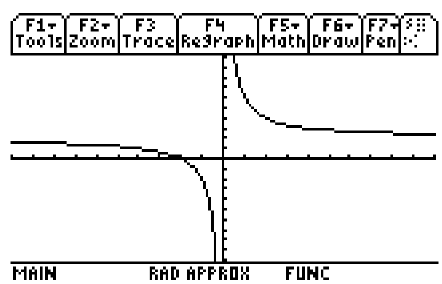
Section 1.4

1. $\dfrac{2x+4}{x}$ or $2 + \dfrac{4}{x}$

$y_1 = (8x \wedge 2 + 16x)/(4x \wedge 2)$

$y_2 = (2x + 4)/x$

$[-10, 10]$ by $[-10, 10]$

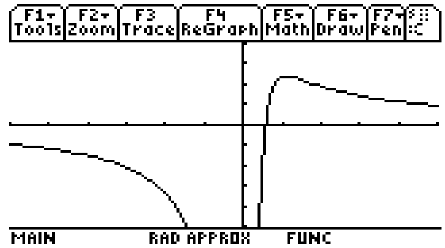


3. $\dfrac{-16x+9}{-3x^2}$ or $\dfrac{16x-9}{3x^2}$

y₁ = (5x − 2)/x ∧ 2 + (3 − x)/(−3x ∧ 2)

y₂ = (−16x + 9)/(−3x ∧ 2)

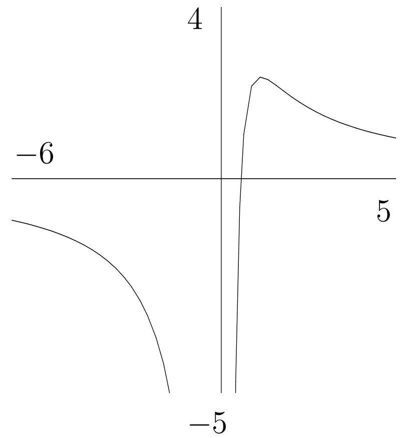
$[-6, 5]$ by $[-5, 4]$



3. On paper:

$$\frac{5x-2}{x^2}+\frac{3-x}{-3x^2}=\frac{(5x-2)(-3)}{(x^2)(-3)}+\frac{3-x}{-3x^2}$$

$$=\frac{-15x+6+3-x}{-3x^2}=\boxed{\frac{-16x+9}{-3x^2}}$$



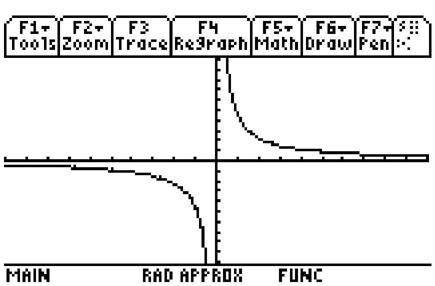
y₁ = (5x − 2)/x ∧ 2 + (3 − x)/(−3x ∧ 2)
y₂ = (−16x + 9)/(−3x ∧ 2)

5. $\dfrac{137}{30x}$

y₁ = 1/(6x) + 2/(5x) + 4/x

y₂ = 137/(30x)

$[-10, 10]$ by $[-10, 10]$

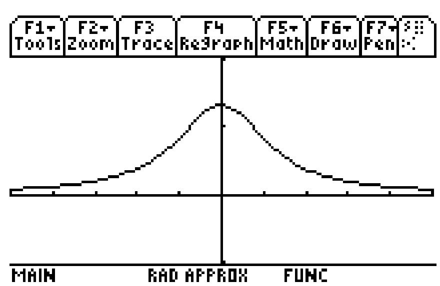


7. $\dfrac{2x^2+8}{(x^2+2)(x^2+3)}$

y₁ = 4/(x ∧ 2 + 2) − 2/(x ∧ 2 + 3)

y₂ = (2x ∧ 2 + 8)/((x ∧ 2 + 2) ∗ (x ∧ 2 + 3))

$[-5, 5]$ by $[-1, 2]$



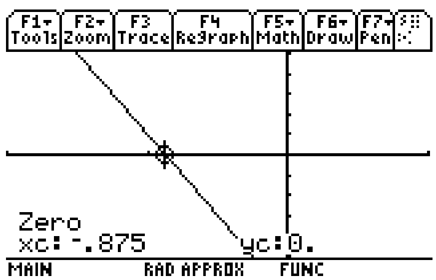
Section 1.5

Both methods, <u>$x-$intercept</u> (on the left) and <u>points of intersection</u> (on the right), are shown. Choose the method you prefer.

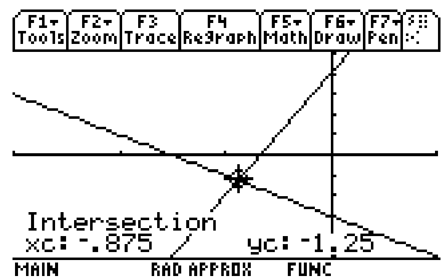
1. $x = -\dfrac{7}{8}$ or -0.875

On the calculator:

