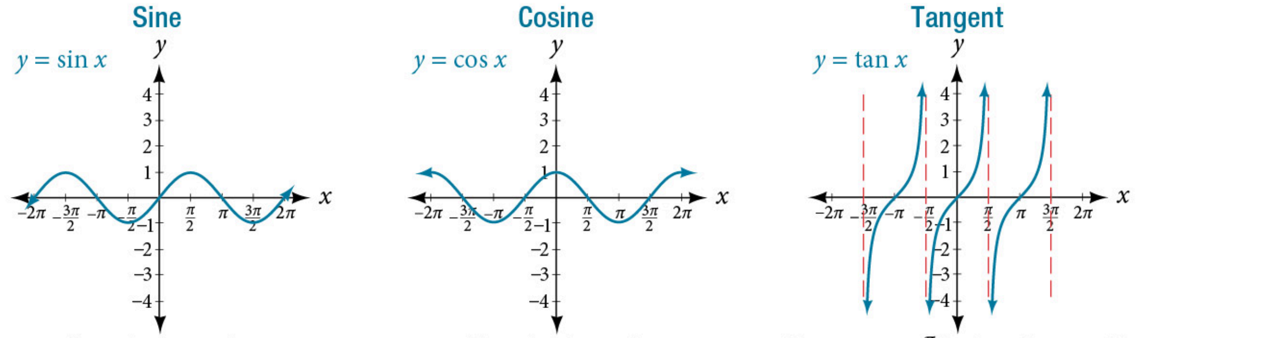
Graphs of the Trigonometric Functions

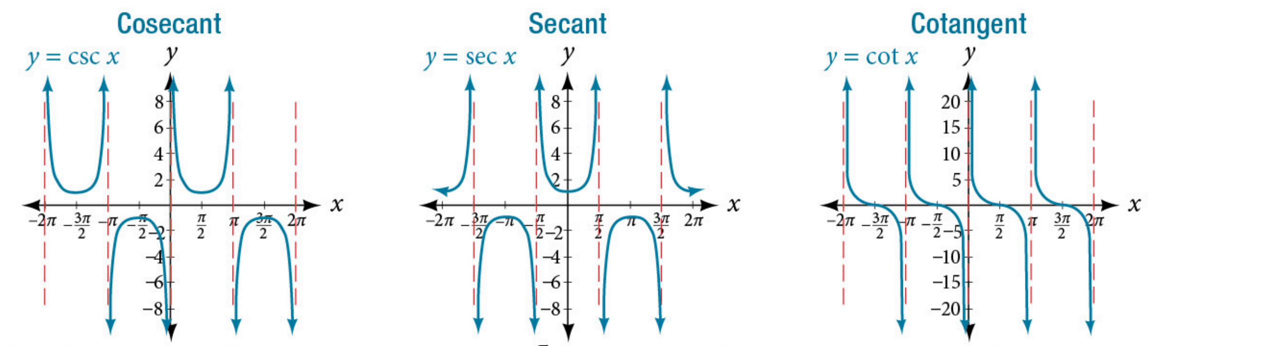


Domain: $(-\infty, \infty)$
Range: $(-1, 1)$

Domain: $(-\infty, \infty)$
Range: $(-1, 1)$

Domain: $x \neq \frac{\pi}{2}k$ where k is an odd integer
Range: $(-\infty, -1] \cup [1, \infty)$

