

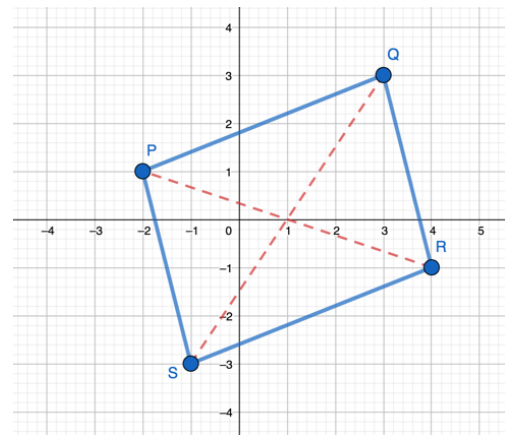
**Formulas we will need:**

$$\text{Midpoint} = \left( \frac{x_1+x_2}{2}, \frac{y_1+y_2}{2} \right)$$

$$\text{Length} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\text{Equation of a circle: } x^2 + y^2 = r^2$$

**Example 1:** Verify that the diagonals of the parallelogram with vertices  $P(-2,1)$ ,  $Q(3,3)$ ,  $R(4,-1)$ , and  $S(-1,-3)$  bisect each other.



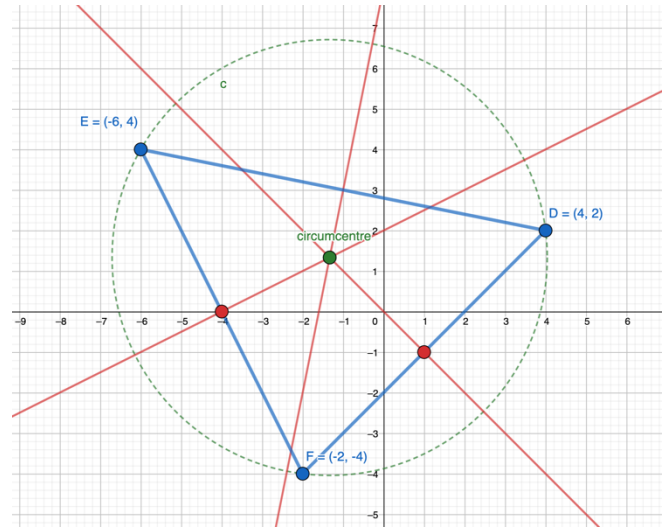
**Example 2:** The vertices of a triangle are  $A(-3,6)$ ,  $B(1,-6)$  and  $C(5,2)$ . If  $M$  is the midpoint of  $AB$  and  $N$  is the midpoint of  $AC$ , verify that

a)  $MN$  is parallel to  $BC$

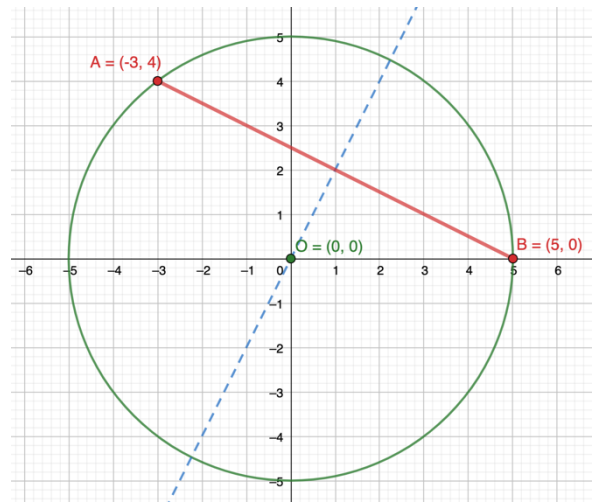
b)  $MN$  is half the length of  $BC$

**Example 3:**  $\triangle DEF$  has vertices  $D(4,2)$ ,  $E(-6,4)$ , and  $F(-2,-4)$ . Determine the coordinates of the circumcentre of  $\triangle DEF$ . The circumcentre is the point of intersection of the right bisectors of the sides of a triangle.

<https://www.geogebra.org/calculator/brabwjsq>



**Example 4:** The equation of a circle with centre  $O(0,0)$  is  $x^2 + y^2 = 25$ . The points  $A(-3,4)$  and  $B(5,0)$  are the endpoints of chord  $AB$ . Verify that the centre of the circle lies on the right bisector of chord  $AB$ .



**Example 5:** Find the distance from the point  $P(-1,3)$  to the line  $x + y - 5 = 0$ , to the nearest tenth of a unit.

**Steps to find shortest distance from a point to a line:**

- 1) Write an equation for the line that is perpendicular to the given line and intersects the point given
- 2) Find the point of intersection of the perpendicular line with the given line
- 3) Find the distance between the POI and the given point.