$y_1 = 3x + 2 - 5(x+1) - 6x - 4$
$[-2, 1]$ by $[-5, 5]$



$y_1 = 3x + 2 - 5(x+1)$, $y_2 = 6x + 4$
$[-3, 1]$ by $[-5, 5]$



1. On paper:

a) $3x + 2 - 5(x+1) = 6x + 4$

$3x + 2 - 5x - 5 = 6x + 4$

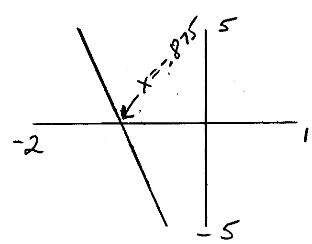
$-2x - 3 = 6x + 4$

$-7 = 8x$

$\boxed{x = -\frac{7}{8}}$

b) <u>x-intercept method</u>

$y_1 = 3x + 2 - 5(x+1) - 6x - 4$



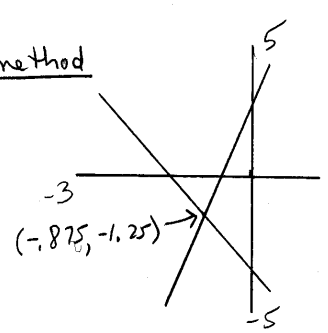
$\boxed{x = -.875}$

or b) <u>points of intersection method</u>

$y_1 = 3x + 2 - 5(x+1)$

$y_2 = 6x + 4$

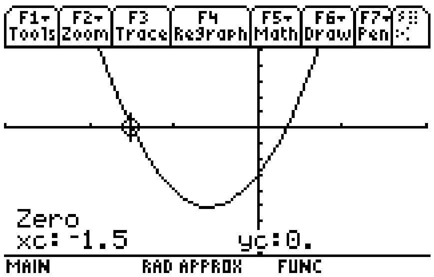
$\boxed{x = -.875}$

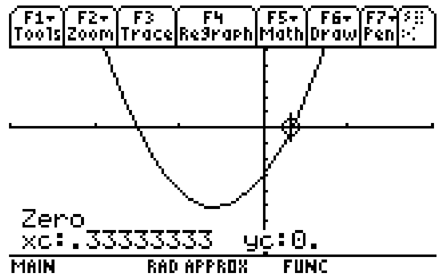


$x-$intercept method is shown first, followed by points of intersection method.

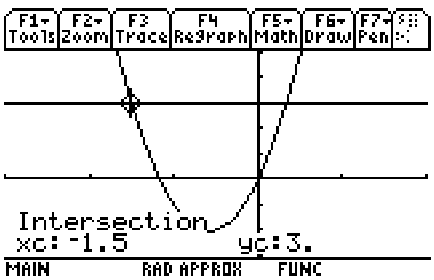
3. $x = -\dfrac{3}{2},\ \dfrac{1}{3}$ or $-1.5,\ 0.333$

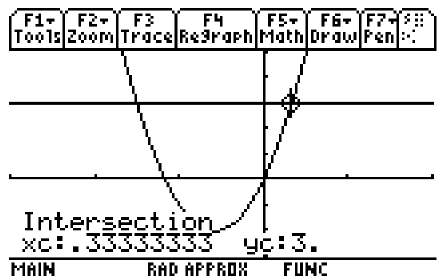
$\mathtt{y_1 = 6x \wedge 2 + 7x - 3}$ $[-3, 2]$ by $[-8, 5]$





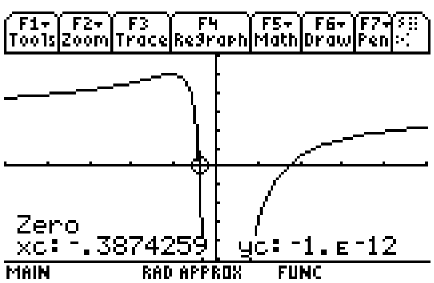
$\mathtt{y_1 = 6x \wedge 2 + 7x},\quad \mathtt{y_2 = 3}$ $[-3, 2]$ by $[-8, 5]$

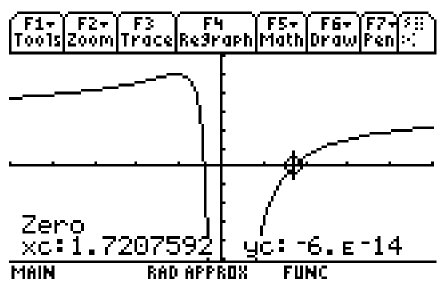




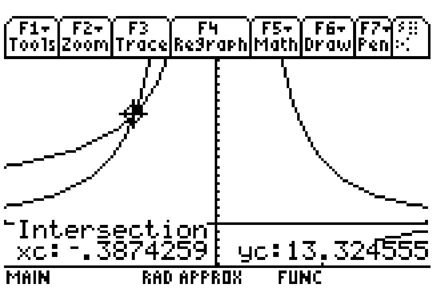
5. $x = \dfrac{2 \pm \sqrt{10}}{3}$ or $-0.387,\ 1.721$

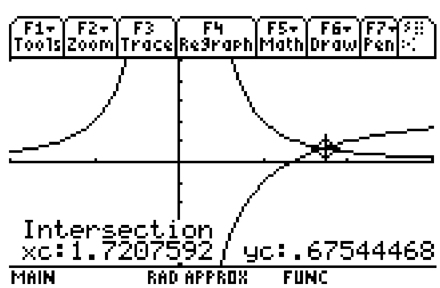
$\mathtt{y_1 = 3 - 4/x - 2/x \wedge 2}$ $[-5, 5]$ by $[-5, 6]$





$\mathtt{y_1 = 3 - 4/x},\ \mathtt{y_2 = 2/x \wedge 2}$ $[-1, 1]$ by $[-5, 20]$ (left), $[-2, 3]$ by $[-5, 5]$ (right)





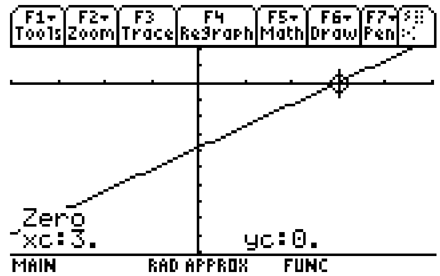
7. $x = 3$

Since $y = 0$ is the $x-$axis, there is no reason to use the points of intersection method. We just need the $x-$intercept.

