

First Chapter

Name Key

Linear Forms / Linear Inequalities / Linear Piece wise Functions

Slope-Intercept Form (e.g. $y = \frac{2}{3}x + 5$, or $y = 7x - 5$)

1. $2x - 3y = 9$

$$\frac{-3y}{-3} = \frac{-2x + 9}{-3}$$

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

1. $y = \frac{2}{3}x - 3$

2. $4x + 3y = 25$

$$\frac{3y}{3} = \frac{-4x + 25}{3}$$

$$y = -\frac{4}{3}x + 8\frac{1}{3}$$

2. $y = -\frac{4}{3}x + 8\frac{1}{3}$

3. $5x - 2y = -9$

$$\frac{-2y}{-2} = \frac{-5x - 9}{-2}$$

$$y = \frac{5}{2}x + 4\frac{1}{2}$$

3. $y = \frac{5}{2}x + 4\frac{1}{2}$

Standard Form Equation

Put each equation in the $Ax + By = C$

4. $y = \frac{3}{4}x - 7$

$$-4 \left[\frac{3}{4}x + y = -7 \right]$$

$$3x - 4y = 28$$

4. $3x - 4y = 28$

5. $y = -\frac{2}{3}x - 4$

$$3 \left[\frac{2}{3}x + y = -4 \right]$$

$$2x + 3y = -12$$

5. $2x + 3y = -12$

6. $y = \frac{5}{2}x + 3$

$$-2 \left[\frac{5}{2}x + y = 3 \right]$$

$$5x - 2y = -6$$

6. $5x - 2y = -6$

Write the equation in the indicated form.

9. $\left\langle \begin{matrix} (4, -1) \\ (8, -6) \end{matrix} \right\rangle^{-5}$

$$m = -\frac{5}{4}$$

$$y = \frac{\Delta y}{\Delta x}x + c$$

$$y = -\frac{5}{4}x + c$$

$$-1 = -\frac{5}{4}(4) + c$$

$$4 = c$$

Slope Int $y = -\frac{5}{4}x + 4$

10. $\left\langle \begin{matrix} (-3, 4) \\ (-5, 7) \end{matrix} \right\rangle + 3$

$$m = -\frac{3}{2}$$

$$3x + 2y = c$$

$$3(-3) + 2(4) = c$$

$$-9 + 8 = c$$

$$-1 = c$$

Standard $3x + 2y = -1$

Write the slope, y intercept as an ordered pair, and x intercept as an ordered pair

11. $5x - 2y = -10$ $m = \underline{\frac{5}{2}}$ $y - \text{int} = \underline{(0, 5)}$ $x - \text{int} = \underline{(-2, 0)}$

12. $y = \frac{2}{3}x + 4$ $m = \underline{\frac{2}{3}}$ $y - \text{int} = \underline{(0, 4)}$ $x - \text{int} = \underline{(-6, 0)}$
 $2x - 3y = -12$

Write the following equations.

13. Parallel to $y = \frac{4}{3}x - 7\frac{1}{9}$ through $(2, -3)$ in standard form.

$m = \frac{4}{3}$ $m_{||} = \frac{4}{3}$ } $4x - 3y = C$
 $(2, -3)$ } $4(2) - 3(-3) = C$
 $8 + 9 = C$
 $17 = C$

13. $4x - 3y = 17$

14. Perpendicular to $x - 4y = -30$ through $(8, -1)$ in slope intercept form.

$m = \frac{1}{4}$ $m_{\perp} = -4$ } $y = -4x + C$
 $(8, -1)$ } $-1 = -4(8) + C$
 $-1 + 32 = C$
 $31 = C$

14. $y = -4x + 31$

15. Parallel to $3x - 4y = 181$ through $(-4, 2)$ in slope intercept form.

$m = \frac{3}{4}$ $m_{||} = \frac{3}{4}$ } $y = \frac{3}{4}x + C$
 $(-4, 2)$ } $2 = \frac{3}{4}(-4) + C$
 $2 = -3 + C$
 $5 = C$

