**Sin half angle formula**

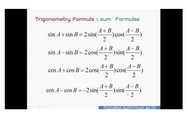
Continue

$$\cos 120^o = -\sqrt{\frac{1+\cos 240^o}{2}}$$

$$= -\sqrt{\frac{1+(-\frac{1}{2})}{2}}$$

$$= -\sqrt{\frac{1}{4}} = -\frac{1}{2}$$

$$\sin\frac{\alpha}{2} = \sqrt{\frac{1-\cos\alpha}{2}}, \quad 0 \le \alpha \le 2\pi$$




$$\cos(x) = \cos^2\left(\frac{x}{2}\right) - \sin^2\left(\frac{x}{2}\right) = 2\cos^2\left(\frac{x}{2}\right) - 1 = 1 - 2\sin^2\left(\frac{x}{2}\right)$$

$$\sin(x) = 2\sin\left(\frac{x}{2}\right)\cos\left(\frac{x}{2}\right)$$

$$\tan(x) = \frac{2\tan\left(\frac{x}{2}\right)}{1-\tan^2\left(\frac{x}{2}\right)}$$

Sin 165 degrees half angle formula. Sin 5pi/12 half angle formula. Sin 75 degrees half angle formula. Sin theta half angle formula. Sin 105 degrees half angle formula. Sin 15 degrees half angle formula. Sin^2 half angle formula. Sin^2x half angle formula.

