Elementary Tools from Algebra and Geometry

Quadratic Formula: $ax^2 + bx + c = 0 \quad \rightsquigarrow \quad x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Pythagorean Theorem: If a right triangle has legs a, b and hypotenuse c, then $a^2 + b^2 = c^2$.

Triangle Area $= \frac{1}{2}$ base $\times$ height.

Rectangle Area = base $\times$ height

Perimeter of a polygon (triangle, rectangle, etc.) = sum of side lengths

Circle Area $= \pi r^2$

Circle Perimeter $= 2\pi r$

Five derivative rules for operations on functions.

Constant Multiple Rule: $\dfrac{d}{dx}\Big(cf(x)\Big) = cf'(x)$

Sum and Difference Rule: $\dfrac{d}{dx}\Big(f(x) \pm g(x)\Big) = f'(x) \pm g'(x)$

Product Rule: $\dfrac{d}{dx}\Big(f(x) \cdot g(x)\Big) = f'(x)g(x) + f(x)g'(x)$

Quotient Rule: $\dfrac{d}{dx}\Big(\dfrac{f(x)}{g(x)}\Big) = \dfrac{f'(x)g(x) - f(x)g'(x)}{(g(x))^2}$

Chain Rule: $\dfrac{d}{dx}\Big(f(g(x))\Big) = f'(g(x)) \cdot g'(x)$

Ten derivative rules for functions

Derivative of a Constant: $\dfrac{d}{dx}(c) = 0$, where c is a constant.

The Power Rule: $\dfrac{d}{dx}\Big(x^n\Big) = nx^{n-1}$

Exponential Functions: $\dfrac{d}{dx}\Big(a^x\Big) = a^x \cdot \ln(a)$

Special Case: $\dfrac{d}{dx}\Big(e^x\Big) = e^x$

Three Trigonometric Rules:

$\dfrac{d}{dx}\Big(\sin(x)\Big) = \cos(x)$

$\dfrac{d}{dx}\Big(\cos(x)\Big) = -\sin(x)$

$\dfrac{d}{dx}\Big(\tan(x)\Big) = \sec^2(x) = \dfrac{1}{\cos^2(x)}$

Three Inverse Function Rules:

$\dfrac{d}{dx}\Big(\ln(x)\Big) = \dfrac{1}{x}$

$\dfrac{d}{dx}\Big(\arctan(x)\Big) = \dfrac{1}{1+x^2}$

$\dfrac{d}{dx}\Big(\arcsin(x)\Big) = \dfrac{1}{\sqrt{1-x^2}}$

General Antiderivative Rules

If k is a constant $\displaystyle\int k\,dx = kx + C$

$\displaystyle\int x^n\,dx = \frac{x^{n+1}}{n+1} + C$, when $n \neq -1$

$\displaystyle\int a^x\,dx = \frac{a^x}{\ln(a)} + C$

$\displaystyle\int e^x\,dx = e^x + C$

$\displaystyle\int \cos(x)\,dx = \sin(x) + C$

$\displaystyle\int \sin(x)\,dx = -\cos(x) + C$

$\displaystyle\int \sec^2(x)\,dx = \tan(x) + C$

$\displaystyle\int \frac{1}{x}\,dx = \ln(|x|) + C$

$\displaystyle\int \frac{1}{1+x^2}\,dx = \arctan(x) + C$

$\displaystyle\int \frac{1}{\sqrt{1-x^2}}\,dx = \arcsin(x) + C$