15. $y = \frac{3}{4}x + 5$

Function Notation

$$f(x) = 2x^2 - 3x + 5 \quad g(x) = 2x - 3 \quad p(x) = 3x + 12 \quad h(x) = x^2 + 3x + 4$$

16. Solve $3[g(w+4)] - p(w) = \frac{2}{3}[p(2w)]$

L.H.S.

$$g(w+4) = 2[w+4] - 3$$
$$= 2w + 8 - 3$$

$$3[g(w+4)] = 3[2w + 5]$$

$$= 6w + 15$$
$$- p(w) = -[3w + 12]$$

$$= -3w - 12$$
$$3[g(w+4)] - p(w) = 6w + 15 - 3w - 12$$
$$= 3w + 3$$

R.H.S.

$$\frac{2}{3}[p(2w)] = \frac{2}{3}[3(2w) + 12]$$

$$= \frac{2}{3}[6w + 12]$$

$$= 4w + 8$$

EQUATION

$$3w + 3 = 4w + 8$$

$$3 - 8 = 4w - 3w$$

$$\boxed{-5 = w}$$

17. Solve to four decimal places $f(g(t)) = h(g(t-3))$

L.H.S.

$$f(g(t)): \quad g(t) = 2t - 3$$

$$f(2t-3) = 2[2t-3]^2 - 3[2t-3] + 5$$

$$= 2(4t^2 - 12t + 9) - 6t + 9 + 5$$

$$= 8t^2 - 24t + 18 - 6t + 9 + 5$$

$$= 8t^2 - 30t + 32$$

R.H.S.

