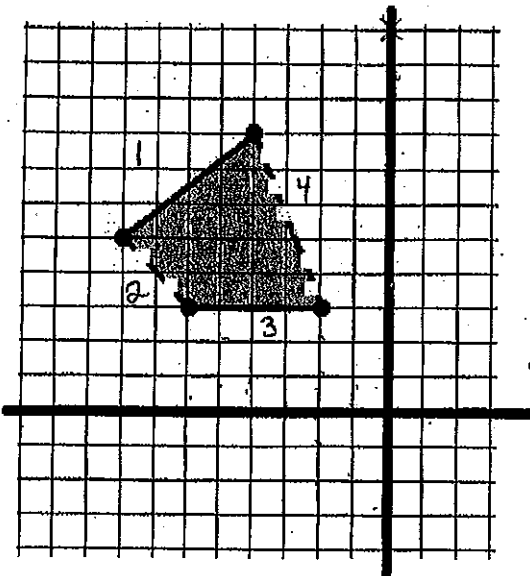


Advanced Precalculus
More with Lines

Name: Key

Find the system of inequalities for the graph below.



1.) $m = \frac{3}{4}$
 $(-4, 8)$

$$y - y_1 = m(x - x_1)$$

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

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

$$\underline{y = \frac{3}{4}x + 11} \text{ (below)}$$

2.) $m = -1$
 $(-6, 3)$

$$y - y_1 = m(x - x_1)$$

$$y - 3 = -1(x + 6)$$

$$y - 3 = -x - 6$$

$$y = -x - 3 \text{ (above)}$$

3.) $y = 3$ (above)

4.) $m = -\frac{5}{2}$
 $(-2, 3)$

$$y - y_1 = m(x - x_1)$$

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

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

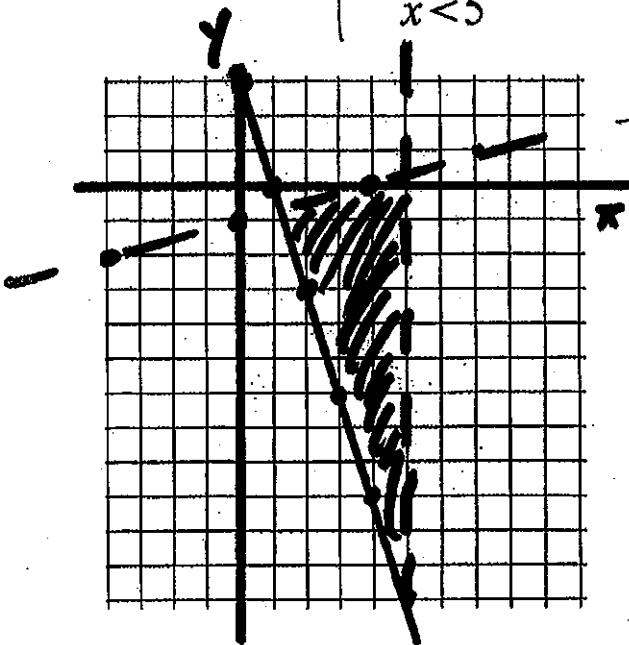
$$y = -\frac{5}{2}x - 2 \text{ (below)}$$

Answer:

$$\begin{cases} y \leq \frac{3}{4}x + 11 \\ y > -x - 3 \\ y \geq 3 \\ y < -\frac{5}{2}x - 2 \end{cases}$$

$$\begin{cases} 3x + y \geq 3 \\ x - 4y > 4 \\ x < 5 \end{cases}$$

2.) Graph:



$$-4y > -x + 4$$

$$y < \frac{x}{4} - 1$$

$$\begin{cases} y \geq -3x + 3 \text{ above} \\ y < \frac{x}{4} - 1 \text{ below} \\ x < 5 \text{ left} \end{cases}$$

Write the equation of the line using point-slope form for each of the following.
Write your answer in slope-intercept form and in standard form.

3.) Point: $(-\frac{5}{4}, -1)$; Slope = $\frac{2}{5}$

$$y - y_1 = m(x - x_1)$$

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

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

$$y = \frac{2}{5}x - \frac{1}{2}$$

$$10y = 4x - 5$$

$$4x - 10y = 5$$

4.) Point: $(\frac{1}{3}, -9)$; Slope = -4

$$y - y_1 = m(x - x_1)$$

$$y + 9 = -4(x - \frac{1}{3})$$

$$y + 9 = -4x + \frac{4}{3}$$

$$y = -4x - \frac{23}{3}$$

$$3y = -12x - 23$$

$$12x + 3y = -23$$

5.) Containing $(9, -2)$ and $(-8, 10)$

$$m = \frac{10 - (-2)}{-8 - 9} = \frac{12}{-17}$$

$$y - y_1 = m(x - x_1)$$

$$y + 2 = \frac{-12}{17}(x - 9)$$

$$y + 2 = \frac{-12}{17}x + \frac{108}{17}$$

$$y = \frac{-12}{17}x + \frac{74}{17}$$

$$17y = -12x + 74 \rightarrow 12x + 17y = 74$$

6.) Containing $(-\frac{3}{2}, -\frac{1}{3})$ and $(\frac{5}{4}, \frac{7}{2})$

$$m = \frac{\frac{7}{2} + \frac{1}{3}}{\frac{5}{4} + \frac{3}{2}} = \frac{\frac{42 + 4}{6}}{\frac{15 + 18}{4}} = \frac{46}{33}$$

