Derivatives of basic elementary functions

1. $(x^\alpha)' = \alpha x^{\alpha-1}$

   $c' = 0$ $\quad$ c-constant,

   $x' = 1$ $\quad$ $\alpha = 1$,

   $(\sqrt{x})' = \dfrac{1}{2\sqrt{x}}$ $\quad$ $\alpha = \frac{1}{2}$,

   $\left(\dfrac{1}{x}\right)' = -\dfrac{1}{x^2}$ $\quad$ $\alpha = -1$.

2. $(\sin x)' = \cos x$.

3. $(\cos x)' = -\sin x$.

4. $(\tan x)' = \dfrac{1}{\cos^2 x}$.

5. $(\cot x)' = -\dfrac{1}{\sin^2 x}$.

6. $(a^x)' = a^x \ln a$ $\quad$ $a > 0, \ \ a \neq 1$.

7. $(e^x)' = e^x$.

8. $(\log_a x)' = \dfrac{1}{x \ln a}$ $\quad$ $a > 0, \quad a \neq 1$.

9. $(\ln x)' = \dfrac{1}{x}$.

10. $(\arcsin x)' = \dfrac{1}{\sqrt{1-x^2}}$

11. $(\arccos x)' = -\dfrac{1}{\sqrt{1-x^2}}$

12. $(\arctan x)' = \dfrac{1}{1+x^2}$

13. $(\operatorname{arccot} x)' = -\dfrac{1}{1+x^2}$

14. $(\sinh x)' = \cosh x$

15. $(\cosh x)' = \sinh x$

16. $(\tanh x)' = \dfrac{1}{\cosh^2 x}$

17. $(\coth x)' = -\dfrac{1}{\sinh^2 x}$

Rules of differentiation

Given two differentiable functions $u = u(x),\ \ v = v(x)$.

1. $[u(x) \pm v(x)]' = u'(x) \pm v'(x)$;
2. $[u(x)v(x)]' = u'(x)v(x) + u(x)v'(x)$;
3. If c is a constant then $[c \cdot u(x)]' = cu'(x)$.
4. $\left[\dfrac{u(x)}{v(x)}\right]' = \dfrac{u'(x)v(x) - u(x)v'(x)}{v^2(x)}$;
5. $\left[\dfrac{1}{v(x)}\right]' = -\dfrac{v'(x)}{v^2(x)}$.
6. The derivative of composite function $y = f\left[\varphi(x)\right]\ y' = f'\left[\varphi(x)\right]\varphi'(x)$