$$h(g(t-3)): \quad g(t-3) = 2[t-3] - 3$$

$$= 2t - 6 - 3$$

$$= 2t - 9$$

$$h(2t-9) = [2t-9]^2 + 3[2t-9] + 4$$

$$= 4t^2 - 36t + 81 + 6t - 27 + 4$$

$$= 4t^2 - 30t + 58$$

EQUATION

$$8t^2 - \underline{30t} + 32 = 4t^2 - \underline{30t} + 58$$

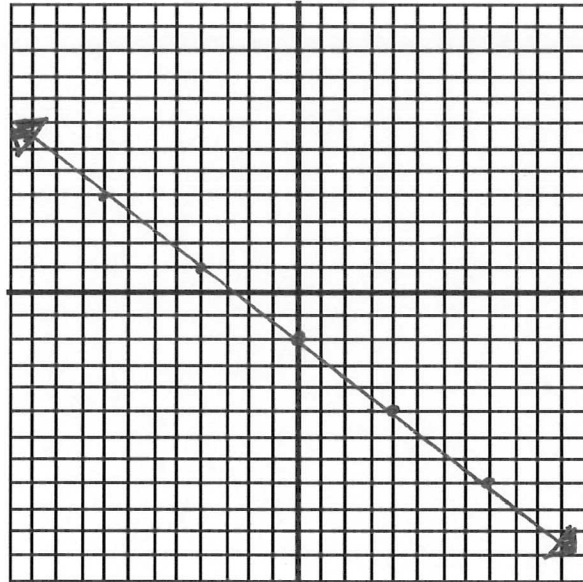
$$4t^2 - 26 = 0$$

$$t = \{-2.5495, 2.5495\} : \text{FROM QUADRATIC FORMULA}$$

Graph Each of the following

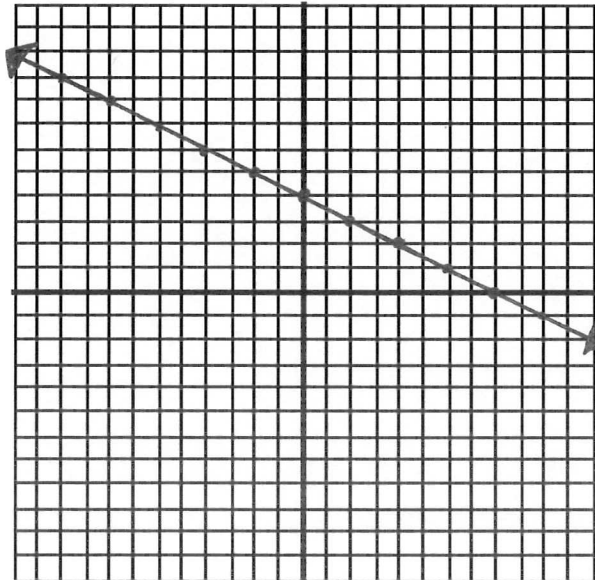
18. $y = -\frac{3}{4}x - 2$ $m = \underline{-\frac{3}{4}}$ $\frac{\text{steep_or_shallow}}{\text{incline_or_decline}}$ $\frac{\text{SHALLOW}}{\text{DECLINE}}$ $y\text{-int} = \underline{(0, -2)}$

x	y
-8	4
-4	1
0	-2
4	-5
8	-8



19. $x + 2y = 8$ $m = \underline{-\frac{1}{2}}$ $\frac{\text{steep_or_shallow}}{\text{incline_or_decline}}$ $\frac{\text{SHALLOW}}{\text{DECLINE}}$ $y\text{-int} = \underline{(0, 4)}$

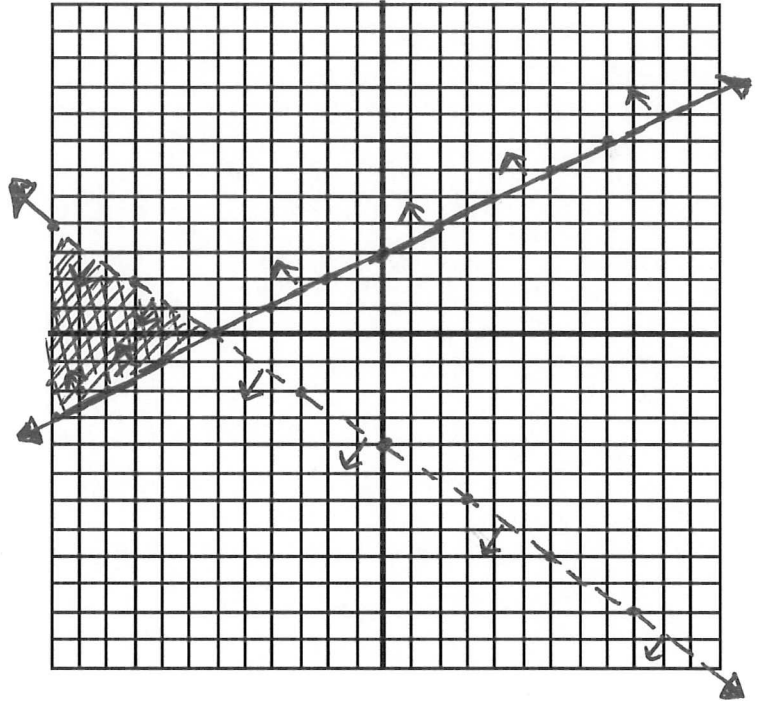
x	y
-4	6
-2	5
0	4
2	3
4	2



Graph The System of Inequalities (Only shade the region that solves the system)