$y = \sqrt{2}x - \sqrt{x+15}$

$\mathtt{y_1 = \sqrt{}(2)x - \sqrt{}(x+15)}$

$[-4, 5]$ by $[-10, 2]$



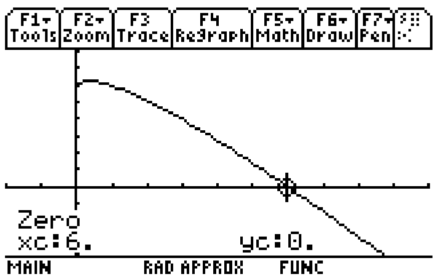
9. $x = 6$

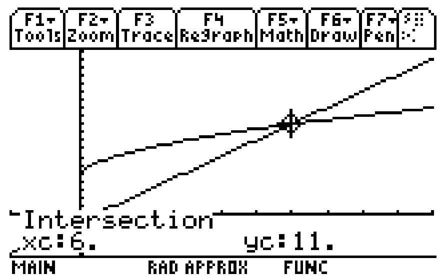
$\mathtt{y_1 = \sqrt{}(8x+1) + 4 - 2x + 1}$

$[-2, 10]$ by $[-4, 8]$

$\mathtt{y_1 = \sqrt{}(8x+1) + 4}$, $\mathtt{y_2 = 2x - 1}$

$[-2, 10]$ by $[-5, 20]$





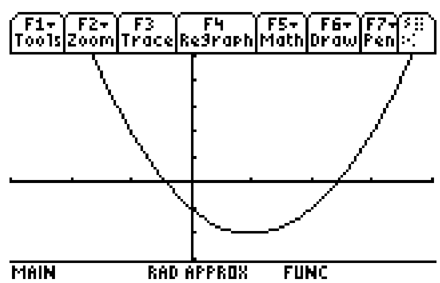
11. zero (we have 1 $x-$intercept, so 1 real solution)

13. negative (no $x-$intercepts, so no real solutions)

15. positive $\mathtt{y_1 = x \wedge 2 - 2x - 1}$

$[-3, 4]$ by $[-3, 5]$

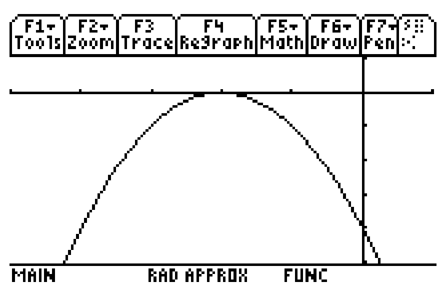
$b^2 - 4ac > 0$ since we have two $x-$intercepts.



17. zero $\mathtt{y_1 = -x \wedge 2 - 4x - 4}$

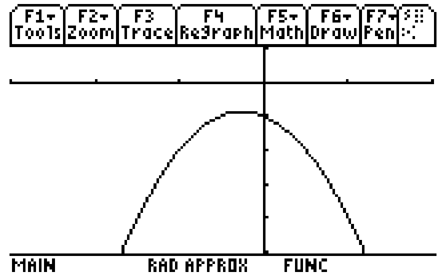
$[-5, 1]$ by $[-5, 1]$

$b^2 - 4ac = 0$ since we have one $x-$intercept.



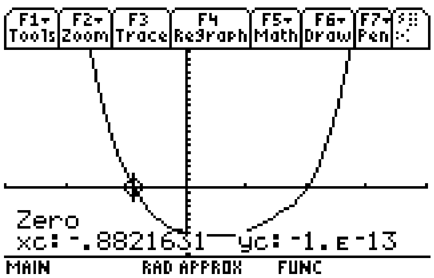
19. negative $\quad$ $\mathtt{y_1 = -2x \wedge 2 - x - 1}$
$[-3, 2]$ by $[-5, 1]$

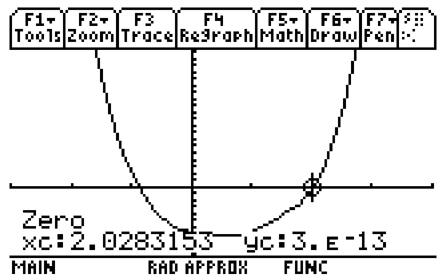
$b^2 - 4ac < 0$ since we have no $x-$intercepts.



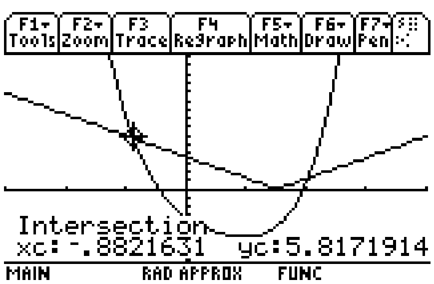
21. $x = -0.882,\ 2.028$

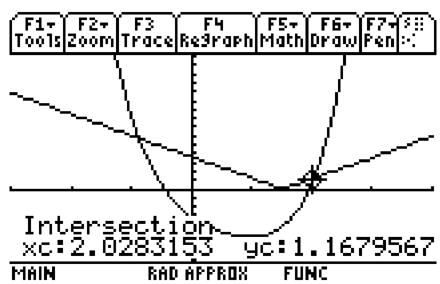
a) $\mathtt{y_1 = x \wedge 4 - 2.1x \wedge 3 + 3.5x \wedge 2 - 4.7x - 3.1 - abs(2.4x - 3.7)}$
$[-3, 4]$ by $[-10, 20]$





b) $\mathtt{y_1 = x \wedge 4 - 2.1x \wedge 3 + 3.5x \wedge 2 - 4.7x - 3.1}$, $\quad$ $\mathtt{y_2 = abs(2.4x - 3.7)}$
$[-3, 4]$ by $[-8, 15]$





Section 1.6

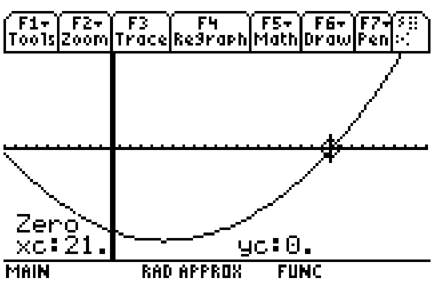
Both methods, $x-$intercept and points of intersection, are shown.
Choose the method you prefer.

(Window used depends on whether we verify the function is graphed appropriately, or we look at only the needed domain.)

