

$uv - \int vdu$

Use tabular integration to integrate the following

$$\begin{aligned} 10. \int x^2 \ln x dx &= \int \ln x \left| \begin{array}{c|c} x^2 & dx \\ \hline \frac{1}{x} & \frac{1}{3} x^3 \end{array} \right. \\ &= \frac{1}{3} x^3 \ln x - \int \frac{1}{x} \cdot \frac{x^3}{3} dx \\ &= \frac{1}{3} x^3 \ln x - \frac{1}{3} \int x^2 dx \\ &= \boxed{\frac{1}{3} x^3 \ln x - \frac{1}{9} x^3 + C} \end{aligned}$$

Use ultra violet minus super vdu to integrate the following

$$10. \int x^2 \ln x dx$$

Use tabular integration to integrate the following

$$\begin{aligned} A. \int \arcsin(x) dx &= x \arcsin x - \int \frac{x}{\sqrt{1-x^2}} \\ &\quad \begin{array}{c} \uparrow \\ \sqrt{1-x^2} \end{array} \quad \begin{array}{c} \rightarrow \\ x \end{array} \\ &= x \arcsin x - \int x (1-x^2)^{-1/2} \\ &\quad \boxed{= x \arcsin x + \frac{1}{2} \cdot 2(1-x^2)^{1/2} + C} \end{aligned}$$

$$19. \int e^x \cos(2x) dx$$

$$\begin{aligned}
 \int \frac{x^3}{\sqrt{1+x^2}} dx &= \int x^3 (1+x^2)^{-1/2} dx \\
 &= \int \frac{x^2 \cdot x}{2x} \cdot \frac{1}{2} \cdot 2(1+x^2)^{-1/2} dx \\
 &= x^2 (1+x^2)^{1/2} - \int 2x (1+x^2)^{1/2} \\
 &\boxed{= x^2 (1+x^2)^{1/2} - \frac{2}{3} (1+x^2)^{3/2} + C}
 \end{aligned}$$

Tabular

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

1	-cos x
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$$= -x \cos x + \sin x + C$$

Guess/Check or u-substitution

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

$$\int x e^x dx$$

$$\int x e^{x^2} dx = \frac{1}{2} e^{x^2} + C$$

CALCULUS: Graphical, Numerical, Algebraic by Finney, Demana, Waits and Kennedy
 Chapter 6: Differential Equations **6.5: Partial Fractions**

What you'll Learn About

- How integrate a fraction when the denominator can be factored and the numerator is not the derivative of the denominator

$$2x-4 = 2(x-2)$$

What x values make the denominator equal to zero?

$$x=0 \quad x=4$$

(1) Factor Denominator

(2) Find A and B

(3) Rewrite Fractions and Take Antiderivative

(4) Properties of Logarithms

$$A) \int \frac{x-12}{x^2 - 4x} dx$$

$$\int \frac{x-12}{x(x-4)} = \int \frac{3}{x} + \frac{-2}{x-4} = 3 \ln x - 2 \ln(x-4) + C$$

$$\frac{x-12}{x(x-4)} = \frac{A}{x} + \frac{B}{x-4}$$

$$\frac{x-12}{x(x-4)} = \frac{A(x-4)}{x(x-4)} + \frac{Bx}{x(x-4)}$$

$$x-12 = A(x-4) + Bx$$

$$\begin{aligned} x=0 & \quad -12 = -4A \\ & \quad 3 = A \\ x=4 & \quad -8 = 4B \\ & \quad -2 = B \end{aligned}$$

$$\ln \left| \frac{x^3}{(x-4)^2} \right| + C$$

$$B) \int \frac{16-x}{x^2+3x-10} dx = \int \frac{-3}{x+5} + \frac{2}{x-2} = -3 \ln(x+5) + 2 \ln(x-2) + C$$

$$\int \frac{16-x}{(x+5)(x-2)} dx$$

$$\ln \left| (x+5)^{-3} \right| + \ln(x-2)^2 + C$$

$$\frac{16-x}{(x+5)(x-2)} = \frac{A}{x+5} + \frac{B}{x-2}$$

$$16-x = A(x-2) + B(x+5)$$

$$x=2 \quad 14 = 7B \quad x=-5 \quad 21 = -7A$$

$$\ln \left| (x+5)^{-3} (x-2)^2 \right| + C$$

$$\ln \left| \frac{(x-2)^2}{(x+5)^3} \right| + C$$