You have seen quite a few trigonometric identities in the past few pages. It is convenient to have a summary of them for reference. These identities mostly refer to one angle denoted θ, but there are some that involve two angles, and for those, the two angles are denoted α and β.  You don't have to know all the identities off the top of your head. But these you should.  Defining relations for tangent, cotangent, secant, and cosecant in terms of sine and cosine. The Pythagorean formula for sines and cosines. This is probably the most important trig identity. Identities expressing trig functions in terms of their complements. There's not much to these. Each of the six trig functions is equal to its co-function evaluated at the complementary angle. Periodicity of trig functions. Sine, cosine, secant, and cosecant have period 2π while tangent and cotangent have period π. Identities for negative angles. Sine, tangent, cotangent, and cosecant are odd functions while cosine and secant are even functions. Ptolemy's identities, the sum and difference formulas for sine and cosine. Double angle formulas for sine and cosine. Note that there are three forms for the double angle formula for cosine. You only need to know one, but be able to derive the other two from the Pythagorean formula.  You should know that there are these identities, but they are not as important as those mentioned above. They can all be derived from those above, but sometimes it takes a bit of work to do so.  The Pythagorean formula for tangents and secants. There's also one for cotangents and cosecants, but as cotangents and cosecants are rarely needed, it's unnecessary. Identities expressing trig functions in terms of their supplements. Sum, difference, and double angle formulas for tangent. The half angle formulas. The ones for sine and cosine take the positive or negative square root depending on the quadrant of the angle θ/2. For example, if θ/2 is an acute angle, then the positive root would be used.  These are just here for perversity. No, not really. They have some applications, but they're usually narrow applications, and they could just as well be forgotten until needed.  Product-sum identities. This group of identities allow you to change a sum or difference of sines or cosines into a product of sines and cosines. Product identities. Aside: weirdly enough, these product identities were used before logarithms were invented in order to perform multiplication. Here's how you could use the second one. If you want to multiply x times y, use a table to look up the angle α whose cosine is x and the angle β whose cosine is y. Look up the cosines of the sum α + β. and the difference α – β. Average those two cosines. You get the product xy! Three table look-ups, and computing a sum, a difference, and an average rather than one multiplication. Tycho Brahe (1546–1601), among others, used this algorithm known as prosthaphaeresis. Triple angle formulas. You can easily reconstruct these from the addition and double angle formulas. More half-angle formulas. These describe the basic trig functions in terms of the tangent of half the angle. These are used in calculus for a particular kind of substitution in integrals sometimes called the Weierstrass t-substitution. It is sometimes very crucial to determine the value of the trigonometric functions for half-angles. For instance, using some half-angle formula we can convert an expression with exponents to one without exponents, and whose angles are multiples of the original angle. It is to note that we get half-angle formulas from double-angle formulas. Both sin (2A) and cos (2A) are obtained from the double angle formula for the cosine.The formula for half-angle identities is as below:\[\text{Sine of a Half Angle} : sin(\frac{a}{2}) = \pm \sqrt{\frac{(1 - cos a)}{2}}\]\[\text{Cosine of a Half Angle}: cos(\frac{a}{2}) = \pm \sqrt{\frac{(1+cosa)}{2}}\]\[\text{Tangent of a Half Angle}: tan(\frac{a}{2}) = \frac{1 - cosa}{sina} = \frac{sina}{1+cosa}\]Half - Angle FormulaHere is a mathematical representation of trigonometry half-angle formulas:\[sin(\frac{\theta}{2}) = \pm \sqrt{\frac{1 - cos(\theta)}{2}}\]\[cos(\frac{\theta}{2}) = \pm \sqrt{\frac{1 + cos(\theta)}{2}}\]\[tan(\frac{\theta}{2}) = \frac{sin(\theta)}{1 + cos(\theta)} = \frac{1 - cos(\theta)}{sin(\theta)}\]Double-Angle and Half-Angle IdentitiesCertain cases of the sums and differences formulas for sine and cosine generate what are called the double-angle identities and the half-angle identities. We will first start by incorporating the sum identity for the sine as given in the reference, prove that \[\begin{vmatrix} sin \alpha & sin \beta  & sin \gamma \\cos \alpha  & cos \beta  & cos\gamma \\sin 2 \alpha & sin 2 \beta  & sin 2 \gamma \end{vmatrix}\]In the same manner, for the cosine,cos 2α = cos (α + α)cos 2α = (cos α cos α - sin α sin α)cos 2α = (cos2α – sin2α)Applying the property of Pythagorean, sin 2α + cos 2α =1, we can obtain two additional cosine identities i.e.Cos 2α = cos2α – sin2αCos 2α = [1- sin2α] - sin2αCos 2α = 1- 2 sin2αCos 2α = cos2α – sin2αcos 2α = cos2α – [1 – cos2α]cos 2α = 2cos2α – 1The half-angle identities for the sine and cosine are derived from two of the cosine identities explained above.Cos 2α = 2cos2α – 1Cos 2 (β/2) = 2cos2 (β/2) – 1Cosβ = 2cos2 (β/2) – 12cos2 (β/2) = 1 + cosβCos 2α = 1 - 2 sin2αCos 2 (β/2) = 1 – 2 sin2 (β/2)Cosβ = 1 – 2 sin2 (β/2)2 sin2 (β/2) = 1- Cosβ\[Cos^{2} (\frac{\beta}{2}) = \frac{(1 + cos\beta )}{2}\]\[Cos (\frac{\beta}{2}) = \pm \frac{\sqrt{(1+cos \beta)}}{2}\]Similarly,\[sin^{2} (\frac{\beta}{2}) = \frac{(1-cos \beta)}{2}\]\[sin (\frac{\beta}{2}) = \frac{\sqrt{(1-cos \beta)}}{2}\]The symbol of the two preceding functions is dependent on the quadrant in which the resulting angle is positioned.For computing the tangent of the half-angle, tan (2A), we need to combine the identities for sine and cosine: \[tan ^{2} (A) = \frac{\frac{(1-cos (2A))}{2}}{\frac{(1+cos (2A))}{2}} = \frac{ 1-cos(2A)}{1 +cos(2A)}\]Again replacing A by (1/2)A, we obtain\[tan = [\frac{A}{2}] = \pm \sqrt{\frac{1 - cosA}{1 + cosA}}\]Trigonometry Angles and their NotationsThese are actually the use of Greek letters such as alpha (α), beta (β), theta (θ) and gamma (γ) to denote angles. It represents the signs of trigonometric functions in each quadrant. A couple of different units of angle measure are extensively used, including degree, radian, and gradian (gons): As an example,1 complete circle (turn) = 360° = 2π radian = 400 gons.However it is not particularly annotated by (°) for a degree or (g) for gradian, all values for angles are assumed to be given in radian.The graphical representation shown below depicts some common angles and their values and the conversions of the basic trigonometric functions:(Image will be uploaded soon)Solved ExamplesExample1: Find the absolute value for cosine 165° using the half angle identities.Solution1:In the given verification, note that 165 degrees is in the 2nd quadrant, and cosine functions in the 2nd quadrant are negative. Also, 330 degrees is in the 4th quadrant, and cosine functions in the 4th quadrant are positive.That said, the reference triangle of 330° in the 4th quadrant is a 30°–60°–90° triangle. Thus, cos 330° = cos 30°.Now, applying the half angle identity for the cosine:We get,\[Cos 165^{\circ} = \frac{cos 330^{\circ}}{2}\]\[Cos 165^{\circ} = \sqrt{\frac{1 + cos 330^{\circ}}{2}}\]\[Cos 165^{\circ} = \sqrt{\frac{(1 + cos 30^{\circ})}{2}}\]\[Cos 165^{\circ} = - \sqrt{\frac{[1 + (-\frac{3}{2})]}{2}}\] (here the minus sign is chosen because 165° is in the 2nd quadrant)\[Cos 165^{\circ} = - [2 + \sqrt{(\frac{3}{4})}]\]= \[0.9659\]So, our answer is Cos 165° = \[- [2+(\frac{\sqrt{3}}{2}]\](Images will be uploaded soon)Example2: Calculate the value of sin15° using the sine half-angle relationship.Solution2:Given that α = 30°Using the formula\[sin \frac{\alpha}{2} = \pm  \sqrt{\frac{1 - cos \alpha}{2}}\]We get,\[sin 15^{\circ} = \pm \sqrt{\frac{1 - cos 30^{\circ}}{2}}\]= \[\pm \sqrt{\frac{1 - 0.866}{2}}\] ...