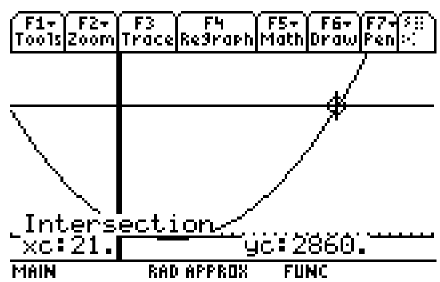
1. domain $(8, \infty)$ The cardboard is 21 inches by 63 inches

   Equation: Let w =the width of the cardboard
   $4(3w-8)(w-8) = 2860$

   $y_1 = 4(3x-8)(x-8) - 2860$
   $[-10, 30]$ by $[-3500, 3000]$
   $x = 21$

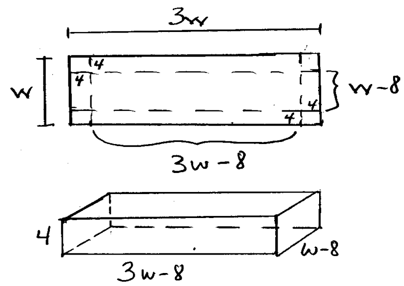
   

   $y_1 = 4(3x-8)(x-8)$, $y_2 = 2860$
   $[-10, 30]$ by $[-500, 4000]$

   See next page for complete solution "on paper".

1. On paper:



$V(w) = 4(3w-8)(w-8)$

$2860 = 4(3w-8)(w-8)$

domain $3w-8>0$ $w-8>0$

$3w>8$ $w>8$

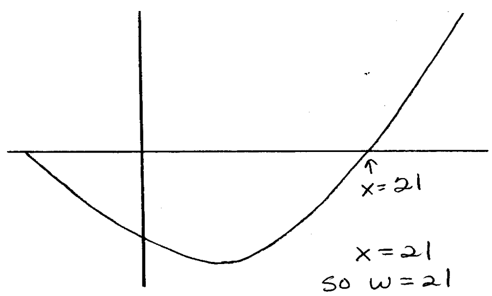
$w>\frac{8}{3}$ so $w>8$

Domain $(8,\infty)$

x-intercept method

$y_1 = 4(3x-8)(x-8) - 2860$

$[-10, 30]$ by $[-3500, 3000]$

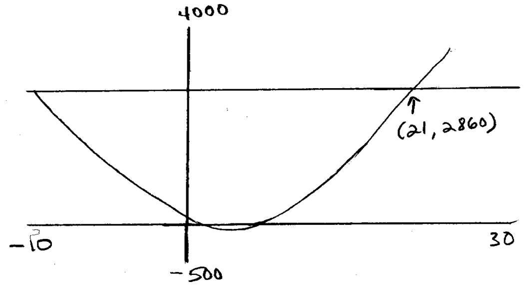


$x = 21$

so $w = 21$

$3w = 63$

points of intersection method



$y_1 = 4(3x-8)(x-8)$

$y_2 = 2860$

Solution: dimensions are 21 inches by 63 inches

3. domain $(0,\infty)$ radius is 3.40 cm

Equation: Let r = the radius of the top

$$2\pi r(9.4) + 2\pi r^2 = 273$$

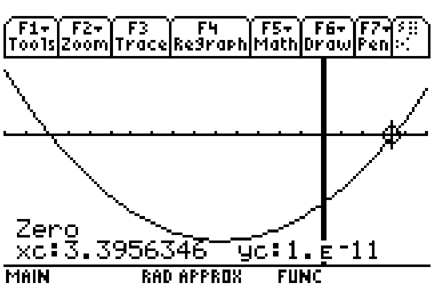
$y_1 = 2\pi x * (9.4) + 2\pi x \wedge 2 - 273$

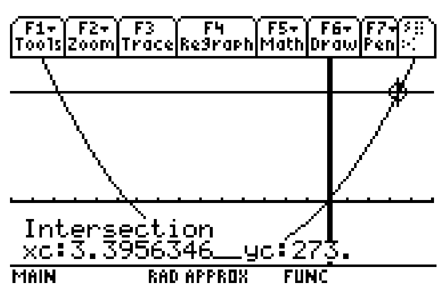
$[-10, 20]$ by $[-100, 100]$

$x = 3.3956346, \quad x = 3.40$

$y_1 = 2\pi x * (9.4) + 2\pi x \wedge 2, \quad y_2 = 273$

$[-15, 5]$ by $[-150, 350]$





5. domain $(50, \infty)$ sidewalk length is 275 yd

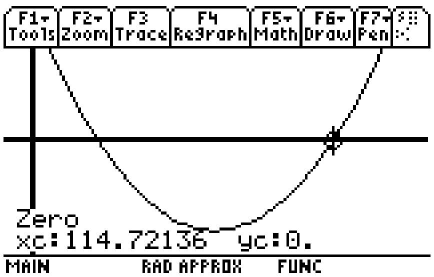
Equation: Let x = length of the hypotenuse
$$(x - 20)^2 + (x - 50)^2 = x^2$$

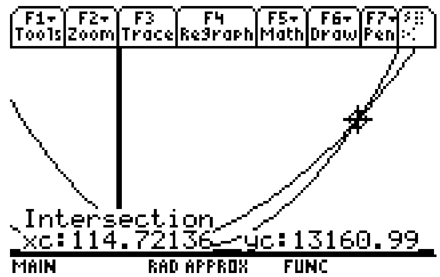
$\mathtt{y_1 = (x - 20) \wedge 2 + (x - 50) \wedge 2 - x \wedge 2}$

$\mathtt{y_1 = (x - 20) \wedge 2 + (x - 50) \wedge 2, \quad y_2 = x \wedge 2}$

$[-10, 150]$ by $[-2500, 2000]$ $\qquad$ $[-50, 150]$ by $[-10, 20000]$

There is only one $x-$intercept (or point of intersection) in the our domain:
$x = 114.72136, \ x = 115$





Thus, $x = 115$, $\quad x - 20 = 95$, $\quad x - 50 = 65$

and the sum of the three sides is $115 + 95 + 65 = 275$

Section 1.7

Both methods, $x-$intercept and points of intersection, are shown.
Choose the method you prefer.

