Finding Medians, Altitudes, and ⊥ Bisectors
in order to find the Centroid, Orthocenter, and Circumcenter
Worksheet₁

In exercise 1-7, use $\triangle RST$ with coordinates $R(-6,-8), S(6,4)$, and $T(-6,10)$.

1.) Plot points R, S, and T.

2.) Find the equation of the median from R.

    a.) Find the midpoint of $\overline{ST}$, label it Z.

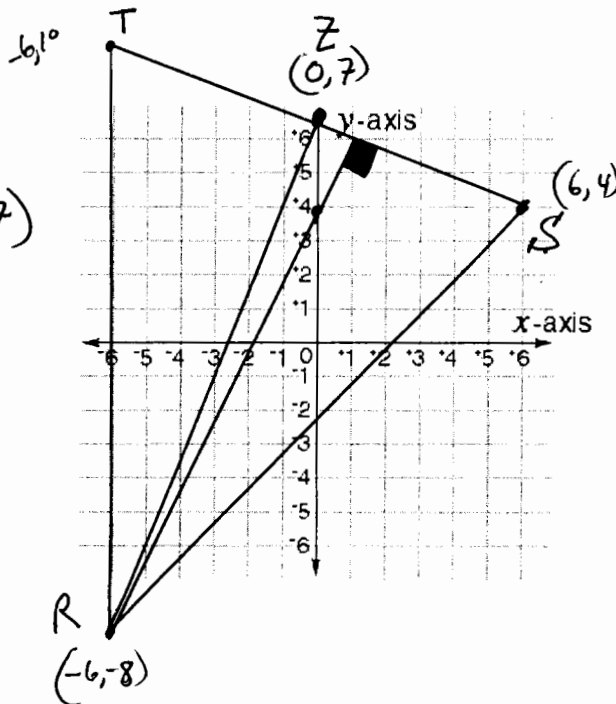$$\left(\frac{-6+6}{2}, \frac{10+4}{2}\right) = (0,7)$$

    b.) Find the slope of $\overline{RZ}$.

$$\frac{7--8}{0--6} = \frac{15}{6} = \frac{5}{2}$$

    c.) Find the equation of the median from R.

$$y - 7 = \frac{5}{2}(x-0)$$
$$y = \frac{5}{2}x + 7$$

[Graph showing triangle RST plotted with T at (-6,10), Z at (0,7), S at (6,4), R at (-6,-8), with x-axis and y-axis labeled]

3.) Find the equation of the altitude from R.

    a.) Find the slope of $\overline{ST}$.

$$\frac{10-4}{-6-6} = \frac{6}{-12} = -\frac{1}{2}$$

    b.) Find the slope perpendicular to $\overline{ST}$.

$$2 \ \left(\text{neg. rec. of } -\tfrac{1}{2}\right)$$

    c.) Find the equation of the altitude from R.

$$\text{through } (-6,-8) \text{ w/ } m = 2$$
$$y + 8 = 2(x+6)$$
$$y = 2x + 4$$

4.) Find the equation of the perpendicular bisector of $\overline{ST}$.

$$\text{Through } (0,7) \quad \text{slope is neg rec. of } -\tfrac{1}{2}, \text{ so } m = 2$$
$$y - 7 = 2(x-0)$$
$$y = 2x + 7$$

5.) Find the coordinates of the centroid of $\triangle RST$. If you can find the centroid formula, you may use it. Otherwise, you will need to find the equations of two medians and then find their intersection.

Centroid Formula – $\left(\dfrac{x_1 + x_2 + x_3}{3}, \dfrac{y_1 + y_2 + y_3}{3} \right)$

$$\left(\frac{-6+6+-6}{3}, \frac{-8+4+10}{3} \right)$$

$$(-2, 2)$$

6.) Find the coordinates of the circumcenter of $\triangle RST$.

    a.) Find the midpoint of $\overline{RS}$.

$$\left(\frac{6+-6}{2}, \frac{-8+4}{2} \right) = (0, -2)$$

    b.) Find the slope of $\overline{RS}$.

$$\frac{-8-4}{-6-6} = \frac{-12}{-12} = 1$$

    c.) Find the slope perpendicular to $\overline{RS}$.

$$-1$$

    d.) Find the equation of the perpendicular bisector.

through $(0,-2)$ w/ $m = -1$ $y+2 = -(x-0)$
$$y = -x - 2$$

    e.) Find the coordinates of the point of intersection of 4.) and 6(d) equations, which is the coordinate of the circumcenter.

$y = 2x + 7$

$y = -x - 2$ using subst. $-x-2 = 2x + 7$

$-9 = 3x$

$-3 = x$ so $y = 1$ $(-3, 1)$ ✓

7.) Find the equation of the Euler line. If you don't know what an Euler Line is, use the Internet to look it up.

The line on which the orthocenter, centroid, circumcenter

$(-2, 2)$ $(-3, 1)$

$m = \dfrac{2-1}{-2--3} = \dfrac{1}{1} = 1$

$y - 1 = 1(x + 3)$
$y = x + 4$ ✓