

COMP2007 - Game Development

General information about rotations and Trigonometry

Angles - degrees and radians

Angles - measured in degrees, 360 degrees are full circle, 180 degrees - half a circle, 90 degrees - quarter of a circle.
Pretty intuitive to work with it, most people are thinking of rotations in degree.

Radians - are what most programming languages are using. Radian is a unit of measurement for angles defined by the ratio of the length of the arc of the circle to the radius of that circle.

1 Radian - is the angle at which that ratio equals 1.

π = PI

180 degrees = π radians;
360 degrees = $2 * \pi$ radians;
90 degrees = $\pi/2$ radians

π - mathematical constant, a 'real' number.

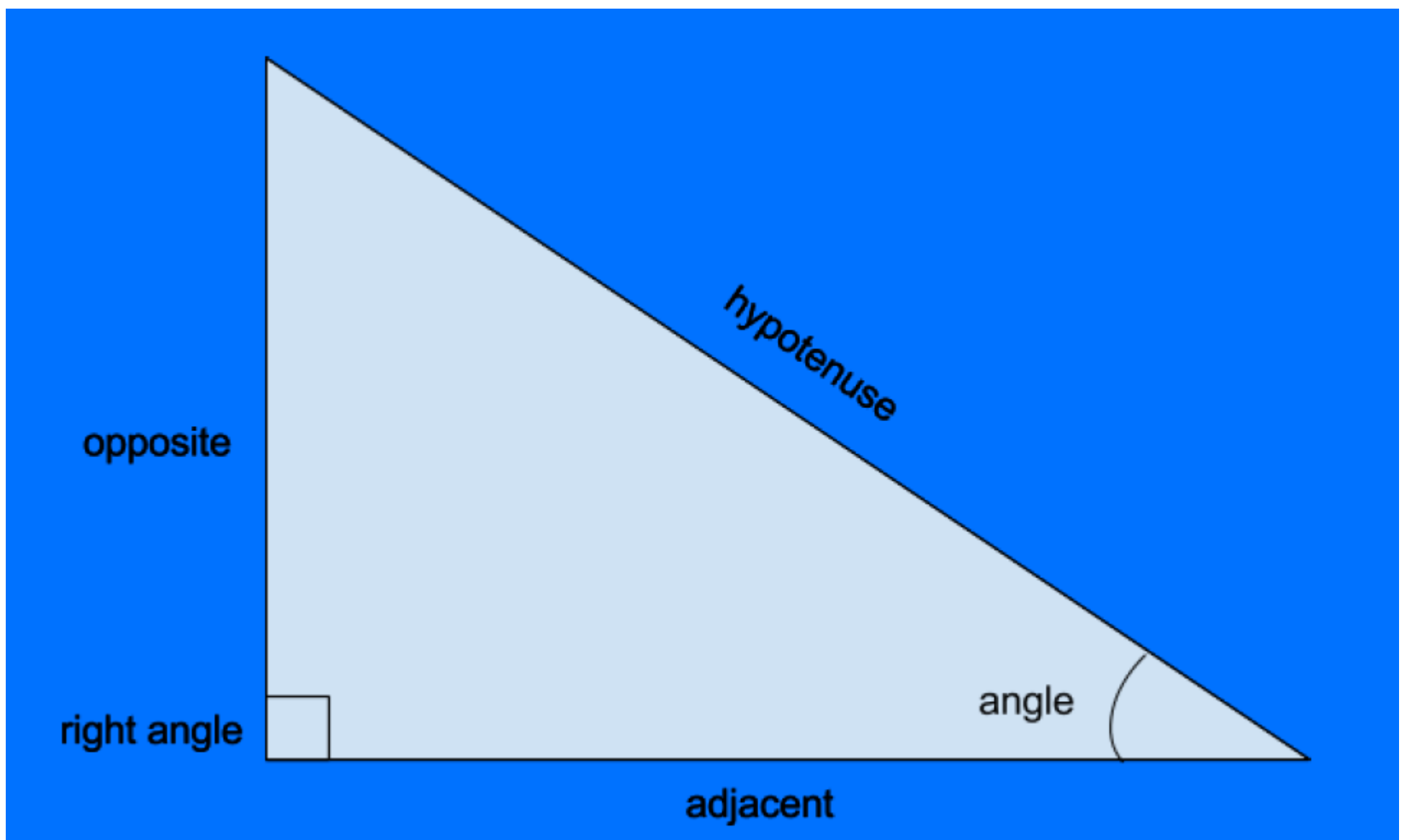
Ratio of a circle's circumference(distance around the perimeter) to its diameter(a straight line that passes through the circle's center).