1. $x = -1.275$ $\qquad$ Solution: $(-\infty, -1.28)$

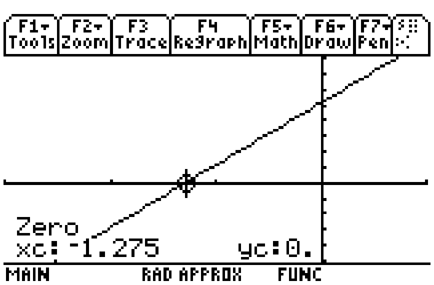
$x-$intercept method

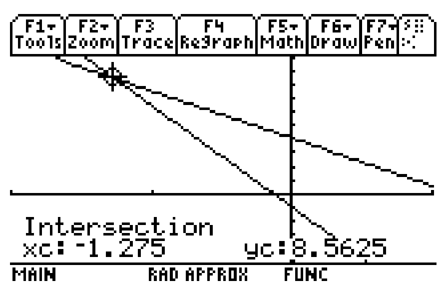
$\mathtt{y_1 = 4.1 - 3.5x + 1 + 7.5x}$
$[-3, 1]$ by $[-5, 8]$

points of intersection method

$\mathtt{y_1 = 4.1 - 3.5x, \quad y_2 = -1 - 7.5x}$
$[-2, 1]$ by $[-5, 10]$

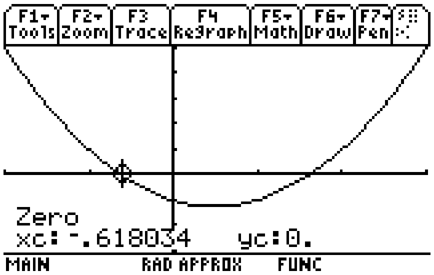
$x = -1.275$

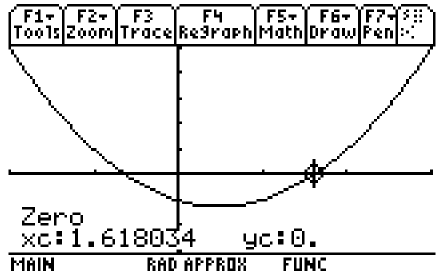




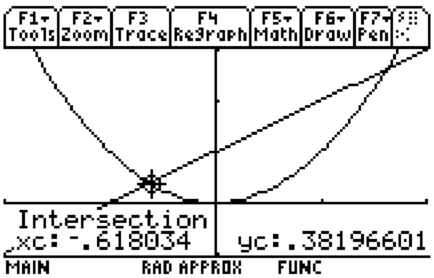
3. $x = -0.618034,\ 1.618034$ Solution: $(-.62, 1.62)$

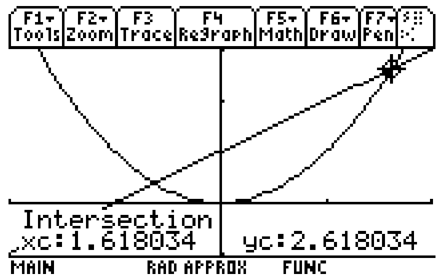
$y_1 = x \wedge 2 - x - 1$ $[-2, 3]$ by $[-3, 5]$





$y_1 = x \wedge 2,\ \ y_2 = x + 1$ $[-2, 2]$ by $[-1, 3]$





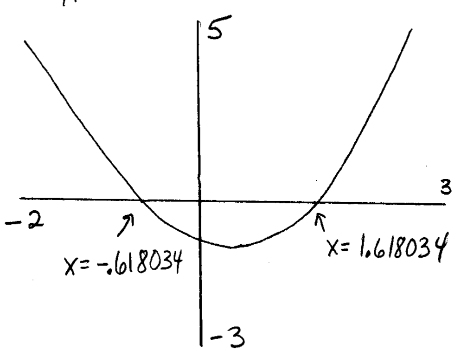
3. On paper:

$x^2 < x + 1$

<u>x-intercept method</u>

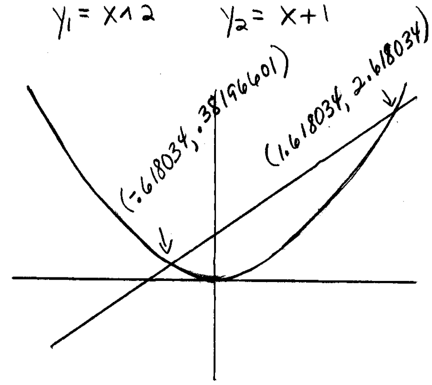
$x^2 - x - 1 < 0$

$y_1 = x \wedge 2 - x - 1$



<u>points of intersection method</u>

$y_1 = x \wedge 2$ $y_2 = x + 1$

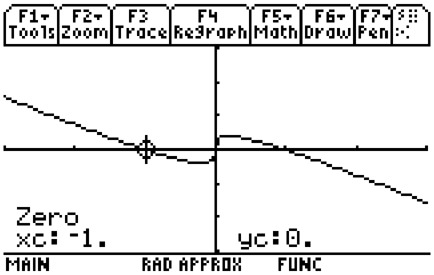


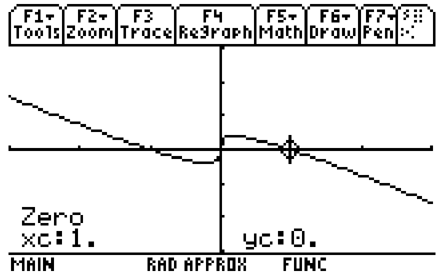
$[-2, 2]$ by $[-1, 3]$

Solution $\boxed{(-.62, 1.62)}$

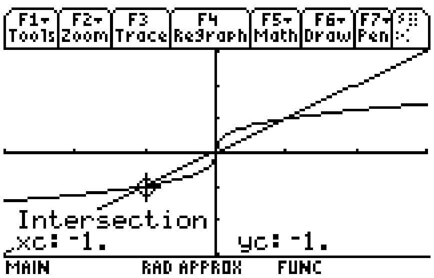
5. $x = -1,\ 0,\ 1$ Solution: $(-1, 0) \cup (1, \infty)$

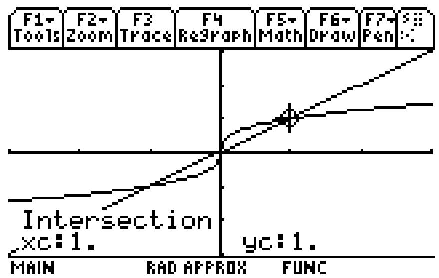
`y₁ = x ∧ (1/3) − x` $[-3, 3]$ by $[-3, 3]$
(TI-89: If you have difficulty with the graph, be sure to use a `Mode` setting of `Complex Format - Real`.)





