Game Mathematics

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Abstract

The article gives a brief and concise explanation to the highly valuable nature of mathematics in video game. We all love play computer games, we only noticed the game's story line and beautiful videos, but we often do not know the games there are many factors mathematics. Through this article, I will introduce mathematics in game, and you will realize that game is resembling the magic because of there are many mathematics in it, and I will also introduce the category of mathematics. So if you want to do some jobs about design a game, you must know something about mathematics in game. I hope this article will help you.

keywords: mathematics, category mathematics.

1 introduction

Math is everywhere in our life, including computer games, this article gives a brief introduction to the game mathematics, we address the following concepts in this article:

- ✓ What type of mathematics?
- ✓ Where is mathematics used?
- ✓ Vectors
- ✓ Matrices
- ✓ Transforms

2 Cartesian coordinate system

A Cartesian coordinate system is a coordinate system that specifies each point uniquely in a plane by a pair of numerical coordinates, which are the signed distances to the point from two fixed perpendicular directed lines, measured in the same unit of length. Each reference line is called a coordinate axis or just axis or just axis of the system, and the point where they meet is its origin usually at ordered pair (0,0). The coordinates can also be defined as the positions of the perpendicular projections of the point onto the two axes, expressed as signed distances from the origin.

Cartesian coordinate system is used in 3D technical which is widely used in the game.

- 3D math is all about measuring locations, distances, and angles precisely and mathematically in 3D space.
- The most frequently used framework to perform such calculations using a computer is called the Cartesian coordinate system.

Before we learn 3D mathematic, we should understand 1D mathematic and 2D Cartesian Space.

1D mathematic

- We assume that you already know about the natural numbers, the integers, the rational numbers, and the real numbers.
- On a computer you have to make do with shorts, ints, floats, and doubles. These have limited precision.
- We assume that you have a basic understanding about how numbers are represented on a computer.
- Remember the First Law of Computer Graphics: If it looks right, it is right.

2D Cartesian Space

- All that really matters are the numbers.
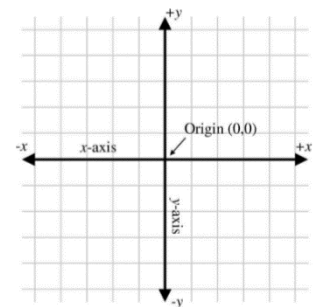- The abstract version of this is called a 2D Cartesian coordinate space.

Figure 1: 2D Cartesian Space

But in Screen Space, it doesn't have be this way. It's only a convention, for example, +y points down. Screen space is how you measure on a computer screen, with the origin at the top left corner.

3D Cartesian Space is point (x, y, z) is located x units along the x-axis, y units along the y-axis, and z units along the z-axis from the origin.
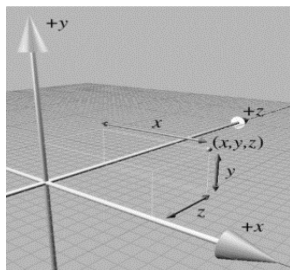

Figure 2 3D Cartesian Space

3 Angles

- An angle measures an amount of rotation in the plane.
- Variables for angles are often given the Greek letter θ.
- The most important units of measure are degrees (°) and radians (rad).
- Humans usually measure angles using degrees.
- One degree measures 1/360th of a revolution, so 360° is a complete revolution.
- Mathematicians, prefer to measure angles in radians, which is a unit of measure based on the properties of a circle.
- When we specify the angle between two rays in radians, we are actually measuring the length of the intercepted arc of a unit circle, as shown in the figure on the following diagram.
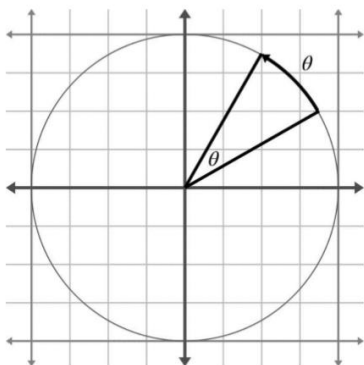

Figure 3: θ Radians

Radians and Degrees
- The circumference of a unit circle is 2π radians, with π radians, with π approximately equal to 3.14159265359.
- Therefore, 2π radians represents a complete revolution.
- Since 360° = 2π rad, 180° = π rad.
- To convert an angle from radians to degrees, we multiply by $180/\pi \approx 57.29578$ and to convert an angle from degrees to radians, we multiply by $\pi/180 \approx 0.01745329$.

4 Where is math used in game

Math is an absolute fundamental foundation to successful game development and game design.

Math is everything when it comes to games. From having the ability to calculating the trajectory of an Angry Bird flying through the sky, to ensuring that a character can jump and come back down to the ground – without the help of mathematics, games simply wouldn't work.

A character wouldn't be able to walk up a slope, slide down a slide, fire a bullet from a gun, or even jump without the help of the mathematics.

The most basic of games use some form of math to the most complex games.

Math is essential to the production of games. It is the flour to the cake that game developers are trying to bake. Without it, the cake wouldn't rise.

5 Acknowledgements

Through this article, I learned a lot of mathematics in video game. If I want to develop a video game, math maybe is the most important thing. So I will learn it harder and harder.

References

Wikipedia, google search.