$$(\frac{5}{4}, \frac{7}{2})$$

$$y - y_1 = m(x - x_1)$$

$$y - \frac{7}{2} = \frac{46}{33}(x - \frac{5}{4})$$

$$y - \frac{7}{2} = \frac{46}{33}x - \frac{115}{66}$$

$$y = \frac{46}{33}x + \frac{58}{33}$$

$$33y = 46x + 58$$

$$46x - 33y = -58$$

7.) Containing $(2, -2)$,

parallel to $x - 2y = -6$

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

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

$$m = \frac{1}{2}$$

$$m_{\text{parallel}} = \frac{1}{2}$$

$$(2, -2)$$

$$y + 2 = \frac{1}{2}(x - 2)$$

$$y + 2 = \frac{1}{2}x - 1$$

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

$$2y = x - 6$$

$$x - 2y = 6$$

8.) Containing $(-\frac{1}{5}, \frac{1}{4})$,

perpendicular to $-3x + 5y = 10$

$$5y = 3x + 10$$

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

$$m = \frac{3}{5}$$

$$m_{\text{perp}} = -\frac{5}{3}$$

$$(-\frac{1}{5}, \frac{1}{4})$$

$$y - \frac{1}{4} = -\frac{5}{3}(x + \frac{1}{5})$$

$$y - \frac{1}{4} = -\frac{5}{3}x - \frac{1}{3}$$

$$y = -\frac{5}{3}x - \frac{1}{12}$$

$$12y = -20x - 1$$

$$20x + 12y = -1$$

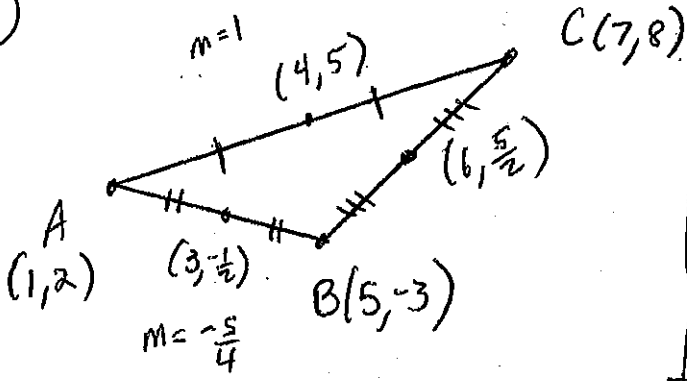
9.) (Separate Paper!!)

Given $\triangle ABC$ with $A(1, 2)$, $B(5, -3)$, $C(7, 8)$, find the following:

- 1.) Coordinates of Circumcenter (where perpendicular bisectors intersect)
- 2.) Coordinates of Orthocenter (where altitudes intersect)
- 3.) Coordinates of Centroid (where medians intersect)

See next pages!

9



AC: $m = \frac{8-2}{7-1} = \frac{6}{6} = 1$
 Midpt = $(\frac{1+7}{2}, \frac{2+8}{2}) = (4, 5)$

AB: $m = \frac{-3-2}{5-1} = \frac{-5}{4}$
 Midpt = $(\frac{1+5}{2}, \frac{2+(-3)}{2}) = (3, -\frac{1}{2})$

BC: $m = \frac{8+3}{7-5} = \frac{11}{2}$
 Midpt = $(\frac{5+7}{2}, \frac{-3+8}{2}) = (6, \frac{5}{2})$

1.) Circumcenter (Perpendicular Bisectors)

AB: $m = \frac{4}{5}, (3, -\frac{1}{2})$

$y + \frac{1}{2} = \frac{4}{5}(x-3)$

$y + \frac{1}{2} = \frac{4}{5}x - \frac{12}{5}$

$y = \frac{4}{5}x - \frac{29}{10}$

AC: $m = -1, (4, 5)$

$y - 5 = -1(x-4)$

$y - 5 = -x + 4$

$y = -x + 9$

BC: $m = -\frac{2}{11}, (6, \frac{5}{2})$

$y - \frac{5}{2} = -\frac{2}{11}(x-6)$

$y - \frac{5}{2} = -\frac{2}{11}x + \frac{12}{11}$

$y = -\frac{2}{11}x + \frac{79}{22}$

$(\frac{119}{18}, \frac{43}{18})$

Circumcenter

$$\begin{cases} y = \frac{4}{5}x - \frac{29}{10} \\ y = -\frac{2}{11}x + \frac{79}{22} \\ y = -x + 9 \end{cases}$$

