

MATH 155 - Basic Integration Rules and Formulas; Arc Length Formulas
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Integration Rules:

1. $\int 0 du = C$
2. $\int k du = k \int du = ku + C$
3. $\int kf(u) du = k \int f(u) du$
4. $\int [f(u) \pm g(u)] du = \int f(u) du \pm \int g(u) du$

Integration Formulas:

5. $\int u^n du = \frac{u^{n+1}}{n+1} + C, \quad n \neq -1$
6. $\int \sin u du = -\cos u + C$
7. $\int \cos u du = \sin u + C$
8. $\int \tan u du = -\ln |\cos u| + C$
9. $\int \cot u du = \ln |\sin u| + C$
10. $\int \sec u du = \ln |\sec u + \tan u| + C$
11. $\int \csc u du = -\ln |\csc u + \cot u| + C$
12. $\int \sec^2 u du = \tan u + C$
13. $\int \sec u \tan u du = \sec u + C$
14. $\int \csc^2 u du = -\cot u + C$
15. $\int \csc u \cot u du = -\csc u + C$

$$16. \int \frac{du}{u} = \ln |u| + C$$

$$17. \int e^u du = e^u + C$$

$$18. \int a^u du = \frac{a^u}{\ln a} + C$$

$$19. \int \frac{du}{\sqrt{a^2 - u^2}} = \sin^{-1} \left(\frac{u}{a} \right) + C$$

$$20. \int \frac{du}{a^2 + u^2} = \frac{1}{a} \tan^{-1} \left(\frac{u}{a} \right) + C$$

$$21. \int \frac{du}{u\sqrt{u^2 - a^2}} = \frac{1}{a} \sec^{-1} \left(\frac{|u|}{a} \right) + C$$

Arc Length Formulas:

Let the function given by $y = f(x)$ represent a smooth curve on the interval $[a, b]$. The **arc length** of f between a and b is

$$s = \int_a^b \sqrt{1 + [f'(x)]^2} dx$$

Similarly, for a smooth curve given by $x = g(y)$, the **arc length** of g between c and d is

$$s = \int_c^d \sqrt{1 + [g'(y)]^2} dy$$