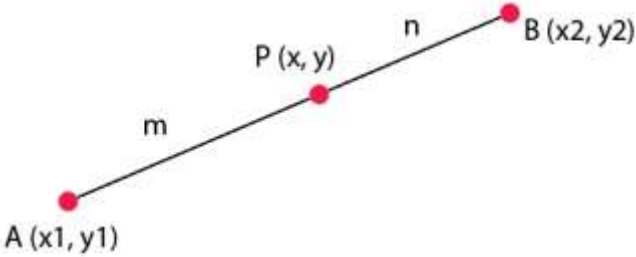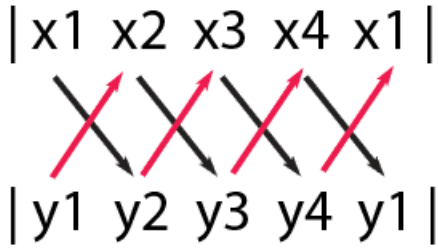# Coordinates Geometry

1	Distance between 2 points (2D) Distance between 2 points (3D)	$$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$ $$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$
2	Midpoint of 2 points (3D)	$$\frac{(x_1 + x_2)}{2}, \frac{(y_1 + y_2)}{2}, \frac{(z_1 + z_2)}{2}$$
3	Slope of 2 points	$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$
4	Line Equation (we need the "slope" value and y-intercept)	$$(Equation)\ y = mx + c$$ $$(Rewritten)\ m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$ $$y - y_1 = m(x - x_1)$$
5	Check if 2 lines are perpendicular	$$m_2 * m_1 = -1$$ $$m_2 = -\frac{1}{m_1}$$
6	For Equation of the perpendicular Bisector of AB (A line equation that is perpendicular to Line AB)	Get a point reside on line AB, midpoint is the easiest solution : midpoint of AB Get slope of line AB : m Get perpendicular slope of AB = $-\frac{1}{m}$
7	Ratio Theorem	$$x = \frac{m(x_2) + n(x_1)}{m + n},$$ $$y = \frac{m(y_2) + n(y_1)}{m + n}$$ P (x, y) n B (x2, y2) m A (x1, y1)
8	Area of Polygon	$$\frac{1}{2}(x_1 y_2 + x_2 y_3 + x_3 y_4 + x_4 y_1 - x_2 y_1 - x_3 y_2 - x_4 y_3 - x_1 y_4)$$

		$\dfrac{1}{2}\begin{vmatrix} x_1 & x_2 & x_3 & x_4 & x_1 \\ y_1 & y_2 & y_3 & y_4 & y_1 \end{vmatrix}$