π - 3.14159 - 3.14

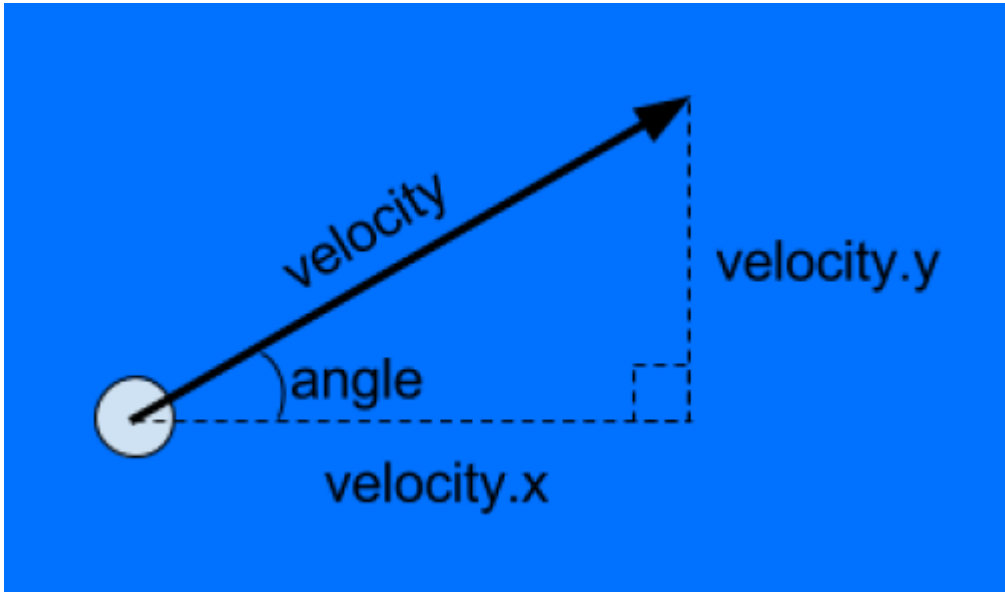
A way to remember the sides of a triangle

Sohcahtoa (soh-cah-toa)

Soh: sine = opposite/hypotenuse
Cah: cosine = adjacent/hypotenuse
Toa: tangent = opposite/adjacent



Here is the triangle above but using a vector instead.
Hypotenuse: vector magnitude v, adjacent: x value of vector v,
opposite: y value of vector v.



Arc Tangent in Maths

`arctangent(velocity.y / velocity.x)`

In Unity (Atan2)

