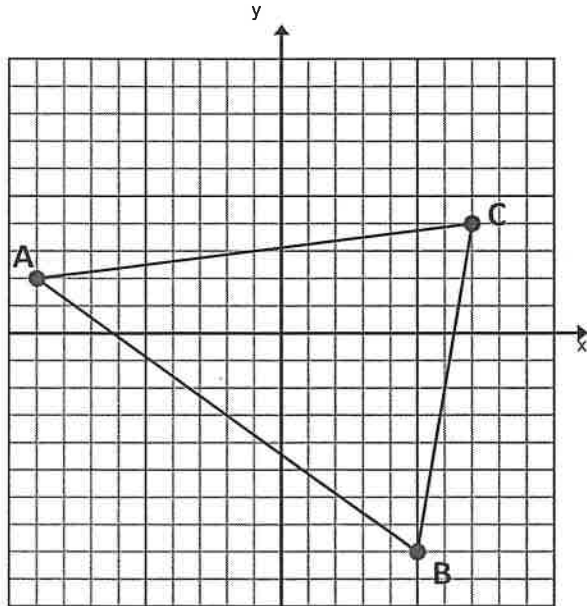


Relationships in Triangles Activity VERSION A

Use the triangle with the following vertices $A(-9, 2)$, $B(5, -8)$, and $C(7, 4)$ to complete the following tasks and find the circumcenter. Use exact values.



1. Write the equation for the perpendicular bisector of each of the sides of $\triangle ABC$ in slope-intercept form. Use this table to help gather the information you need to write the equations.

	Midpoint	Slope	\perp Slope
\overline{AB}	$(-2, -3)$	$-5/7$	$7/5$
\overline{BC}	$(6, -2)$	6	$-1/6$
\overline{CA}	$(-1, 3)$	$1/8$	-8

$$\begin{aligned} \perp \text{ bisector of } AB & \quad y = \frac{7}{5}x - \frac{1}{5} \\ \perp \text{ bisector of } BC & \quad y = -\frac{1}{6}x - 1 \\ \perp \text{ bisector of } CA & \quad y = -8x - 5 \end{aligned}$$

2. Use a system of equations to solve for the point of intersection of the perpendicular bisectors of AB and BC. Show work.

$$\begin{aligned} y &= \frac{7}{5}x - \frac{1}{5} & \frac{7}{5}x - \frac{1}{5} &= -\frac{1}{6}x - 1 & y &= \frac{7}{5}x - \frac{1}{5} \\ y &= -\frac{1}{6}x - 1 & \frac{47}{30}x - \frac{1}{5} &= -1 & y &= \frac{7}{5}\left(-\frac{24}{47}\right) - \frac{1}{5} \\ & & \frac{47}{30}x &= -\frac{4}{5} & y &= -\frac{168}{235} - \frac{1}{5} \\ & & x &= -\frac{24}{47} & y &= -\frac{43}{47} \end{aligned}$$

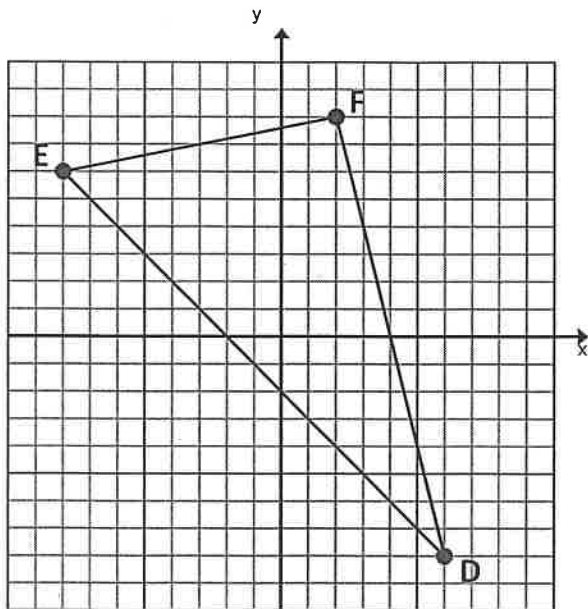
3. Check that your solution in problem #2 works for the perpendicular bisector of CA.

$$\begin{aligned} y &= -8x - 5 & \left(-\frac{43}{47}\right) &= -8\left(-\frac{24}{47}\right) - 5 \\ & & \left(-\frac{43}{47}\right) &= \frac{192}{47} - 5 & \left(-\frac{43}{47}\right) &= -\frac{43}{47} \end{aligned}$$

4. What is the circumcenter of $\triangle ABC$ based on the solution to your system of equations? $\left(-\frac{24}{47}, -\frac{43}{47}\right)$

5. Graph each of your perpendicular bisectors on the given graph to check your answer.

Use the triangle with the following vertices $D(6, -8)$, $E(-8, 6)$, and $F(2, 8)$ to complete the following tasks and find the centroid. Use exact values.



