# Rules for Differentiation

1. $\frac{d}{dx}(u^n) = nu^{n-1}\frac{du}{dx}$

2. $\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$

3. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

4. $\frac{d}{dx}(\sin u) = \cos u\frac{du}{dx}$

5. $\frac{d}{dx}(\cos u) = -\sin u\frac{du}{dx}$

6. $\frac{d}{dx}(\tan u) = \sec^2 u\frac{du}{dx}$

7. $\frac{d}{dx}(\cot u) = -\csc^2 u\frac{du}{dx}$

8. $\frac{d}{dx}(\sec u) = \sec u\tan u\frac{du}{dx}$

9. $\frac{d}{dx}(\csc u) = -\csc u\cot u\frac{du}{dx}$

10. $\frac{d}{dx}(\sinh u) = \cosh u\frac{du}{dx}$

11. $\frac{d}{dx}(\cosh u) = \sinh u\frac{du}{dx}$

12. $\frac{d}{dx}(\tanh u) = \operatorname{sech}^2 u\frac{du}{dx}$

13. $\frac{d}{dx}(\coth u) = -\operatorname{csch}^2 u\frac{du}{dx}$

14. $\frac{d}{dx}(\operatorname{sech} u) = -\operatorname{sech} u\tanh u\frac{du}{dx}$

15. $\frac{d}{dx}(\operatorname{csch} u) = -\operatorname{csch} u\coth u\frac{du}{dx}$

16. $\frac{d}{dx}(e^u) = e^u\frac{du}{dx}$

17. $\frac{d}{dx}(a^u) = a^u\ln a\frac{du}{dx}$

18. $\frac{d}{dx}(\log_a u) = \frac{1}{u\ln a}\frac{du}{dx}$

19. $\frac{d}{dx}(\ln u) = \frac{1}{u}\frac{du}{dx}$

20. $\frac{d}{dx}(\sin^{-1} u) = \frac{1}{\sqrt{1-u^2}}\frac{du}{dx}$

21. $\frac{d}{dx}(\cos^{-1} u) = \frac{-1}{\sqrt{1-u^2}}\frac{du}{dx}$

22. $\frac{d}{dx}(\tan^{-1} u) = \frac{1}{1+u^2}\frac{du}{dx}$

23. $\frac{d}{dx}(\cot^{-1} u) = \frac{-1}{1+u^2}\frac{du}{dx}$

24. $\frac{d}{dx}(\sec^{-1} u) = \frac{1}{|u|\sqrt{u^2-1}}\frac{du}{dx}$

25. $\frac{d}{dx}(\csc^{-1} u) = \frac{-1}{|u|\sqrt{u^2-1}}\frac{du}{dx}$

26. Parametric Equations:

$x = f(t) \qquad y = g(t)$

$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} \quad or \quad \frac{dy}{dt} * \frac{dt}{dx}$