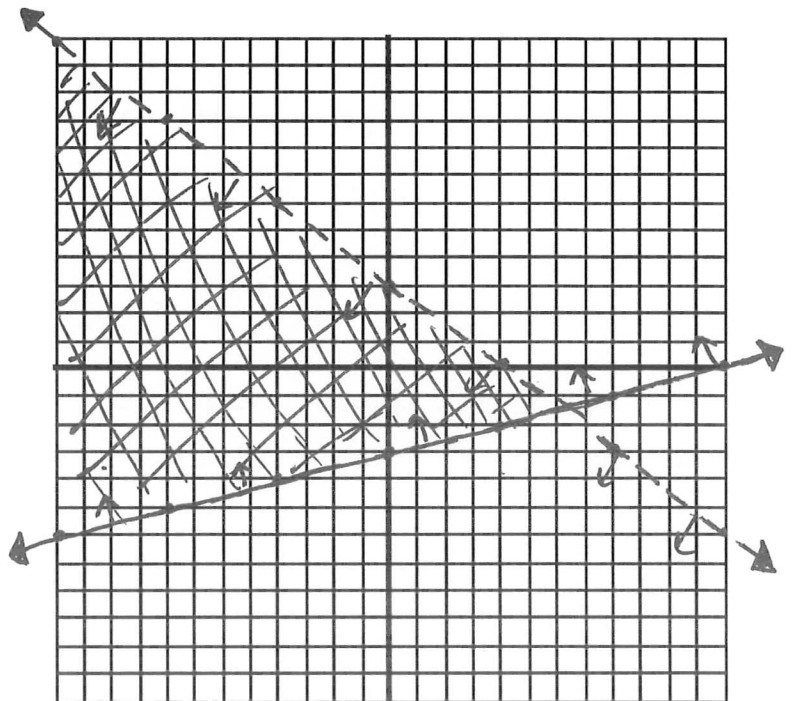
20.

$$y \geq \frac{1}{2}x + 3 \quad \begin{cases} \rightarrow m = 1/2 \\ \rightarrow (0, 3) \end{cases}$$
$$y < \frac{-2}{3}x - 4 \quad \begin{cases} \rightarrow m = -2/3 \\ \rightarrow (0, -4) \end{cases}$$



21.

$$y \geq \frac{1}{4}x - 3 \quad \begin{cases} \rightarrow m = 1/4 \\ \rightarrow (0, -3) \end{cases}$$
