MATH 136-03 Calculus 2, Spring 2019

Integration Formulas

$c, k \in \mathbb{R}$ are arbitrary constants

1. $\displaystyle\int 0 \, dx = c$, where c is an arbitrary constant

2. $\displaystyle\int k \, dx = kx + c$

3. **Power Rule**: $\displaystyle\int x^n \, dx = \frac{x^{n+1}}{n+1} + c, \quad$ where $n \neq -1$

4. $\displaystyle\int \frac{1}{x} \, dx = \ln|x| + c$

5. $\displaystyle\int e^x \, dx = e^x + c \quad$ and more generally, $\displaystyle\int e^{kx} \, dx = \frac{1}{k} e^{kx} + c, \quad (k \neq 0)$

6. $\displaystyle\int a^x \, dx = \frac{a^x}{\ln a} + c \quad$ for any real number $a > 0$

7. $\displaystyle\int \sin x \, dx = -\cos x + c \quad$ and more generally, $\displaystyle\int \sin(kx) \, dx = -\frac{1}{k}\cos(kx) + c, \quad (k \neq 0)$

8. $\displaystyle\int \cos x \, dx = \sin x + c \quad$ and more generally, $\displaystyle\int \cos(kx) \, dx = \frac{1}{k}\sin(kx) + c, \quad (k \neq 0)$

9. $\displaystyle\int \sec^2 x \, dx = \tan x + c$

10. $\displaystyle\int \csc^2 x \, dx = -\cot x + c$

11. $\displaystyle\int \sec x \tan x \, dx = \sec x + c$

12. $\displaystyle\int \csc x \cot x \, dx = -\csc x + c$

13. $\displaystyle\int \tan x \, dx = -\ln|\cos x| + c = \ln|\sec x| + c$

14. $\displaystyle\int \sec x \, dx = \ln|\sec x + \tan x| + c$

15. $\displaystyle\int \frac{1}{\sqrt{1-x^2}} \, dx = \sin^{-1} x + c$

16. $\displaystyle\int \frac{1}{x^2+1} \, dx = \tan^{-1} x + c$

– **OVER** –

17. **Linearity:** **(i)** $\displaystyle\int k f(x)\,dx \;=\; k\int f(x)\,dx$ (constants pull out)

(ii) $\displaystyle\int f(x)+g(x)\,dx \;=\; \int f(x)\,dx+\int g(x)\,dx$ (integral of a sum is the sum of the integrals)

18. **Integration by Parts:** $\displaystyle\int u\,dv \;=\; u\,v-\int v\,du$

19. **Important Trig Identities:**

(i) $\cos^2\theta=\dfrac{1}{2}\left(1+\cos(2\theta)\right)$

(ii) $\sin^2\theta=\dfrac{1}{2}\left(1-\cos(2\theta)\right)$

(iii) $\cos^2\theta+\sin^2\theta=1$

(iv) $1+\tan^2\theta=\sec^2\theta$

(v) $\sin(2\theta)=2\sin\theta\cos\theta$

20. **Partial Fractions:**

(i) $\dfrac{p(x)}{(x-r_1)(x-r_2)} \;=\; \dfrac{A}{x-r_1}+\dfrac{B}{x-r_2}$ Two Distinct Linear Factors

(ii) $\dfrac{p(x)}{(x-r_1)(x-r_2)(x-r_3)} \;=\; \dfrac{A}{x-r_1}+\dfrac{B}{x-r_2}+\dfrac{C}{x-r_3}$ Three Distinct Linear Factors

(iii) $\dfrac{p(x)}{(x-r_1)(x-r_2)^2} \;=\; \dfrac{A}{x-r_1}+\dfrac{B}{x-r_2}+\dfrac{C}{(x-r_2)^2}$ Repeated Linear Factor

(iv) $\dfrac{p(x)}{(x-r_1)(x^2+a^2)} \;=\; \dfrac{A}{x-r_1}+\dfrac{Bx+C}{x^2+a^2}$ Irreducible Quadratic Factor