

[09-11-13-MT 2.2]

Exercises 2.2

Most of the following equations are identities. Some may be conditional equations. Determine in which category each belongs and prove your conclusion. Give the replacement set for each equation.

- ~~1.~~ $\sec x \sin x \equiv \tan x.$
2. $\sec \phi \cot \phi \equiv \csc \phi.$
3. $\tan y \csc y \equiv \sec y.$
4. $\csc \theta \cos \theta \equiv \cot \theta.$
5. $\sin \alpha \cot \alpha \equiv \cos \alpha.$
- ~~6.~~ $\cos \beta \tan \beta \equiv \sin \beta.$
- ~~7.~~ $\sec^2 x - \tan^2 x \equiv 1.$
8. $\csc^2 \beta - \cot^2 \beta \equiv 1.$
- ~~9.~~ $\csc^2 y - \sec^2 y \equiv \sin^2 y.$
- ~~10.~~ $\cos(-\theta) \cos \theta - \sin \theta \sin(-\theta) \equiv 1.$
- ~~11.~~ $\tan^2 \theta \csc^2 \theta - \sec^2 \theta \sin^2 \theta \equiv 1.$
- ~~12.~~ $\cos^2 y \tan^2 y + \sin^2 y \cot^2 y \equiv 1.$
13. $\sec^2 \phi \cot^2 \phi - \csc^2 \phi \cos^2 \phi \equiv 1.$
14. $\cos^4 \alpha - \sin^4 \alpha \equiv \cos^2 \alpha - \sin^2 \alpha.$
- ~~15.~~ $\sec^4 x - \tan^4 x \equiv \sec^2 x + \tan^2 x.$
- ~~16.~~ $\sec^4 \phi - 1 \equiv \tan^2 \phi (\sec^2 \phi + 1).$
17. $\csc^4 z - \cot^4 z \equiv \csc^2 z + \cot^2 z.$
18. $\tan^3 \alpha + 1 \equiv (\tan \alpha + 1)(\sec^2 \alpha - \tan \alpha).$
19. $\tan^3 \alpha - 1 \equiv (\tan \alpha - 1)(\tan \alpha + \sec^2 \alpha).$
- ~~20.~~ $\cot^3 \beta + 1 \equiv (\cot \beta + 1)(\csc^2 \beta - \cot \beta).$
21. $\cot^3 \beta - 1 \equiv (\cot \beta - 1)(\cot \beta + \csc^2 \beta).$
- ~~22.~~ $\cos^6 \gamma - \sin^6 \gamma \equiv \cos^2 \gamma + \cos^4 \gamma.$
- ~~23.~~ $\cos^6 \phi - \sin^6 \phi \equiv \cos^4 \phi + \sin^2 \phi.$
- ~~24.~~ $\cos^3 x + \sin^3 x \equiv \cos x(1 - \cos x \sin x) + \sin x(1 - \cos x \sin x).$
25. $\cos^3 y + \sin^3 y \equiv \cos y(1 - \cos y \sin y) - \sin y(\cos y \sin y - 1).$
26. $\cos^3 \alpha - \sin^3 \alpha \equiv \cos \alpha(1 + \sin \alpha \cos \alpha) - \sin \alpha(1 + \sin \alpha \cos \alpha).$
- ~~27.~~ $(\tan^2 \gamma + 1)^2 \equiv (-\sec \gamma)^4.$
28. $(\cos x - \sin x)^2 \equiv 1 - 2 \sin x \cos x.$
29. $(\tan \alpha - 1)^2 \equiv \sec^2 \alpha - 2 \tan \alpha.$
30. $(1 + \cot z)^2 \equiv 2 \cot z + \csc^2 z.$
- ~~31.~~ $(\cos \beta + \sin \beta)^4 \equiv \cos^2 \beta + \sin^2 \beta + 4 \cos^2 \beta \sin^2 \beta + 4 \cos \beta \sin \beta.$
32. $(\cos \alpha - \sin \alpha)^4 \equiv \cos^2 \alpha + \sin^2 \alpha + 4 \cos^2 \alpha \sin^2 \alpha - 4 \cos \alpha \sin \alpha.$
33. $(\sin \theta + \cos \theta)^3 \equiv \sin \theta + 2 \sin \theta \cos \theta (\sin \theta + \cos \theta) + \cos \theta.$
- ~~34.~~ $\cos^2 x - \sin^2 x \equiv 1 - 2 \sin^2 x.$
- ~~35.~~ $\cos^2 \alpha - \sin^2 \alpha \equiv 2 \cos^2 \alpha - 1.$
36. $\cos^4 \theta \equiv 1 - 2 \sin^2 \theta + \sin^4 \theta.$
- ~~37.~~ $\sec^2 \phi + \csc^2 \phi \equiv \sec^2 \phi \csc^2 \phi.$
- ~~38.~~ $\sec^4 x - \tan^4 x \equiv \frac{\sin^2 x + 1}{\cos^2 x}.$
39. $\csc^4 \beta - \cot^4 \beta \equiv \frac{\cos^2 \beta + 1}{\sin^2 \beta}.$
40. $\csc^4 \alpha - 1 \equiv \cot^2 \alpha (\csc^2 \alpha + 1).$
41. $\tan^2 \gamma - \cot^2 \gamma \equiv \frac{\sin^2 \gamma - \cos^2 \gamma}{\cos^2 \gamma \sin^2 \gamma}.$
42. $\tan^2 z + \cot^2 z \equiv \frac{2 \sin^4 z - 2 \sin^2 z + 1}{\sin^2 z \cos^2 z}.$
43. $\tan^2 \phi + \cot^2 \phi \equiv 2 \tan^2 \phi - 2 \sec^2 \phi + \sec^2 \phi \csc^2 \phi.$
44. $\frac{\tan y + \cot y}{\sec y \csc y} \equiv 1.$
45. $\frac{\sin \phi + \cos^2 \phi \csc \phi}{\csc \phi} \equiv 1.$