$$3x + 4y < 12 \quad \begin{cases} \rightarrow m = -3/4 \\ \rightarrow (0, 3) \end{cases}$$



Graph The System of Inequalities (Only shade the region that solves the system)

22.

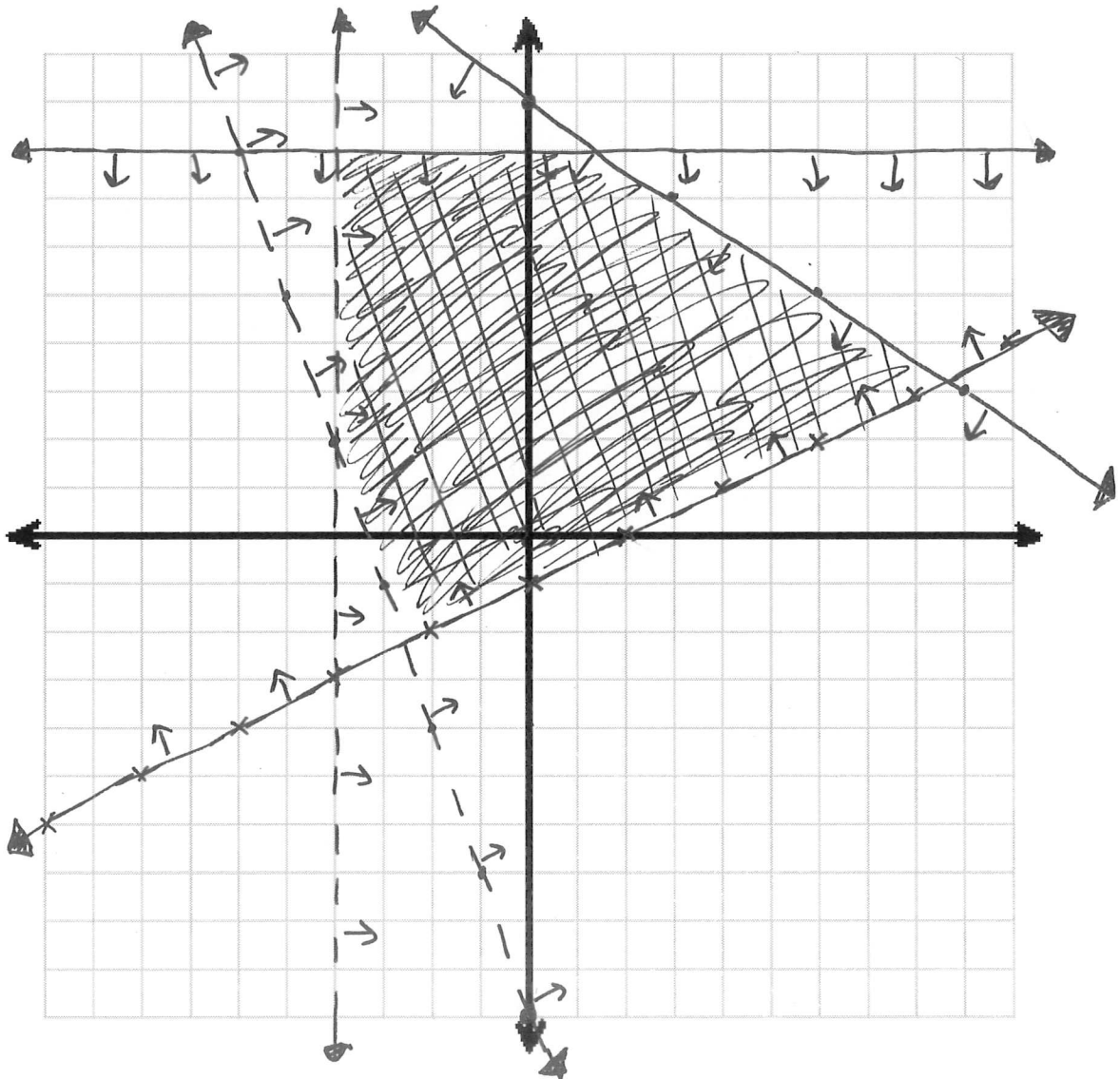
$$y \leq \frac{-2}{3}x + 9 \quad \begin{cases} \rightarrow m = -2/3 \\ \rightarrow (0, 9) \end{cases}$$

