# CHAPTERS 2 & 3

## midpoints OF LINE SEGMENTS

midpoints

A midpoint of a line is the point that divides a line evenly in half.

The midpoint of line AB, where $A=(x_1, y_1)$ and $B=(x_2, y_2)$ is:

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

## length OF LINE SEGMENTS (distance formula)

length

The distance formula finds the distance between two points on the Cartesian Plane.

The distance between A and B (the length of segment AB), where A is $(x_1, y_1)$ and B is $(x_2, y_2)$, is:

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

This is derived from the Pythagorean Theorem, which states that

$$c^2 = a^2+b^2, \text{ or } c = \sqrt{a^2+b^2}$$

where a & b are side lengths of a right triangle, and c is the hypotenuse.

# slope OF A LINE

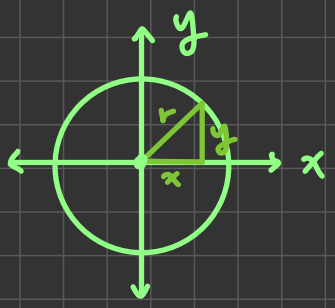
slope

The slope of a line is calculated using the following formula, where point A is $(x_1, y_1)$ and B is $(x_2, y_2)$:

$$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$$

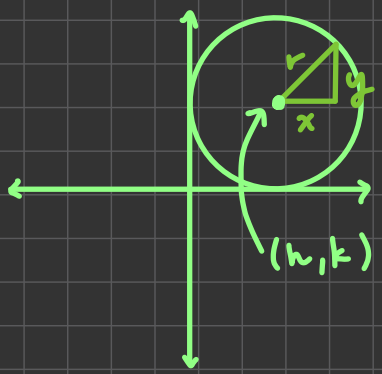
# equation OF A CIRCLE

equation




The equation of a circle with the origin as the center is

$$r = \pm\sqrt{x^2 + y^2} \longrightarrow r^2 = x^2 + y^2$$




The equation of a circle with the center at $(h, k)$ is

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

# properties OF TRIANGLES

properties

Altitude ⟶ height of a geometric shape.

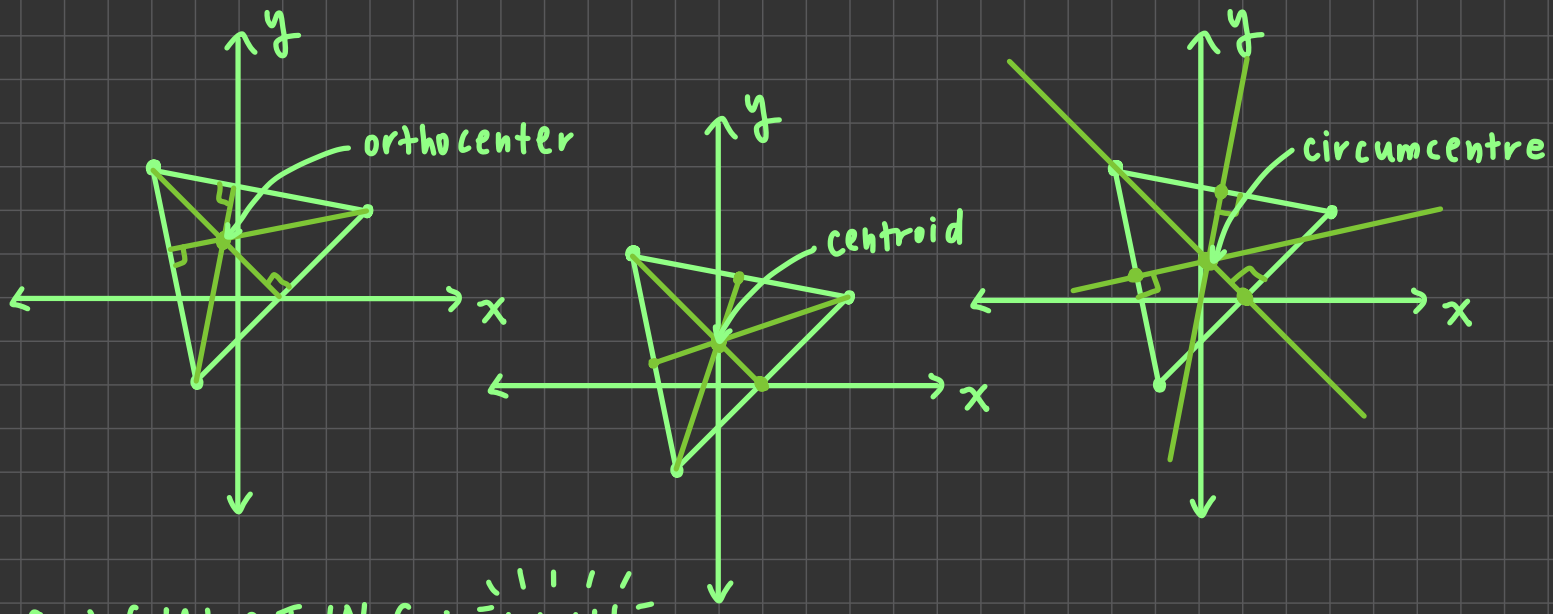
Median ⟶ line that connects the midpoint of a side to the vertex across from the side.

Perpendicular Bisector ⟶ line perpendicular to the side of a geometric shape that divides the side in half.

Orthocenter ⟶ where the altitudes meet.

Centroid ⟶ where the medians meet.

Circumcentre ⟶ where the ⊥ bisectors meet.




CALCULATING: hint!!

orthocentre:
- intersection of 2 altitudes, which are calculated using the vertex of intersection and perpendicular slope rules! (negative reciprocal)

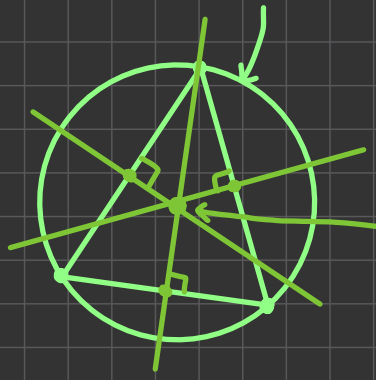
- centroid: intersection of 2 medians, which are calculated using the vertex of intersection and the midpoint of the opposite side length.

- circumcentre: intersection of 2 ⊥ bisectors, which are calculated using the midpoint of a side length and the ⊥ slope rule. (neg reciprocal)

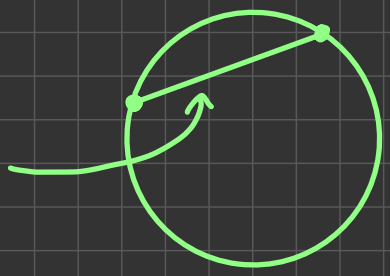
# circles AND triangles

circles triangles

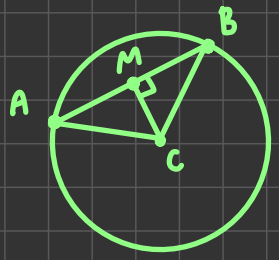
circumcircle → circle that passes through all the vertices of a triangle
the circumcentre is the centre of this circle.



coord → a line segment joining 2 points of a curve.



## SOLVE FOR A CIRCLE USING ITS COORD AND CENTRE:




→ solve for midpoint of AB
→ find length of AB, then AM and BM
→ find length of CM
→ find length of AC or BC → is the radius
→ plug C = (h,k) and radius into

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

→ you're done!