Ray - Plane Intersection :—

Let a ray,

$$\text{Origin} \quad O = [O_x, O_y, O_z]$$
$$\text{direction} \quad R = [R_x, R_y, R_z]$$

$$\boxed{P = O + Rt} \quad \text{——} \quad ①$$

Plane

$$P: \quad \boxed{Ax + By + Cz + D = 0} \quad \text{——} \quad ②$$

P_{normal} :— normal of the plane

$$= [A \ B \ C]$$
$$A^2 + B^2 + C^2 = 1$$

D :— distance from origin
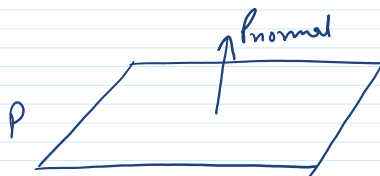
Substituting P_x, P_y, P_z from equation ① into ②
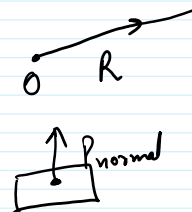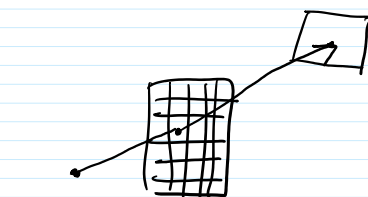
$$A(P_x) + B(P_y) + C(P_z) + D = 0$$
$$A(O_x + R_x t) + B(O_y + R_y t) + C(O_z + R_z t) + D = 0$$

solving for t,

$$AO_x + AR_x t + BO_y + BR_y t + CO_z + CR_z t + D = 0$$

$$t = - \frac{AO_x + BO_y + CO_z + D}{AR_x + BR_y + CR_z}$$
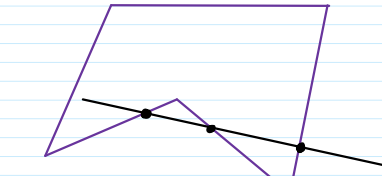
$$= - \frac{P_{normal} \cdot O + D}{P_{normal} \cdot R}$$

Where if $P_{normal} \cdot R = 0$ the ray is parallel

to the "plane:

$P_{normal} \cdot R > 0$ normal is pointing away from the ray
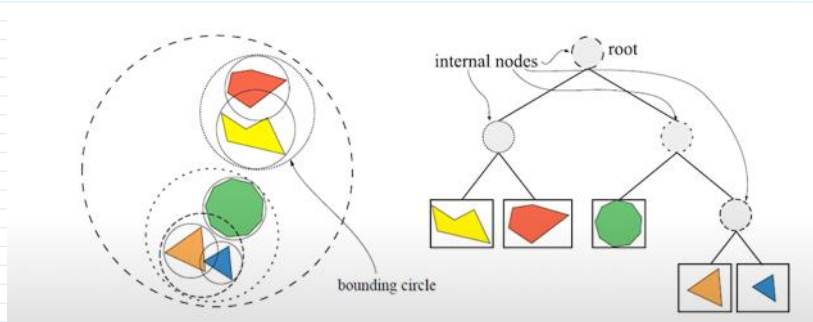
Polygon Intersection :-

Containment Test :-

If the number of intersections are odd the point is inside.

Bounding Volume Hierarchies :-
(BVH)

Tracing a ray is $O(\log N)$