$$y > -3x - 10 \quad \begin{cases} \rightarrow m = -3 \\ \rightarrow (0, -10) \end{cases}$$

$$x - 2y \leq 2 \quad \begin{cases} \rightarrow m = \frac{1}{2} \\ \rightarrow (0, -1) \end{cases}$$

VERTICAL $x > -4$

HORIZONTAL $y \leq 8$



REGION WITH FIVE SHADINGS

$$23. h(x) = \begin{cases} -[x] + 1, \dots -\infty < x \leq -6 & : \text{SECTION 1} \\ -2|x+4| + 8, \dots (-6, -1] & : \text{SECTION 2} \\ 5, \dots (-1, 1] & : \text{SECTION 3} \\ -(x-3)^2 + 5, \dots 1 < x < 4 & : \text{SECTION 4} \\ [x] + 1, \dots [4, 7) & : \text{SECTION 5} \\ -x + 1, \dots 7 \leq x < \infty & : \text{SECTION 6} \end{cases}$$

SECTION 1:

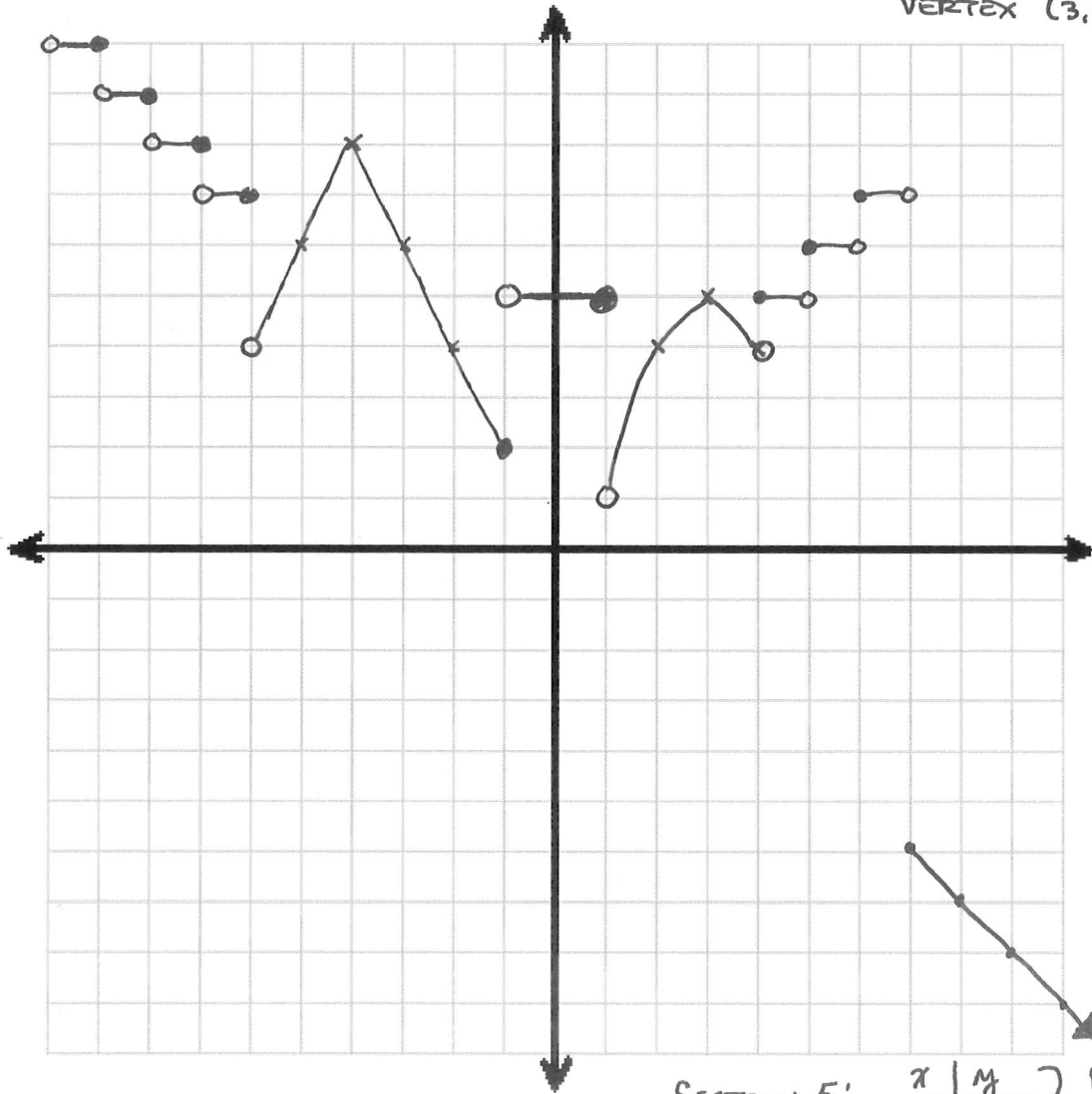
x	M
-9.3	10
-8.7	9
-7.6	8
-6.2	7

 } CEILING
RIGHT ENDPOINT

SECTION 2: ABSOLUTE VALUE
 VERTEX $(-4, 8)$
 OPENS DOWN
 SLOPES ± 2 } OPEN AT $x = -6$
 CLOSED AT $x = -1$

SECTION 3: HORIZONTAL LINE
 OPEN AT $x = -1$ CLOSED AT $x = 1$

SECTION 4: STANDARD PARABOLA
 OPENS DOWNWARD
 VERTEX $(3, 5)$ } OPEN POINTS AT BOTH
 $x = 1$ AND
 $x = 4$



SECTION 5:

