9.1 Polygons in a Coordinate Plane

Formula Review:

Distance Formula:
Where (x_1, y_1) and (x_2, y_2) are points on the coordinate plane.

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

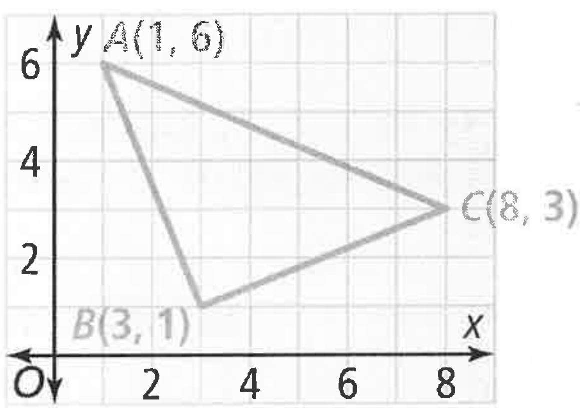
Midpoint Formula:
Where (x_1, y_1) and (x_2, y_2) are points on the coordinate plane.

midpoint: $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Slope Formula:
Where (x_1, y_1) and (x_2, y_2) are points on the coordinate plane.

slope $= \frac{y_2 - y_1}{x_2 - x_1}$

Example 1: Classify the triangle on the coordinate plane.



Find the side lengths.

$AC = \sqrt{(1-8)^2 + (6-3)^2} = \sqrt{(-7)^2 + (3)^2} = \sqrt{58}$

same length

$AB = \sqrt{(1-3)^2 + (6-1)^2} = \sqrt{(-2)^2 + (5)^2} = \sqrt{29}$

$BC = \sqrt{(8-3)^2 + (3-1)^2} = \sqrt{(5)^2 + (2)^2} = \sqrt{29}$

Find the slope of the sides.

$AB = \frac{6-1}{1-3} = \frac{5}{-2}$ $BC = \frac{3-1}{8-3} = \frac{2}{5}$

$AC = \frac{6-3}{1-8} = \frac{3}{-7}$ $AB \perp BC$

$\triangle ABC$ is an isosceles right $\triangle$

Example 2: The vertices of ΔPQR are P(4, 1), Q(2, 7) and R(8, 5).

a) Is ΔPQR equilateral, isosceles or scalene?

$PQ = \sqrt{(4-2)^2 + (1-7)^2} = \sqrt{2^2 + (-6)^2} = \sqrt{40}$

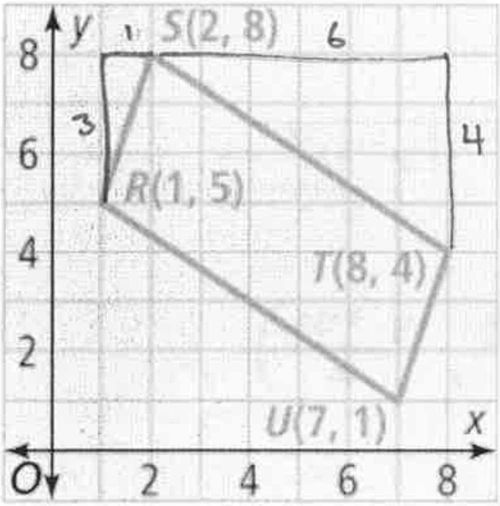
$PR = \sqrt{(4-8)^2 + (1-5)^2} = \sqrt{(-4)^2 + (-4)^2} = \sqrt{32}$

$QR = \sqrt{(2-8)^2 + (7-5)^2} = \sqrt{(-6)^2 + (2)^2} = \sqrt{40}$

Isosceles Triangle

Classifying Quadrilaterals

Example 3: What type of parallelogram is *RSTU?* A regular parallelogram.



Check length

$SR = \sqrt{(2-1)^2 + (8-5)^2} = \sqrt{1^2 + (3)^2} = \sqrt{10}$

$ST = \sqrt{(2-8)^2 + (8-4)^2} = \sqrt{(-6)^2 + (4)^2} = \sqrt{52}$

Check Slopes

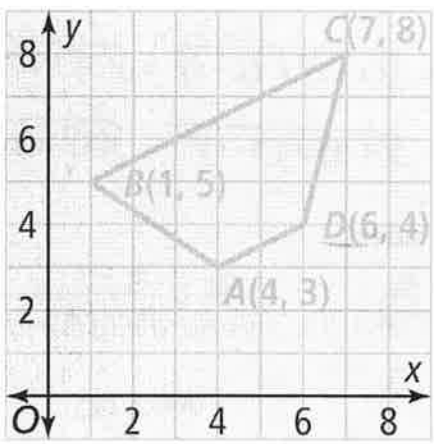
$SR = 3$

$ST = -\frac{4}{6} = -\frac{2}{3}$

*If you know its a parallelogram, only need to check 2 sides

Classify each quadrilateral below.

a)



Trapezoid

$AB = d = \sqrt{(5-3)^2 + (1-4)^2} = \sqrt{4 + (-3)^2} = \sqrt{13}$

$CD = d = \sqrt{(7-6)^2 + (8-4)^2} = \sqrt{(1)^2 + (4)^2} = \sqrt{17}$

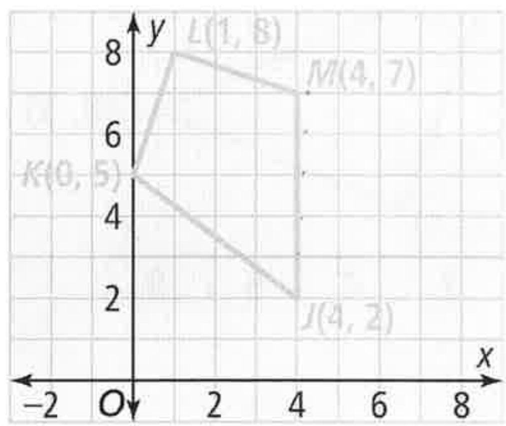
Slopes

$CB = \frac{8-5}{7-1} = \frac{3}{6} = \frac{1}{2}$

$AD = \frac{4-3}{6-4} = \frac{1}{2}$

*one set of parallel lines

b)