`y₁ = x ∧ (1/3),  y₂ = x` $[-3, 3]$ by $[-3, 3]$





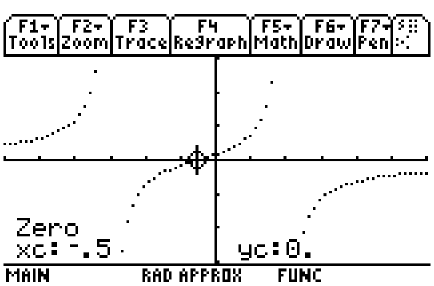
There is also an $x-$intercept (and a point of intersection) at $x = 0$.

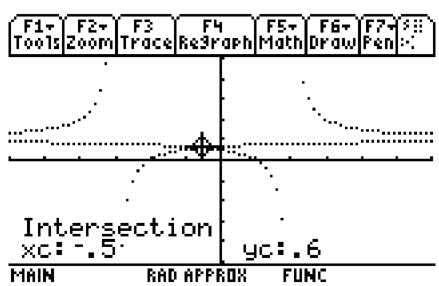
7. $x = -0.5$ Solution: $(-\infty, -3) \cup [-0.5, 2)$
vertical asymptotes: $x = -3, x = 2$

`y₁ = (x + 2)/(x + 3) − (x − 1)/(x − 2)`

$[-6, 6]$ by $[-3, 3]$

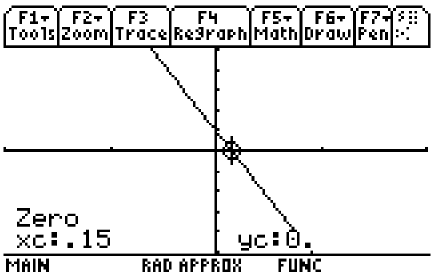
`y₁ = (x + 2)/(x + 3),  y₂ = (x − 1)/(x − 2)`
$[-6, 6]$ by $[-5, 5]$



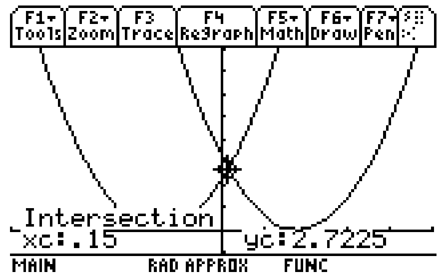


9. $x = 0.15$ Solution: $(-\infty, 0.15)$

$\mathtt{y_1} = (\mathtt{x} - 1.8) \wedge 2 - (\mathtt{x} + 1.5) \wedge 2$
$[-2, 2]$ by $[-5, 5]$

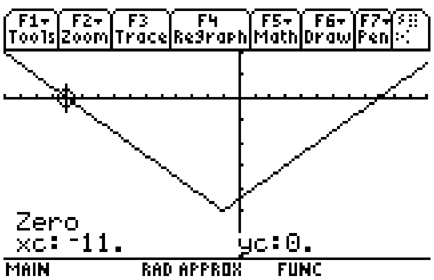


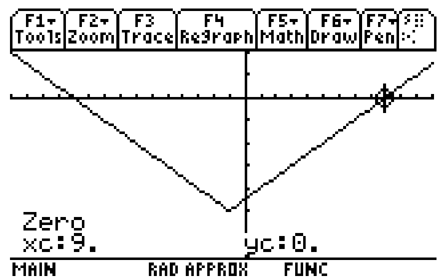
$\mathtt{y_1} = (\mathtt{x} - 1.8) \wedge 2, \quad \mathtt{y_2} = (\mathtt{x} + 1.5) \wedge 2$
$[-5, 5]$ by $[-1, 8]$



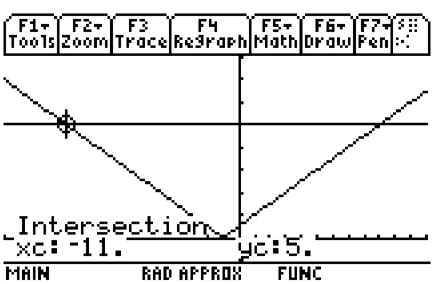
11. $x = -11, \ 9$ Solution: $(-\infty, -11] \cup [9, \infty)$

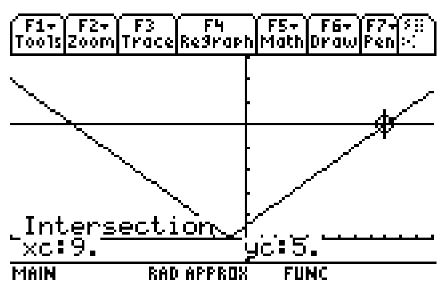
$\mathtt{y_1} = \mathtt{abs}((\mathtt{x} + 1)/2) - 5$ $[-15, 12]$ by $[-7, 2]$