x	M
4.2	5
5.6	6
6.9	7

 } FLOOR
LEFT ENDPOINT

SECTION 6: SIMPLE LINEAR FUNCTION
 $m = -1/1$
 POINT IN INTERVAL $(8, -7)$
 CLOSED AT $x = 7$

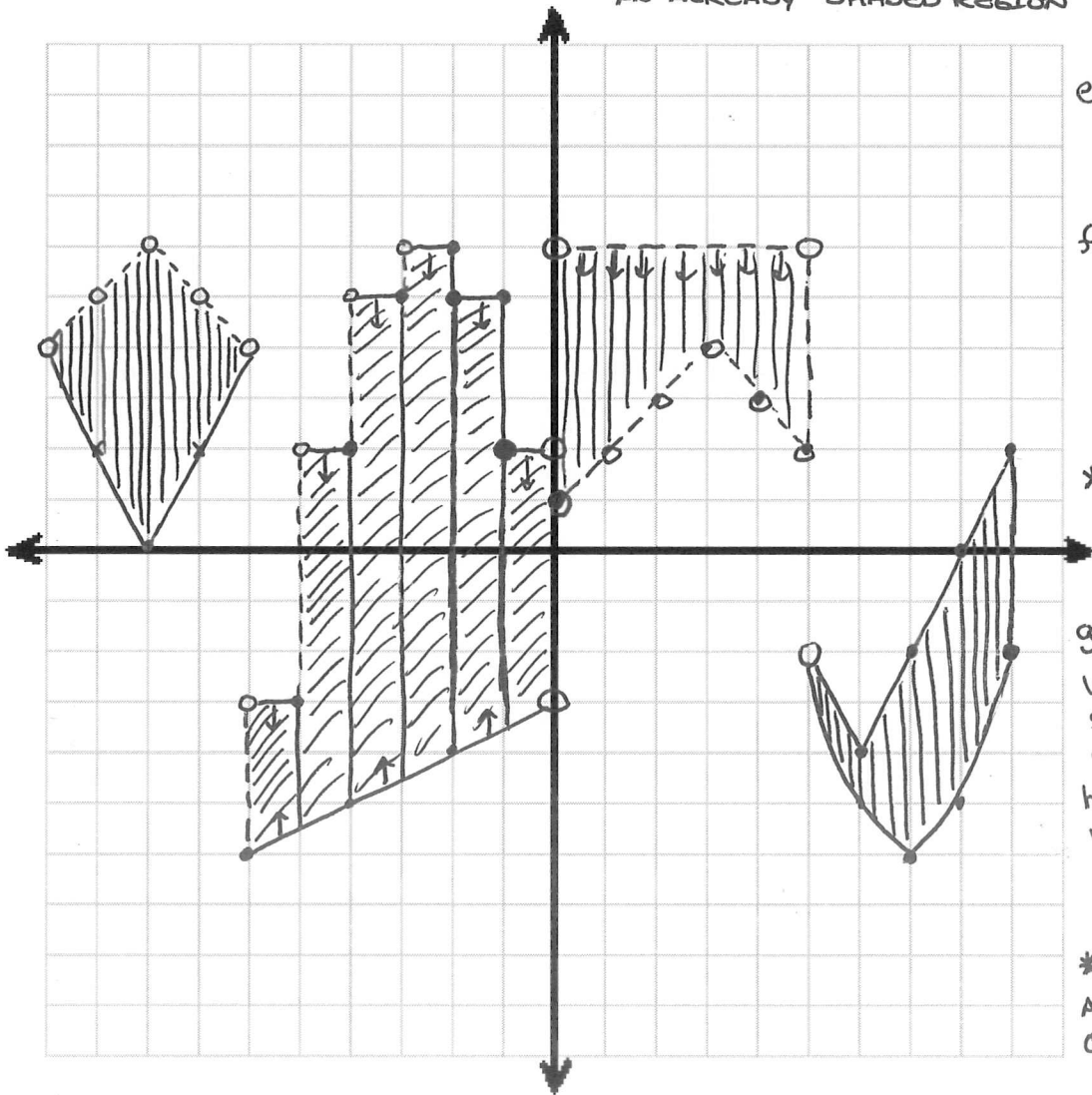
Graph each system independently (create the four regions for solutions)

$$\begin{aligned}
 & \left. \begin{aligned} a(x) &\geq 2|x+8| \\ b(x) &< -|x+8|+6 \end{aligned} \right\} \text{for...}(-\infty, -6) \\
 & \left. \begin{aligned} c(x) &\leq -|x+2|^2 + 6 \\ d(x) &\geq \frac{1}{2}x - 3 \end{aligned} \right\} \text{for...}[-6, 0) \\
 24. & \left. \begin{aligned} e(x) &< 6 \\ f(x) &> -|x-3|+4 \end{aligned} \right\} \text{for...}[0, 5] \\
 & \left. \begin{aligned} g(x) &\geq (x-7)^2 - 6 \\ h(x) &\leq 2|x-6|-4 \end{aligned} \right\} \text{for...}(5, 9]
 \end{aligned}$$