= \[0.2588\]Thus, our answer is sin 15° = 0.2588Remember here the positive value is taken since 15° is in the 1st quadrant.Key FactsIn the half-angle formula problems for sine and cosine, observe that a plus/minus sign occurs in front of each square root (radical).Whether your answer is negative or positive depends on which quadrant the new half-angle is in.The tan half-angle formula doesn't have a ± sign in front, so the above doesn't apply to tangents.Conclusion The article is very useful for the students to understand the concept of half-angle formulas. All the important half-angle formulas and their conversion is provided. Solved examples will help students apply the half-angle formula in problems. Editor's note: This is an excerpt from the recently published book, The Startup Owner's Manual, written by entrepreneurs-turned-educators Steve Blank and Bob Dorf. Come back each week for more how-tos from this 608-page guide. Whether your venture is a new pizza parlor or the hottest new software product, beware: These nine flawed assumptions are toxic. First and deadliest of all is a founder's unwavering belief that he or she understands who the customers will be, what they need, and how to sell it to them. Any dispassionate observer would recognize that on Day One, a start-up has no customers, and unless the founder is a true domain expert, he or she can only guess about the customer, problem, and business model. On Day One, a start-up is a faith-based initiative built on guesses. To succeed, founders need to turn these guesses into facts as soon as possible by getting out of the building, asking customers if the hypotheses are correct, and quickly changing those that are wrong. The second flawed assumption is implicitly driven by the first. Founders, presuming they know their customers, assume they know all the features customers need.These founders specify, design, and build a fully featured product using classic product development methods without ever leaving their building. Yet without direct and continuous customer contact, it's unknown whether the features will hold any appeal to customers.Traditionally, engineering, sales, and marketing have all focused on the immovable launch date. Marketing tries to pick an "event" (trade show, conference, blog, etc.) where they can "launch" the product. Executives look at that date and the calendar, working backward to ignite fireworks on the day the product is launched. Neither management nor investors tolerate "wrong turns" that result in delays. The product launch and first customer ship dates are merely the dates when a product development team thinks the product's first release is "finished." It doesn't mean the company understands its customers or how to market or sell to them, yet in almost every start-up, ready or not, departmental clocks are set irrevocably to "first customer ship." Even worse, a start-up's investors are managing their financial expectations by this date as well. Established companies execute business models where customers, problems, and necessary product features are all knowns; start-ups, on the other hand, need to operate in a "search" mode as they test and prove every one of their initial hypotheses. They learn from the results of each test, refine the hypothesis, and test again—all in search of a repeatable, scalable, and profitable business model. In practice, start-ups begin with a set of initial guesses, most of which will end up being wrong. Therefore, focusing on execution and delivering a product or service based on those initial, untested hypotheses is a going-out-of-business strategy. Traditional business plans and product development models have one great advantage: They provide boards and founders an unambiguous path with clearly defined milestones the board presumes will be achieved. Financial progress is tracked using metrics like income statement, balance sheet, and cash flow. The problem is, none of these metrics are very useful because they don't track progress against your start-up's only goal: to find a repeatable and scalable business model.  Most startups simply borrow job titles from established companies. But remember, these are jobs in an organization that's executing a known business model. The term "Sales" at an existing company refers to a team that repeatedly sells a known product to a well-understood group of customers with standard presentations, prices, terms, and conditions. Start-ups by definition have few, if any, of these. In fact, they're out searching for them! The demands of customer discovery require people who are comfortable with change, chaos, and learning from failure and are at ease working in risky, unstable situations without a roadmap. Hiring VPs and execs with the right titles but the wrong skills leads to further trouble as high-powered sales and marketing people arrive on the payroll to execute the "plan." Executives and board members accustomed to measurable signs of progress will focus on these execution activities because this is what they know how to do (and what they believe they were hired to do). Of course, in established companies with known customers and markets, this focus makes sense.And even in some start-ups in "existing markets," where customers and markets are known, it might work. But in a majority of startups, measuring progress against a product launch or revenue plan is simply false progress, since it transpires in a vacuum absent real customer feedback and rife with assumptions that might be wrong. The business plan, its revenue forecast, and the product introduction model assume that every step a start-up takes proceeds flawlessly and smoothly to the next.The model leaves little room for error, learning, iteration, or customer feedback.Even the most experienced executives are pressured to hire and staff per the plan regardless of progress. This leads to the next startup disaster: premature scaling. The consequences of most start-up mistakes begin to show by the time of first customer ship, when sales aren't happening according to "the plan." Shortly thereafter, the sales VP is probably terminated as part of the "solution." A new sales VP is hired and quickly concludes that the company just didn't understand its customers or how to sell them. Since the new sales VP was hired to "fix" sales, the marketing department must now respond to a sales manager who believes that whatever was created earlier in the company was wrong. (After all, it got the old VP fired, right?) Here's the real problem: No business plan survives first contact with customers. The assumptions in a business plan are simply a series of untested  hypotheses. When real results come in, the smart startups pivot or change their business model based on the results. It's not a crisis, it's part of the road to success.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