$10(\frac{4}{5}x - \frac{29}{10}) = (-x + 9)10$

$8x - 29 = -10x + 90$

$18x = 119$

$x = \frac{119}{18}$

$y = -x + 9$

$y = \frac{119}{18} + 9$

$y = \frac{43}{18}$

2.) Orthocenter (Altitudes)

AB: $m = \frac{4}{5}, (7, 8)$
 vertex C

$y - 8 = \frac{4}{5}(x-7)$

$y - 8 = \frac{4}{5}x - \frac{28}{5}$

$y = \frac{4}{5}x + \frac{12}{5}$

AC: $m = -1, (5, -3)$
 vertex B

$y + 3 = -1(x-5)$

$y + 3 = -x + 5$

$y = -x + 2$

BC: $m = -\frac{2}{11}, (1, 2)$
 vertex A

$y - 2 = -\frac{2}{11}(x-1)$

$y - 2 = -\frac{2}{11}x + \frac{2}{11}$

$y = -\frac{2}{11}x + \frac{24}{11}$

$(-\frac{2}{9}, \frac{20}{9})$

Orthocenter $y = x + 2$

$y = \frac{2}{9} + 2 = \frac{20}{9}$

$$\begin{cases} y = \frac{4}{5}x + \frac{12}{5} \\ y = -\frac{2}{11}x + \frac{24}{11} \\ y = -x + 2 \end{cases}$$

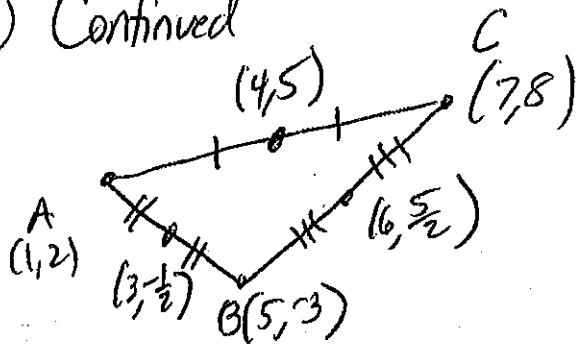
$5(\frac{4}{5}x + \frac{12}{5}) = (-x + 2)5$

$4x + 12 = -5x + 10$

$9x = -2$

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

9) Continued



3.) Centroid (Medians)

$$\overline{AB} = (3, \frac{1}{2}) \text{ to } (7, 8)$$

$$m = \frac{8 + \frac{1}{2}}{7 - 3} = \frac{\frac{17}{2}}{4} = \frac{17}{8}$$

$$m = \frac{17}{8}; (7, 8)$$

$$y - 8 = \frac{17}{8}(x - 7)$$

$$y - 8 = \frac{17}{8}x - \frac{119}{8}$$

$$\boxed{y = \frac{17}{8}x - \frac{55}{8}}$$

$$\overline{AC} = (4, 5) \text{ to } (5, -3)$$

$$m = \frac{-3 - 5}{5 - 4} = \frac{-8}{1} = -8$$

$$m = -8; (4, 5)$$

$$y - 5 = -8(x - 4)$$

$$y - 5 = -8x + 32$$

$$\boxed{y = -8x + 37}$$

$$\star \boxed{\left(\frac{13}{3}, \frac{7}{3}\right)}$$

Centroid

$$\overline{BC} = (6, \frac{5}{2}) \text{ to } (1, 2)$$

$$m = \frac{2 - \frac{5}{2}}{1 - 6} = \frac{-\frac{1}{2}}{-5} = \frac{1}{10}$$

$$m = \frac{1}{10}; (1, 2)$$

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

$$y - 2 = \frac{1}{10}x - \frac{1}{10}$$

$$\boxed{y = \frac{1}{10}x + \frac{19}{10}}$$

$$\begin{cases} y = \frac{17}{8}x - \frac{55}{8} \\ y = \frac{1}{10}x + \frac{19}{10} \\ y = -8x + 37 \end{cases}$$

$$10(-8x + 37) = \left(\frac{1}{10}x + \frac{19}{10}\right)10$$

$$-80x + 370 = x + 19$$

$$351 = 81x$$

$$\frac{351}{81} = \frac{13}{3}$$

$$x = \frac{13}{3}$$

$$\downarrow$$

$$y = -8\left(\frac{13}{3}\right) + 37$$

$$y = \frac{7}{3}$$