### Unraveling the Mystery of $cos(\pi/2)$

The trigonometric functions, such as cosine, sine, and tangent, describe the relationships between angles and sides in right-angled triangles. However, their applications extend far beyond simple geometry, playing crucial roles in fields like physics, engineering, and computer graphics. Understanding these functions, particularly their values at specific angles, is fundamental to mastering these applications. This article focuses on understanding the value of  $cos(\pi/2)$ , demystifying its calculation and providing a solid foundation for further exploration.

### **1. Understanding Radians and Degrees**

Before diving into  $cos(\pi/2)$ , it's essential to grasp the concept of radians. Radians and degrees are two different units for measuring angles. A full circle encompasses 360 degrees (360°), while the same circle encompasses  $2\pi$  radians ( $2\pi$  rad). The conversion factor is:  $180^\circ = \pi$  rad. Therefore,  $\pi/2$  radians is equivalent to ( $\pi/2$ ) ( $180^\circ/\pi$ ) =  $90^\circ$ . This means  $cos(\pi/2)$  is essentially asking for the cosine of a 90-degree angle.

#### 2. Visualizing the Unit Circle

The unit circle provides a powerful visual aid for understanding trigonometric functions. It's a circle with a radius of 1 centered at the origin of a coordinate system (0,0). Any point on the unit circle can be represented by its coordinates (x, y), where  $x = cos(\theta)$  and  $y = sin(\theta)$ , and  $\theta$  is the angle formed between the positive x-axis and the line connecting the origin to the point.

When  $\theta = \pi/2$  (or 90°), the point on the unit circle lies directly on the positive y-axis. The

## **3. Defining Cosine in the Unit Circle Context**

Cosine, in the context of the unit circle, represents the x-coordinate of the point on the circle corresponding to a given angle. As we established in the previous section, at  $\theta = \pi/2$ , the x-coordinate is 0. This directly leads to the conclusion that  $\cos(\pi/2) = 0$ .

### 4. Applying Cos( $\pi/2$ ) to Real-world Problems

The value of  $cos(\pi/2) = 0$  has significant implications in various applications.

Physics: In oscillatory motion (like a pendulum), the cosine function often describes the displacement from equilibrium. When the pendulum reaches its highest point (90° from equilibrium), its horizontal displacement is zero, reflecting  $cos(\pi/2) = 0$ .

Engineering: In AC circuits, the cosine function models the voltage or current waveform. The value of  $cos(\pi/2)$  helps determine the instantaneous voltage or current at specific points in the cycle.

Computer Graphics: Cosine is frequently used in rotation transformations. Understanding  $cos(\pi/2) = 0$  is crucial in scenarios involving 90-degree rotations.

# 5. Key Takeaways

 $Cos(\pi/2)$  is equal to 0.

This is derived from the unit circle, where the x-coordinate at 90° (or  $\pi/2$  radians) is 0. The value has significant applications in various fields, especially those involving periodic or cyclical phenomena.

Understanding radians and their relationship with degrees is fundamental for grasping trigonometric functions.

# FAQs

1. Why is  $cos(\pi/2)$  not 1? Because cosine represents the x-coordinate on the unit circle, and at  $\pi/2$  radians (90°), the x-coordinate is 0, not 1 (which is the y-coordinate, representing  $sin(\pi/2)$ ).

2. How can I remember the value of  $cos(\pi/2)$ ? Visualize the unit circle. At 90°, the point lies on the y-axis, where the x-coordinate (cosine) is 0.

3. Is  $cos(\pi/2)$  always 0, regardless of the unit (degrees or radians)? Yes, as long as the angle is equivalent to 90 degrees, the cosine will always be 0, whether expressed in degrees or radians.

4. What is the value of  $sin(\pi/2)$ ?  $Sin(\pi/2) = 1$ . At  $\pi/2$  radians (90°), the y-coordinate on the unit circle is 1.

5. Are there other angles where the cosine is 0? Yes, cosine is also 0 at 270° ( $3\pi/2$  radians) and any angle that is an odd multiple of 90°. These angles correspond to points on the negative and positive y-axis of the unit circle.

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**functions - What is cos<sup>2</sup> (x)? - Mathematics Stack Exchange** Truthfully, the notation  $(\cos^2(x))$  should actually mean  $(\cos(x)) = (\cos \sin(x))$ , that is, the 2nd iteration or compositional power of  $(\cos)$  with itself, because on an arbitrary space of self-functions on a given set, the natural "multiplication" operation is composition of those functions, and the power is applied to the function symbol itself, not the whole evaluation ...

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 $cos^2(x)\$  may be misinterpreted as  $cos(cos x)\$ , which is how you're supposed to interpret the exponent in  $cos^{-1}(x)\$ . It's confusing, but somehow the two meanings don't conflict that often, so it's a convension that is kept.  $cos^{-1}(x)\$ 

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#### Cos 2

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When  $\theta = \pi/2$  (or 90°), the point on the unit circle lies directly on the positive y-axis. The coordinates of this point are (0, 1). Therefore,  $\cos(\pi/2) = 0$  and  $\sin(\pi/2) = 1$ .

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these three identities: \$\$

\$  $\sin(x+y) = \sin x \cos y +$ 

\cos x \sin y \$\$ \$\$ \cos(x+y)=\cos x \cos y - \sin x \sin y \$\$ Then a large class of other identities follows, including the ones in your guestion. Now why would a ...

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#### Prove that \$\\cos (A + B)\\cos (A - B) = {\\cos ^2}A

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#### algebra precalculus - Why \$\cos^2 (2x) = \frac{1}{2}(1+\cos (4x ...

Recall the formula \$\$\cos(2 \theta) = 2 \cos^2(\theta) - 1\$\$ This gives us \$\$\cos^2(\theta) = \dfrac{1+\cos(2 \theta)}{2}\$\$ Plug in \$\theta = 2x\$, to get what you want.

Help with using Euler's formula
to prove that \$\\cos^2(\\theta
... \$\$\cos^2(\theta) =
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#### Prove $\frac{1}{\sin^2} + \frac{1}{\sin^2}$ $cos^2 = 1$ Mathematics Stack ... 6 Oct 2014 · (Imagine bringing the blue segment down so it lies on top of part of the purple segment - $\frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt$ $\cos^2 = 1$ (since $\frac{1}{1} + \cos^2 =$ 1<sup>2</sup>\$). Since the radius has a length of \$1\$ and the total tangent segment (orange and turquoise combined) is perpendicular to the radius, this proves the other two Pythagorean identities: \$1 + $\tan^2 = \dots$

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