COMP270
Mathematics for 3D Worlds and Simulations

Week 7 Seminar: 3D Vectors and the cross product

The questions below explore some applications of the cross product in games and graphics situations.

EXERCISES

1. A nonplayer character (NPC) is standing at a location **p** with a forward direction of **v**.
    Consider three points **a**, **b** and **c** in the xz plane of a left-handed coordinate system, which represent waypoints on the NPC's path.

    a. How can the cross product be used to determine whether, when moving from **a** to **b** to **c**, the NPC makes a clockwise or anticlockwise turn at **b**, when viewing the path from above?

    b. For each of the following sets of three points, determine whether the NPC is turning clockwise or anticlockwise when moving from **a** to **b** to **c**:

        i. $\mathbf{a} = (2, 0, 3), \mathbf{b} = (-1, 0, 5), \mathbf{c} = (-4, 0, 1)$

        ii. $\mathbf{a} = (-3, 0, -5), \mathbf{b} = (4, 0, 0), \mathbf{c} = (3, 0, 3)$

        iii. $\mathbf{a} = (1, 0, 4), \mathbf{b} = (7, 0, -1), \mathbf{c} = (-5, 0, -6)$

        iv. $\mathbf{a} = (-2, 0, 1), \mathbf{b} = (1, 0, 2), \mathbf{c} = (4, 0, 4)$

2. Consider a triangle defined by the vertices (6, 10, -2), (3, -1, 17) and (-9, 8, 0).

    a. What is the (implicit) equation of the plane containing this triangle?

    b. Is the point (3, 4, 5) on the front or back side of this plane (relative to the direction of the normal)? How far is this point from the plane?