Figure A4

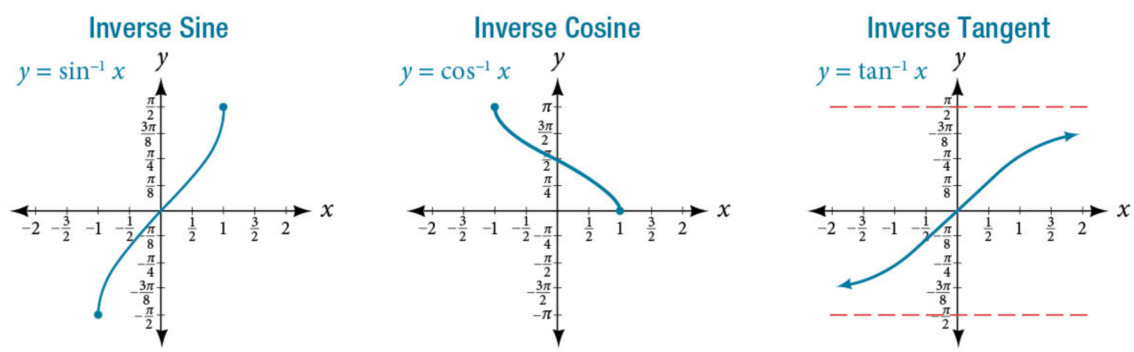


Domain: $x \neq \pi k$ where k is an integer
Range: $(-\infty, -1] \cup [1, \infty)$

Domain: $x \neq \frac{\pi}{2}k$ where k is an odd integer
Range: $(-\infty, -1] \cup [1, \infty)$

Domain: $x \neq \pi k$ where k is an integer
Range: $(-\infty, \infty)$

Figure A5



Domain: $[-1, 1]$
Range: $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

Domain: $[-1, 1]$
Range: $[0, \pi)$

Domain: $(-\infty, \infty)$
Range: $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

Figure A6

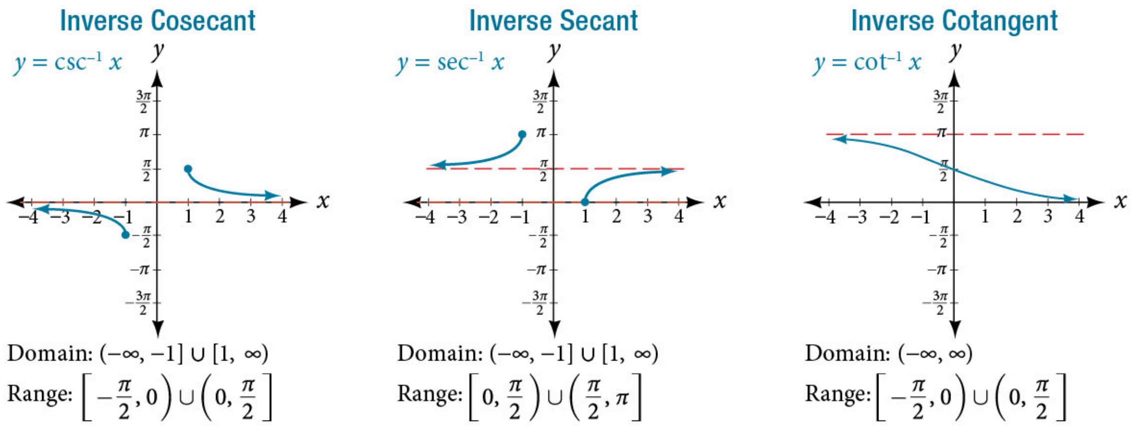


Figure A7

Trigonometric Identities

Pythagorean Identities	$\cos^2\theta + \sin^2\theta = 1$ $1 + \tan^2\theta = \sec^2\theta$ $1 + \cot^2\theta = \csc^2\theta$
Even-Odd Identities	$\cos(-\theta) = \cos\theta$ $\sec(-\theta) = \sec\theta$ $\sin(-\theta) = -\sin\theta$ $\tan(-\theta) = -\tan\theta$ $\csc(-\theta) = -\csc\theta$ $\cot(-\theta) = -\cot\theta$
Cofunction Identities	$\cos\theta = \sin\left(\frac{\pi}{2} - \theta\right)$ $\sin\theta = \cos\left(\frac{\pi}{2} - \theta\right)$ $\tan\theta = \cot\left(\frac{\pi}{2} - \theta\right)$ $\cot\theta = \tan\left(\frac{\pi}{2} - \theta\right)$ $\sec\theta = \csc\left(\frac{\pi}{2} - \theta\right)$ $\csc\theta = \sec\left(\frac{\pi}{2} - \theta\right)$
Fundamental Identities	$\tan\theta = \frac{\sin\theta}{\cos\theta}$ $\sec\theta = \frac{1}{\cos\theta}$ $\csc\theta = \frac{1}{\sin\theta}$ $\cot\theta = \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta}$
Sum and Difference Identities	$\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$ $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$ $\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$ $\sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$ $\tan(\alpha + \beta) = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$ $\tan(\alpha - \beta) = \frac{\tan\alpha - \tan\beta}{1 + \tan\alpha\tan\beta}$