6. Write the equation for the medians of each of the sides of $\triangle DEF$ in slope-intercept form. Use this table to help gather the information you need to write the equations.

	Midpoint	Opp. Vertex	Slope of Median
\overline{DE}	$(-1, -1)$	$F(2, 8)$	3
\overline{EF}	$(-3, 7)$	$D(6, -8)$	$-5/3$
\overline{FD}	$(4, 0)$	$E(-8, 6)$	$-1/2$

Median of DE $y = 3x + 2$

Median of EF $y = -\frac{5}{3}x + 2$

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

7. Use a system of equations to solve for the point of intersection of the medians of DE and EF . Show work.

$$y = 3x + 2$$

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

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

$$\frac{14}{3}x + 2 = 2$$

$$\frac{14}{3}x = 0$$

$$x = 0$$

$$y = 3(0) + 2$$

$$y = 2$$

8. Check that your solution in problem #2 works for the median of FD .

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

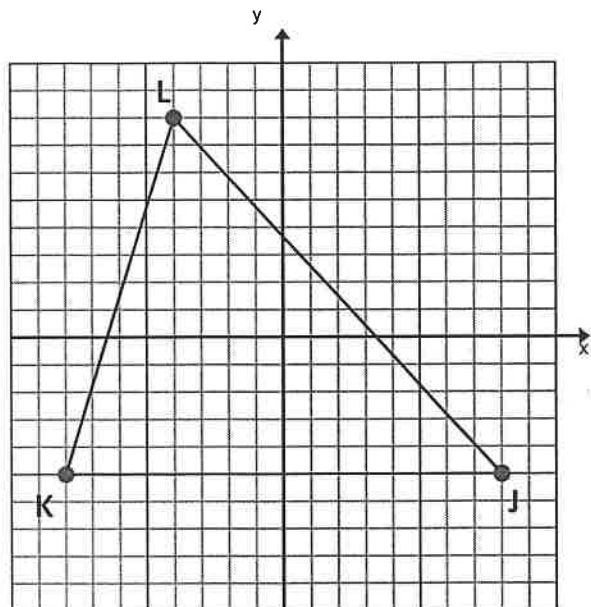
$$(2) = -\frac{1}{2}(0) + 2$$

$$(2) = 2$$

9. What is the centroid of $\triangle DEF$ based on the solution to your system of equations? $(0, 2)$

10. Graph each of your medians on the given graph to check your answer.

Use the triangle with the following vertices $J(8, -5)$, $K(-8, -5)$, and $L(-4, 8)$ to complete the following tasks and find the orthocenter. Use exact values.



11. Write the equation for the altitudes of each of the sides of $\triangle JKL$ in slope-intercept form. Use this table to help gather the information you need to write the equations.

	Opp. Vertex	Slope	\perp Slope
\overline{JK}	$L(-4, 8)$	0	Undefined
\overline{KL}	$J(8, -5)$	$13/4$	$-4/13$
\overline{LJ}	$K(-8, -5)$	$-13/12$	$12/13$

Altitude of JK $x = -4$

Altitude of KL $y = -\frac{4}{13}x - \frac{33}{13}$

Altitude of LJ $y = \frac{12}{13}x + \frac{31}{13}$

12. Use a system of equations to solve for the point of intersection of the altitudes of JK and KL . Show work.

$$x = -4$$

$$y = -\frac{4}{13}(-4) - \frac{33}{13}$$

$$y = -\frac{4}{13}x - \frac{33}{13}$$

$$y = \frac{16}{13} - \frac{33}{13}$$

$$y = -\frac{17}{13}$$

13. Check that your solution in problem #2 works for the altitude of LJ .

$$y = \frac{12}{13}x + \frac{31}{13}$$

$$\left(-\frac{17}{13}\right) = \frac{12}{13}(-4) + \frac{31}{13}$$

$$\left(-\frac{17}{13}\right) = -\frac{48}{13} + \frac{31}{13}$$

$$\left(-\frac{17}{13}\right) = -\frac{17}{13}$$

14. What is the orthocenter of $\triangle JKL$ based on the solution to your system of equations? $\left(-4, -\frac{17}{13}\right)$

15. Graph each of your altitudes on the given graph to check your answer.