Kite

$KL = \sqrt{(0-1)^2 + (5-8)^2} = \sqrt{10}$

$LM = \sqrt{(1-4)^2 + (8-7)^2} = \sqrt{10}$

$KJ = \sqrt{(0-4)^2 + (5-2)^2} = \sqrt{25} = 5$

$JM = \sqrt{(4-4)^2 + (7-2)^2} = 5$

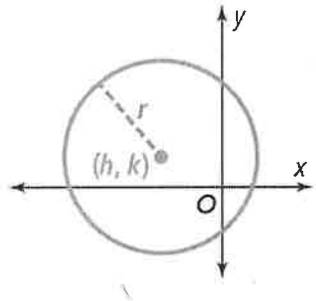
9.3 Circles in the Coordinate Plane

Equation of a Circle:

$$(x-h)^2 + (y-k)^2 = r^2$$

(h,k): center

r: radius



Example 1: Write the equation of the circle given the following information.

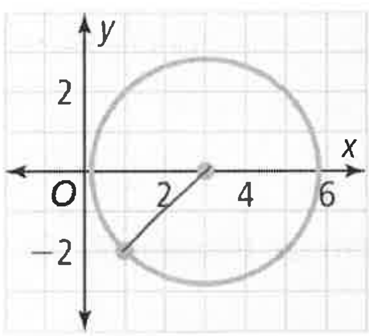
a) Center: (-4, 2) and a radius 4

$$(x+4)^2 + (y-2)^2 = 16$$

b) Center: (1, -5) and a radius of $\sqrt{10}$

$$(x-1)^2 + (y+5)^2 = 10$$

Example 2: Write the equation of each circle.



Find the center: $(3,0)$

Find the radius: $d = \sqrt{(3-1)^2 + (0+2)^2} = \sqrt{2^2 + (2)^2} = \sqrt{8}$

$$(x-3)^2 + y^2 = 8$$

Example 3: Circle Q has a radius of 7 and is centered at the origin. Does the point $(-3\sqrt{2}, 5)$ lie on the circle?

$$(x)^2 + (y)^2 = 49$$

$$(-3\sqrt{2})^2 + 5^2 = 49$$

$$9(2) + 25 = 49$$

$$43 \neq 49$$

No, $(-3\sqrt{2}, 5)$ is not on the circle.

Plug in point for x & y.

Example 2: Determine whether each point lies on the circle.

A. Point: (6, 3) with a center at (2, 4) and a radius of $3\sqrt{3}$.

$$(x-2)^2 + (y-4)^2 = 27$$

$$(6-2)^2 + (3-4)^2 = 27$$

$$4^2 + (-1)^2 = 27$$

$$17 \neq 27$$

No it is not on the circle

B. Point (5, -2) with a center at (8, 2) and a radius of 5.

$$(x-8)^2 + (y-2)^2 = 25$$

$$(5-8)^2 + (-2-2)^2 = 25$$

$$(-3)^2 + (-4)^2 = 25$$

$$9 + 16 = 25$$

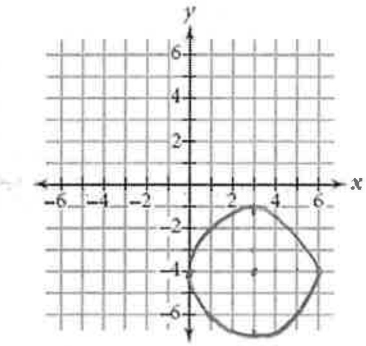
$$25 = 25$$

Yes (5, -2) is on the circle.

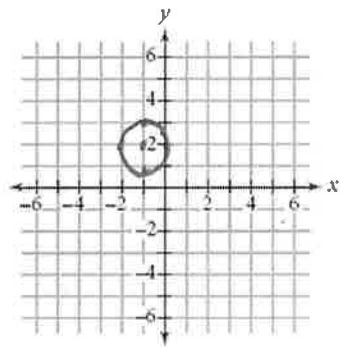
Graphing Circles

Example 3: Graph the circle.

a) $(x-3)^2 + (y+4)^2 = 9$

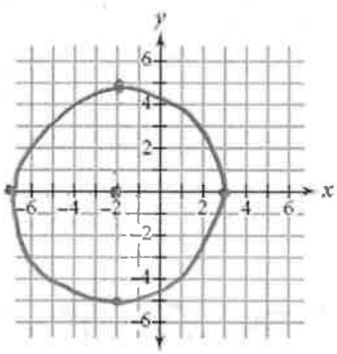


b) $(x+1)^2 + (y-2)^2 = 1$



You Try:

a) Graph the circle: $(x+2)^2 + y^2 = 25$



b) What is the equation of the circle with a center at (5, 11) that passes through the point (9, -2)?

$(x-5)^2 + (y-11)^2 = r^2$

$(9-5)^2 + (-2-11)^2 = r^2$

$(4)^2 + (-13)^2 = r^2$

$185 = r^2$ $\quad r = \sqrt{185}$

$(x-5)^2 + (y-11)^2 = 185$