Table A1

Double-Angle Formulas	$\sin(2\theta) = 2\ \sin\ \theta\ \cos\ \theta$ $\cos(2\theta) = \cos^2\theta - \sin^2\theta$ $\cos(2\theta) = 1 - 2\ \sin^2\theta$ $\cos(2\theta) = 2\ \cos^2\theta - 1$ $\tan(2\theta) = \frac{2\ \tan\ \theta}{1-\tan^2\theta}$
Half-Angle Formulas	$\sin\ \frac{\alpha}{2} = \pm\sqrt{\frac{1-\cos\ \alpha}{2}}$ $\cos\ \frac{\alpha}{2} = \pm\sqrt{\frac{1+\cos\ \alpha}{2}}$ $\tan\ \frac{\alpha}{2} = \pm\sqrt{\frac{1-\cos\ \alpha}{1+\cos\ \alpha}}$ $\tan\ \frac{\alpha}{2} = \frac{\sin\ \alpha}{1+\cos\ \alpha}$ $\tan\ \frac{\alpha}{2} = \frac{1-\cos\ \alpha}{\sin\ \alpha}$
Reduction Formulas	$\sin^2\ \theta = \frac{1-\cos(2\theta)}{2}$ $\cos^2\ \theta = \frac{1+\cos(2\theta)}{2}$ $\tan^2\ \theta = \frac{1-\cos(2\theta)}{1+\cos(2\theta)}$
Product-to-Sum Formulas	$\cos\ \alpha\ \cos\ \beta = \frac{1}{2}[\cos(\alpha-\beta) + \cos(\alpha+\beta)]$ $\sin\ \alpha\ \cos\ \beta = \frac{1}{2}[\sin(\alpha+\beta) + \sin(\alpha-\beta)]$ $\sin\ \alpha\ \sin\ \beta = \frac{1}{2}[\cos(\alpha-\beta) - \cos(\alpha+\beta)]$ $\cos\ \alpha\ \sin\ \beta = \frac{1}{2}[\sin(\alpha+\beta) - \sin(\alpha-\beta)]$
Sum-to-Product Formulas	$\sin\ \alpha + \sin\ \beta = 2\ \sin\left(\frac{\alpha+\beta}{2}\right)\ \cos\left(\frac{\alpha-\beta}{2}\right)$ $\sin\ \alpha - \sin\ \beta = 2\ \sin\left(\frac{\alpha-\beta}{2}\right)\ \cos\left(\frac{\alpha+\beta}{2}\right)$ $\cos\ \alpha - \cos\ \beta = -2\ \sin\left(\frac{\alpha+\beta}{2}\right)\ \sin\left(\frac{\alpha-\beta}{2}\right)$ $\cos\ \alpha + \cos\ \beta = 2\ \cos\left(\frac{\alpha+\beta}{2}\right)\ \cos\left(\frac{\alpha-\beta}{2}\right)$
Law of Sines	$\frac{\sin\ \alpha}{a} = \frac{\sin\ \beta}{b} = \frac{\sin\ \gamma}{c}$ $\frac{a}{\sin\ \alpha} = \frac{b}{\sin\ \beta} = \frac{c}{\sin\ \gamma}$
Law of Cosines	$a^2 = b^2 + c^2 - 2bc\ \cos\ \alpha$ $b^2 = a^2 + c^2 - 2ac\ \cos\ \beta$ $c^2 = a^2 + b^2 - 2ab\ \cos\ \gamma$

Table A1