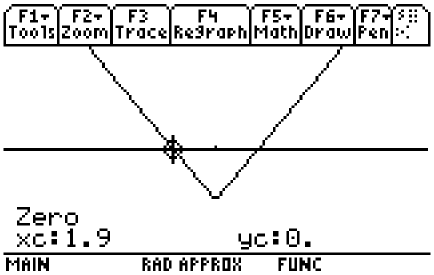
$\mathtt{y_1} = \mathtt{abs}((\mathtt{x} + 1)/2), \quad \mathtt{y_2} = 5$ $[-15, 12]$ by $[-1, 8]$

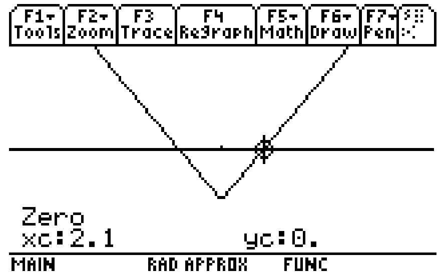




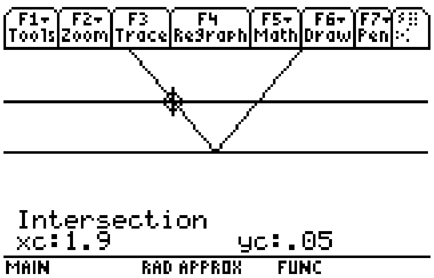
13. $x = 1.9,\ 2.1$ Solution: $(1.9, 2.1)$

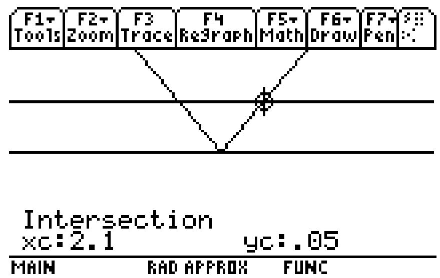
$\texttt{y}_1 = \texttt{abs}(1 - \texttt{x}/2) - 0.05$ $[1.5, 2.5]$ by $[-.1, .1]$





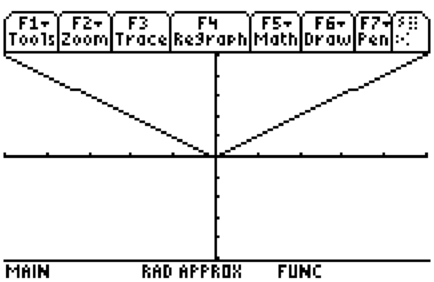
$\texttt{y}_1 = \texttt{abs}(1 - \texttt{x}/2)$, $\texttt{y}_2 = 0.05$ $[1.5, 2.5]$ by $[-.1, .1]$



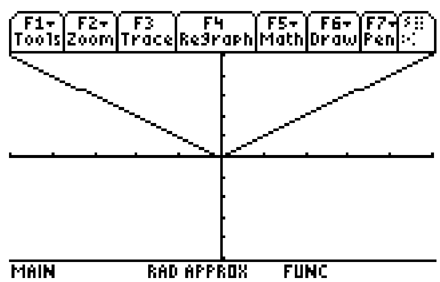


15. $|x| = \sqrt{x^2}$ Graphs (a) and (b) are the same.

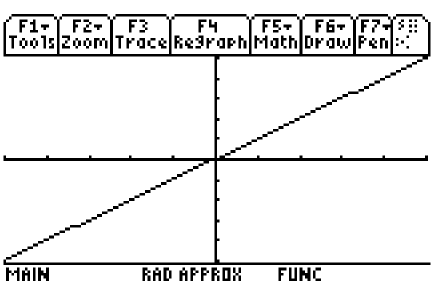
(a) $\texttt{y}_1 = \texttt{abs}(\texttt{x})$ $[-5, 5]$ by $[-5, 5]$



(b) $\texttt{y}_1 = \sqrt{\ }(\texttt{x} \wedge 2)$ $[-5, 5]$ by $[-5, 5]$



(c) $\texttt{y}_1 = \texttt{x}$ $[-5, 5]$ by $[-5, 5]$

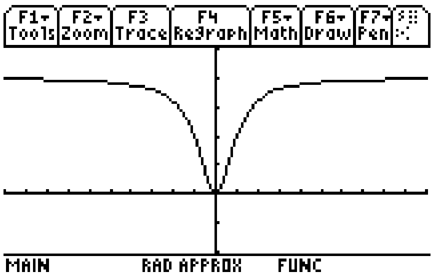


Section 1.8

1) $y-$axis

$\mathtt{y_1} = (\mathtt{4x} \wedge \mathtt{2})/(\mathtt{x} \wedge \mathtt{2} + \mathtt{1})$

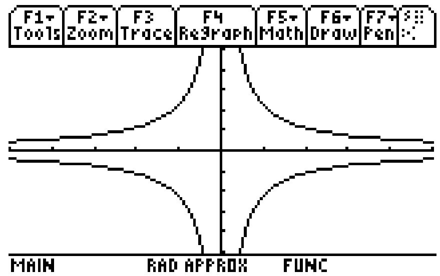
$[-10, 10]$ by $[-2, 5]$



3) $x-$axis, $y-$axis, origin

$\mathtt{y_1} = \sqrt{\ }(\mathtt{5}/\mathtt{x} \wedge \mathtt{2}),\ \mathtt{y_2} = -\sqrt{\ }(\mathtt{5}/\mathtt{x} \wedge \mathtt{2})$