Calculates a rotation from two values

- X & Y = Z rotation
- X & Z = Y rotation
- Y & Z = X rotation

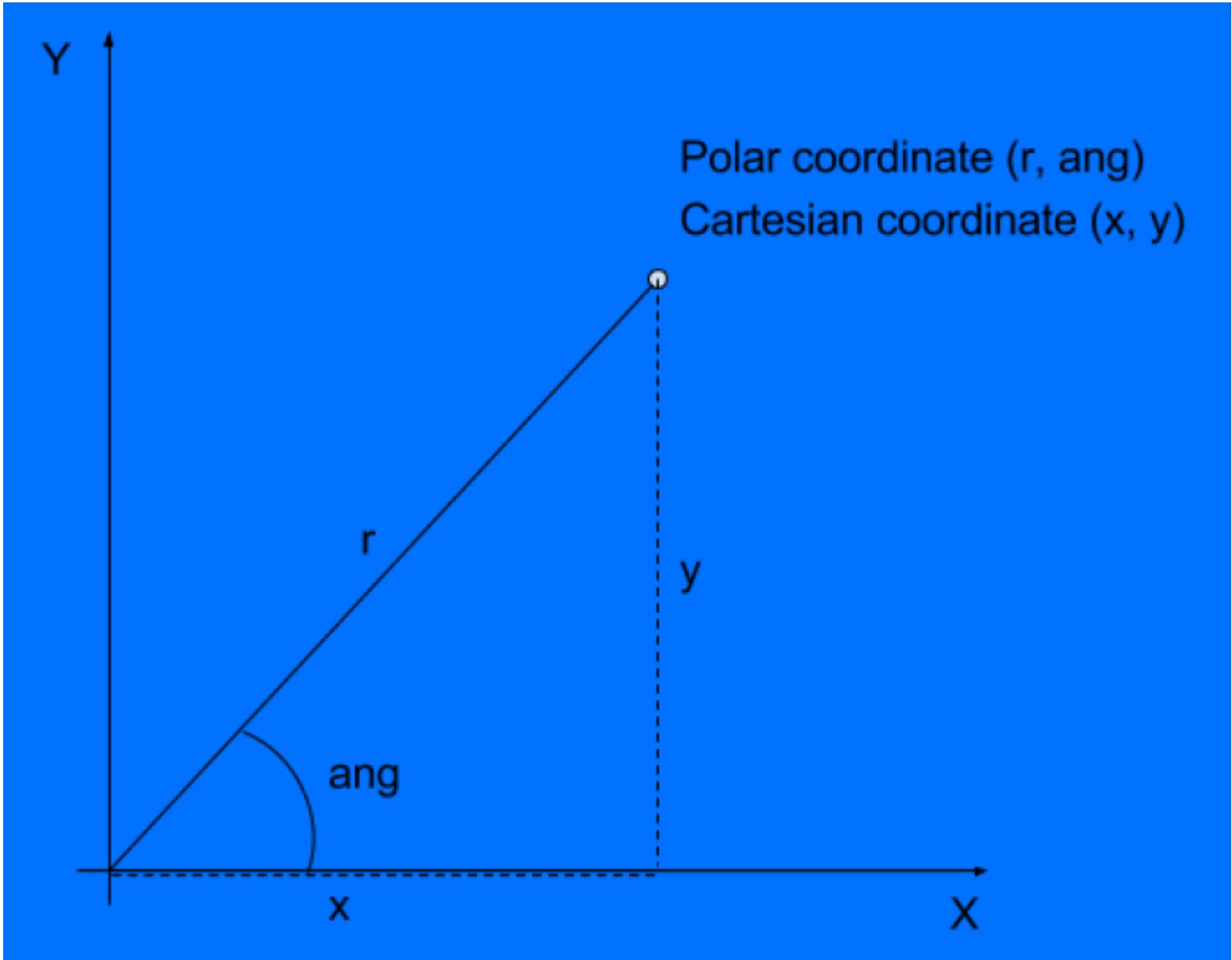
`Mathf.Atan2(velocity.y / velocity.x)` - caters for different direction that give the same result

Polar and Cartesian Coordinates

Cartesian coordinates - describes a point in space using x and y coordinates or the components of a vector.
Polar coordinates - describes a point in space as an angle of rotation around the origin and a radius from the origin, the magnitude(length) and direction(angle) of a vector.

We can calculate the Sine and Cosine using the following:

$\text{Sin}(\text{ang}) = y/r$
 $y = r * \text{Sin}(\text{ang})$
 $\text{Cosine}(\text{ang}) = x/r$
 $x = r * \text{Cosine}(\text{ang})$



Simple Harmonics (or Waves)

- Can be expressed with 2 elements:
- Amplitude: The distance from the centre of the motion to either extremes
- Period: The amount of time it takes for one complete cycle of motion.

Formula

NOTE: Refer to the Waves example for an implementation

$X = \text{amplitude} * \sin(2 * \pi * \text{frameCount} / \text{period});$



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