$a(x)$: ABSOLUTE VALUE / VERTEX $(0, -8)$
 SLOPE ± 2 / OPENS UP
 $b(x)$: ABSOLUTE VALUE / VERTEX $(-8, 6)$
 SLOPE ± 1 / OPENS DOWN
 (CANNOT HAVE EDGE OF STRICT INEQUALITY)

$c(x)$: STEP FUNCTION MERGED WITH PARABOLA
 CEILING: CLOSED CIRCLES TO RIGHT AND THOSE POINTS WILL REPRESENT POINTS OF PARABOLA
 VERTEX $(-2, 6)$ / STANDARD / OPENS DOWN

$d(x)$: LINEAR FUNCTION
 SLOPE $1/2$ $(0, -3) \Rightarrow$ OPEN
 * TECHNICALLY $(-2, 5)$ AND $(-1, 2)$ SHOULD BE SHADED BECAUSE THOSE POINTS FALL BELOW AN ALREADY SHADED REGION



$e(x)$: HORIZONTAL LINE; ALL OPEN AS IT IS A STRICT INEQUALITY

$f(x)$: ABSOLUTE VALUE / VERTEX $(3, 4)$
 OPENS DOWN
 SLOPE ± 1 , BUT SHADES UP
 * ALL POINTS AROUND REGION SHOULD BE OPEN.

$g(x)$: PARABOLA
 VERTEX $(7, -6)$
 STANDARD OPENS UPWARD

$h(x)$: ABSOLUTE VALUE
 VERTEX $(6, -4)$
 SLOPE ± 2

* OPEN POINT AT $x=5$
 CLOSED AT $x=9$

$$f(x) = 3x^2 - 2x + 5 \quad g(x) = 5x - 3 \quad p(x) = 4x + 1 \quad h(x) = x^2 + 2x - 1$$

25. Solve $h\left(p\left(\frac{7}{4}z - 3\right)\right) - 7 = 3[f(z)] - 2[g(z)] - 2[p(1)]$

L.H.S.

$$h\left(p\left(\frac{7}{4}z - 3\right)\right) - 7 :$$

$$h(7z - 11) - 7$$

$$49z^2 - 140z + 98 - 7$$

$$49z^2 - 140z + 91$$

$$p\left(\frac{7}{4}z - 3\right) = 4\left[\frac{7}{4}z - 3\right] + 1$$

$$= 7z - 12 + 1$$

$$= 7z - 11$$

$$h(7z - 11) = [7z - 11]^2 + 2[7z - 11] - 1$$

$$= 49z^2 - 154z + 121 + 14z - 22 - 1$$

$$= 49z^2 - 140z + 98$$

R.H.S.

$$3[f(z)] - 2[g(z)] - 2[p(1)]$$

$$9z^2 - 6z + 15 - 10z + 6 - 10$$

$$9z^2 - 16z + 5 + 6$$

$$3[f(z)] = 3[3z^2 - 2z + 5]$$

$$= 9z^2 - 6z + 15$$

$$-2[g(z)] = -2[5z - 3]$$

$$= -10z + 6$$

$$-2[p(1)] = -2[4(1) + 1]$$

$$= -2[5]$$

$$= -10$$

EQUATION

$$49z^2 - 140z + 91 = 9z^2 - 16z + 5 + 6$$

$$40z^2 - 124z + 80 = 0$$

$$z = \{.9156, 2.1844\} \quad \text{FROM QUADRATIC FORMULA}$$