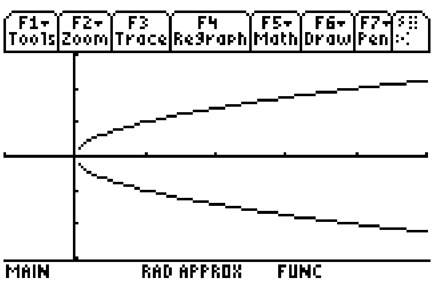
$[-5, 5]$ by $[-5, 5]$



5) $x-$axis

$\mathtt{y_1} = \sqrt{\ }(\mathtt{x}),\ \mathtt{y_2} = -\sqrt{\ }(\mathtt{x})$

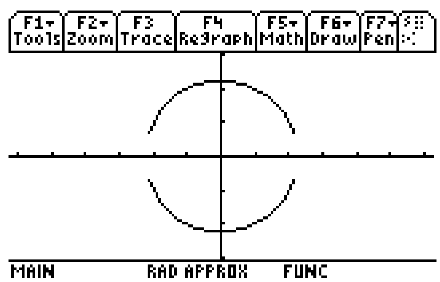
$[-1, 5]$ by $[-3, 3]$



7) $x-$axis, $y-$axis, origin

$\mathtt{y_1} = \sqrt{\ }(\mathtt{5} - \mathtt{x} \wedge \mathtt{2}),\ \mathtt{y_2} = -\sqrt{\ }(\mathtt{5} - \mathtt{x} \wedge \mathtt{2})$

using $[-3, 3]$ by $[-3, 3]$ then zoom square

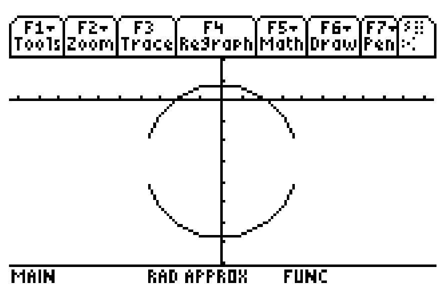


9) $y-$axis

$\mathtt{y_1} = -\mathtt{3} + \sqrt{\ }(\mathtt{14} - \mathtt{x} \wedge \mathtt{2}),$

$\mathtt{y_2} = -\mathtt{3} - \sqrt{\ }(\mathtt{14} - \mathtt{x} \wedge \mathtt{2})$

using $[-4, 4]$ by $[-8, 2]$ then zoom square



11) $y-$axis

13) origin

15) b, d

The graph shows the center on the negative side of the $x-$axis, and the radius is less than the distance from the center to the origin.

a) $(x-2)^2+y^2=3$ C(2,0), does not work, center is on positive $x-$axis

b) $(x+2)^2+y^2=3$ C(-2,0), $r=\sqrt{3}<2$ (distance from center to origin), this works

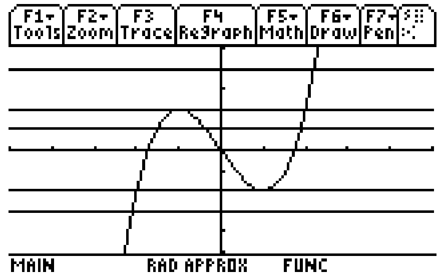
c) $x^2+(y-2)^2=3$ C(0,2), does not work, center is on $y-$axis

d) $x^2+y^2+10x+16=0$ $(x+5)^2+y^2=9$
C(-5,0), $r=3<5$ (distance from center to origin), this works

e) $x^2+y^2+10x-2y=1$ $(x+5)^2+(y-1)^2=27$
C(-5,1), does not work, center is not on the $x-$axis

Section 1.9

1. $\mathtt{y_1 = x \wedge 3 - 3x}$, $\mathtt{y_2} = \{-3, -2, 1, 2, 4\}$
   $[-5, 5]$ by $[-5, 5]$



   One solution for $k = -3$ and $k = 4$.

   Two solutions for $k = -2$ and $k = 2$.

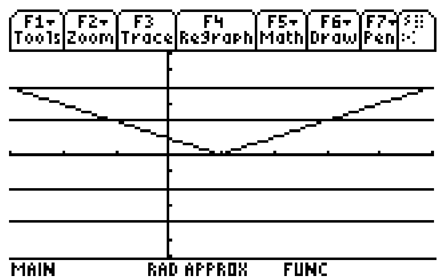
   Three solutions for $k = 1$.

   One solution for $(-\infty, -2) \cup (2, \infty)$.

   Two solutions for $k = \pm 2$.

   Three solutions for $(-2, 2)$.

3. $\mathtt{y_1 = abs(x - 1)}$, $\mathtt{y_2} = \{-4, -2, 0, 2, 4\}$
   $[-3, 5]$ by $[-6, 6]$



   No solution for $k = -4, -2$.

   One solution for $k = 0$.

   Two solutions for $k = 1, 2$.

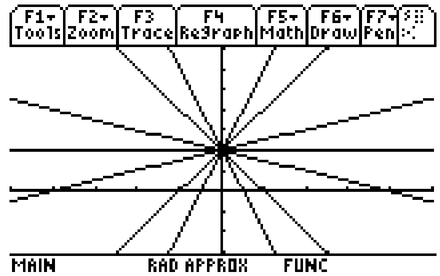
   No solution for $k < 0$ so $(-\infty, 0)$.

   One solution for $k = 0$.

   Two solutions for $k > 0$, so $(0, \infty)$.

Section 1.10

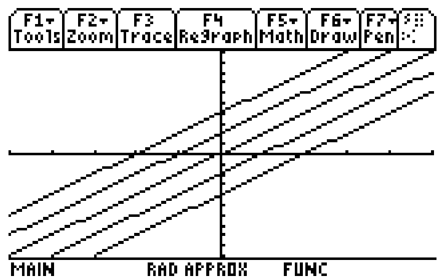
1. (a) $\texttt{y}_1 = \{-4, -2, -1/2, 0, 1/2, 2, 4\}\texttt{x} + 2$
$[-5, 5]$ by $[-3, 7]$



The lines all have the same $y-$intercept.

As k increases, the slant of the line goes from steep slanted downward to flat to steep slanted upward (slope changes from negative to zero to positive).

(b) $\texttt{y}_1 = 2\texttt{x} + \{-4, -2, 0, 2, 4\}$
$[-5, 5]$ by $[-10, 10]$



The lines all have the same slope - they are parallel.

As k increases, the $y-$intercept changes, moves from negative to zero to positive. The line moves up vertically.

3. E Put each equation into slope-intercept form and compare information.
Equations (E) have the same positive slopes but different $y-$intercepts, one negative and one positive.

5. B graph A has slope $\frac{3}{2}$ while graph B has slope 3 due to the scale being different on the $y-$axis.

