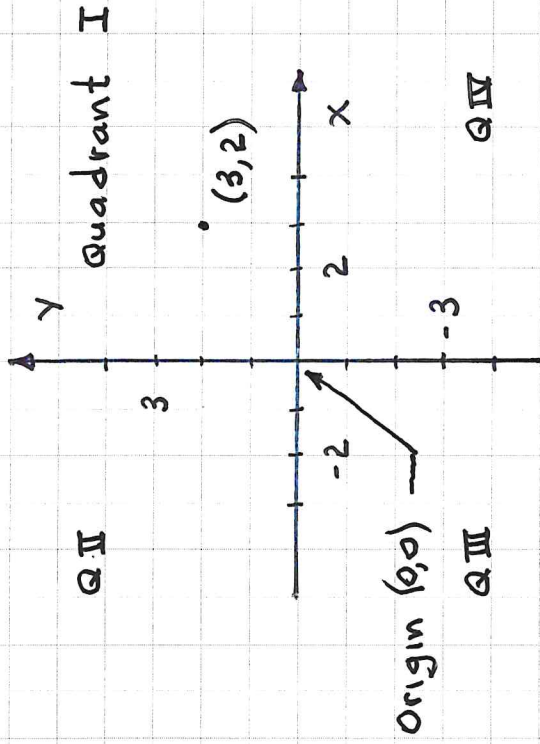


B.1 The Cartesian Coordinate System



The system is formed by two intersecting number lines that divide the plane into four quadrants.

The location of a point is specified by an ordered pair (x, y) .

Given two points (x_1, y_1) and (x_2, y_2) we can find:

1) The slope of the line through them

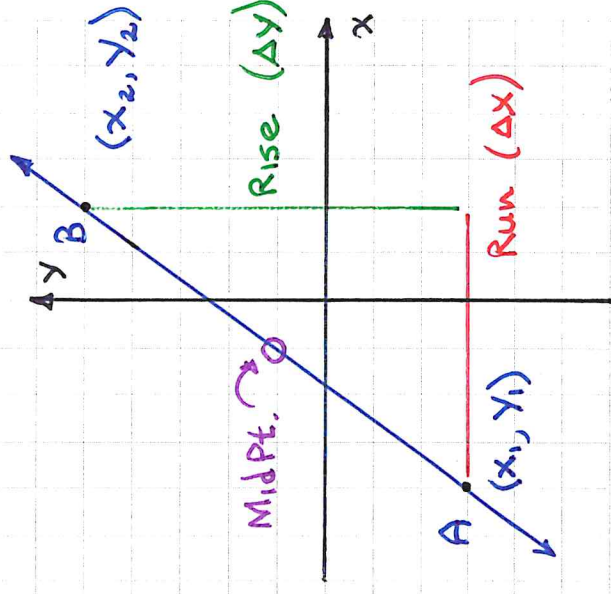
$$\text{Slope (m)} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x} \left(\frac{\text{Rise}}{\text{Run}} \right)$$

2) The distance between them

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(\Delta x)^2 + (\Delta y)^2}$$

3) The midpoint of the segment joining them

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

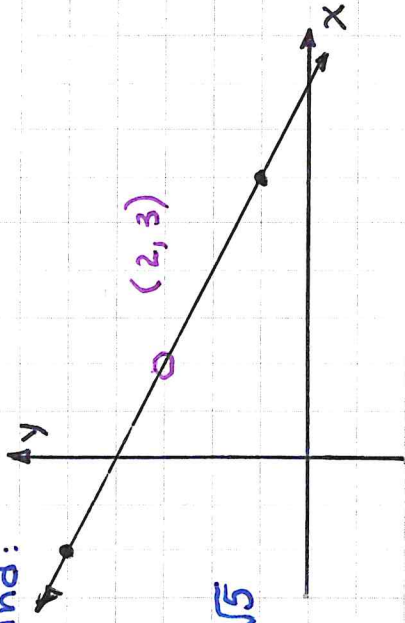


Ex. ① Given the points: $(-2, 5)$ and $(6, 1)$, find:

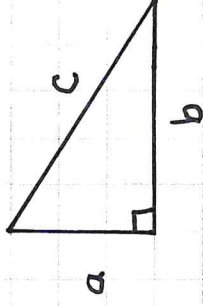
$$a) m = \frac{1-5}{6-(-2)} = \frac{-4}{8} = -\frac{1}{2}$$

$$b) d = \sqrt{8^2 + (-4)^2} = \sqrt{80} = \sqrt{16 \cdot 5} = 4\sqrt{5}$$

$$c) \text{Midpoint: } \left(\frac{-2+6}{2}, \frac{5+1}{2} \right) = (2, 3)$$

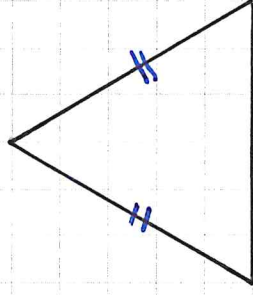


Notes: 1) A right triangle has one right angle and satisfies the Pythagorean theorem.

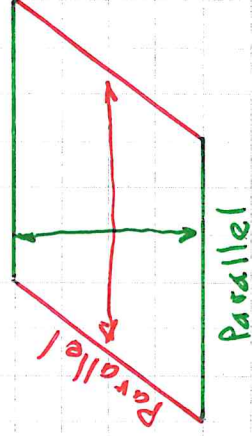


$$a^2 + b^2 = c^2$$

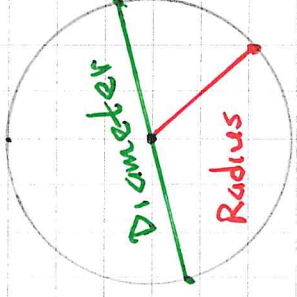
2) An isosceles triangle has two congruent sides.



3) A parallelogram is a quadrilateral whose opposite sides are parallel.



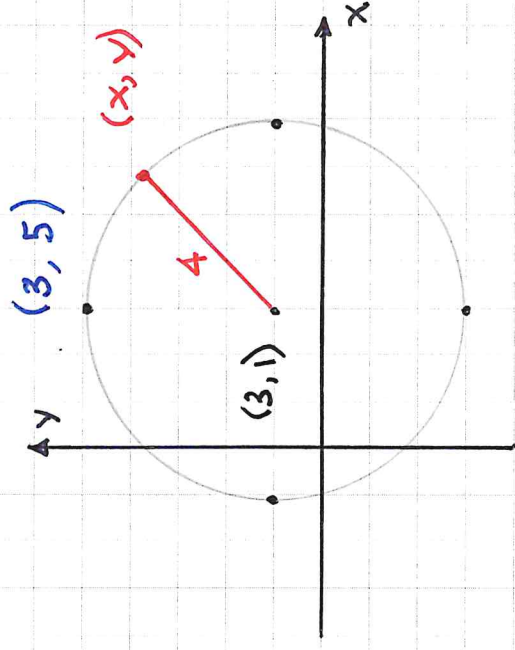
DEFINITION: A circle is the set of all points in a plane that are the same distance from a fixed point called the center.



Ex. ② Find an equation of the circle centered at the point $(3,1)$ with a radius of 4.

$$\text{Now, } r = \sqrt{(x-3)^2 + (y-1)^2} = 4$$

$$r^2 = (x-3)^2 + (y-1)^2 = 16$$



In general, a circle centered at the point (h,k) with radius r has the equation

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

Ex. (3) Given that A (-3, 1) and B (5, -5) are the endpoints of a diameter, find an equation of the circle.

Note: The center will be at the midpoint of the diameter.

$$\text{So, } C = \left(\frac{-3+5}{2}, \frac{1+(-5)}{2} \right) = (1, -2)$$

Note: The radius is one half of the diameter.

$$\text{So, } r = \frac{1}{2} \sqrt{(5+3)^2 + (-5-1)^2} = \frac{1}{2} \sqrt{64+36} = \frac{1}{2} \sqrt{100} = 5$$

And the equation is:

$$(x-1)^2 + (y+2)^2 = 5^2 = 25$$

