f)

Dot product and cross product are mathematical operations used in vector algebra.

Dot product: The dot product of two vectors A and B is defined as the product of their magnitudes and the cosine of the angle between them. It is denoted as A . B. The dot product of two vectors is a scalar quantity.

Cross product: The cross product of two vectors A and B is defined as a vector that is perpendicular to both A and B. It is denoted as A x B. The cross product of two vectors is a vector quantity.

In graphics environment, dot product is used to calculate the angle between two vectors, which is useful in lighting calculations such as diffuse and specular lighting. Dot product can also be used to project one vector onto another.

Cross product is used in graphics environment for a variety of purposes such as calculating surface normals, determining the orientation of triangles, and computing the rotation axis between two vectors. It is also used in physics simulations to calculate torque and angular momentum.

Here are some resources for further reading:

Dot product: https://en.wikipedia.org/wiki/Dot_product

Cross product: https://en.wikipedia.org/wiki/Cross_product

Use of dot product in graphics: https://www.scratchapixel.com/lessons/mathematics-physics-for-computer-graphics/geometry/dot-product-usage-in-3d-graphics

Use of cross product in graphics: https://www.scratchapixel.com/lessons/mathematics-physics-for-computer-graphics/geometry/cross-product-and-handiness

Bonus answer:

Intersection between a ray and a plane:

To calculate the intersection between a ray and a plane, we first need to determine if the ray is intersecting the plane. This can be done by calculating the dot product of the ray direction and the plane normal. If the dot product is zero, the ray is parallel to the plane and does not intersect it. If the dot product is non-zero, the ray intersects the plane at a point P = O + tD, where O is the origin of the ray, D is the direction of the ray, and t is the distance along the ray at which the intersection occurs.

Intersection between a ray and a sphere:

To calculate the intersection between a ray and a sphere, we first need to determine if the ray is intersecting the sphere. This can be done by calculating the discriminant of the quadratic equation that represents the intersection between the ray and the sphere. If the discriminant is negative, the ray does not intersect the sphere. If the discriminant is zero, the ray intersects the sphere at a single point. If the discriminant is positive, the ray intersects the sphere at two points.

Intersection between a ray and a triangle:

To calculate the intersection between a ray and a triangle, we first need to determine if the ray is intersecting the plane of the triangle. This can be done by calculating the dot product of the ray direction and the triangle normal. If the dot product is zero, the ray is parallel to the triangle and does not intersect it. If the dot product is non-zero, the ray intersects the plane of the triangle. We then need to determine if the intersection point is inside the triangle by checking if it lies within the bounds of the triangle edges.

Here are some resources for further reading:

Ray-plane intersection: https://en.wikipedia.org/wiki/Line%E2%80%93plane_intersection

Ray-sphere intersection: https://en.wikipedia.org/wiki/Line%E2%80%93sphere_intersection

Ray-triangle intersection:
https://en.wikipedia.org/wiki/M%C3%B6ller%E2%80%93Trumbore_intersection_algorithm