

Math 151 Formulas

Differentiation Rules

General Formulas

1. $\frac{d}{dx}(c) = 0$
2. $\frac{d}{dx}[cf(x)] = cf'(x)$
3. $\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x)$
4. $\frac{d}{dx}[f(x) - g(x)] = f'(x) - g'(x)$
5. $\frac{d}{dx}[f(x)g(x)] = f(x)g'(x) + f'(x)g(x)$
6. $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$
7. $\frac{d}{dx}f(g(x)) = f'(g(x)) \cdot g'(x)$
8. $\frac{d}{dx}(x^n) = nx^{n-1}$

Exponential and Logarithm Functions

9. $\frac{d}{dx}(e^x) = e^x$
10. $\frac{d}{dx}(a^x) = a^x \ln a$
11. $\frac{d}{dx} \ln |x| = \frac{1}{x}$
12. $\frac{d}{dx}(\log_a x) = \frac{1}{x \ln a}$

Trigonometric Functions

13. $\frac{d}{dx}(\sin x) = \cos x$
14. $\frac{d}{dx}(\cos x) = -\sin x$
15. $\frac{d}{dx}(\tan x) = \sec^2 x$
16. $\frac{d}{dx}(\cot x) = -\csc^2 x$
17. $\frac{d}{dx}(\sec x) = \sec x \cdot \tan x$
18. $\frac{d}{dx}(\csc x) = -\csc x \cdot \cot x$

Inverse Trigonometric Functions

19. $\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$
20. $\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$
21. $\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$
22. $\frac{d}{dx}(\cot^{-1} x) = -\frac{1}{1+x^2}$

Important Limits

1. $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$
2. $\lim_{h \rightarrow 0} \frac{a^h - 1}{h} = \ln a$
3. $\lim_{x \rightarrow 0} (1+x)^{\frac{1}{x}} = e$
4. $\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n = e$

Note: Math 151 students are not allowed to use any formula sheet during a test or a final exam.

Differentials and Relative Change

Differential dy : $dy = f'(x) dx$, or $df = f'(x) dx$

Relative Change: $\frac{\Delta y}{y} \approx \frac{dy}{y}$, or $\frac{\Delta f}{f(x_0)} \approx \frac{df}{f(x_0)}$

Linearization

Linearization of f at a : $L(x) = f(a) + f'(a)(x - a)$

Table of Indefinite Integrals

$$1. \int [f(x) + g(x)] dx = \int f(x) dx + \int g(x) dx$$

$$2. \int cf(x) dx = c \int f(x) dx$$

$$3. \int x^n dx = \frac{1}{n+1} x^{n+1} + C \quad (n \neq -1)$$

$$4. \int \frac{1}{x} dx = \ln|x| + C$$

$$5. \int e^x dx = e^x + C$$

$$6. \int a^x dx = \frac{a^x}{\ln a} + C$$

$$7. \int \sin(x) dx = -\cos(x) + C$$

$$8. \int \cos(x) dx = \sin(x) + C$$

$$9. \int \sec^2(x) dx = \tan(x) + C$$

$$10. \int \csc^2(x) dx = -\cot(x) + C$$

$$11. \int \sec(x) \tan(x) dx = \sec(x) + C$$

$$12. \int \csc(x) \cot(x) dx = -\csc(x) + C$$

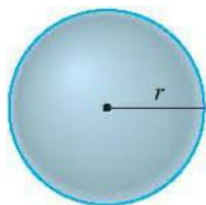
$$13. \int \frac{1}{x^2 + 1} dx = \tan^{-1}(x) + C$$

$$14. \int \frac{1}{\sqrt{1-x^2}} dx = \sin^{-1}(x) + C$$

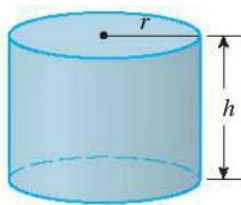
Geometry**Sphere**

$$V = \frac{4}{3} \pi r^3$$

$$A = 4\pi r^2$$

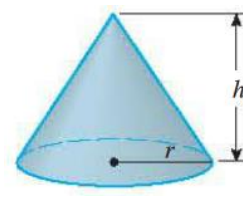
**Cylinder**

$$V = \pi r^2 h$$

**Cone**

$$V = \frac{1}{3} \pi r^2 h$$

$$A = \pi r \sqrt{r^2 + h^2}$$



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