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Assignment 10

1. $\int \frac{11-3x\,dx}{x^2+2x-3} = \int \frac{11-3x}{(x+3)(x-1)}$

$\frac{11-3x}{(x+3)(x-1)} = \frac{A}{(x+3)} + \frac{B}{(x-1)}$ ..... ①

$\frac{11-3x}{(x+3)(x-1)} = \frac{A(x-1)+B(x+3)}{(x+3)(x-1)}$

$11-3x = A(x-1) + B(x+3)$ .... ②

• $F(-3) \Rightarrow 11-3(-3) = A(-3-1)$

$\frac{20}{-4} = \frac{\cancel{-4}A}{\cancel{-4}}$ $\therefore A = -5$

• $F(1) \Rightarrow 11-3(1) = B(1+3)$

$\frac{8}{4} = \frac{\cancel{4}B}{\cancel{4}}$ $\therefore B = 2$

Substitute A and B in equation 1

$\frac{11-3x}{(x+3)(x-1)} = \frac{-5}{(x+3)} + \frac{2}{(x-1)}$

$\int \frac{11-3x}{(x+3)(x-1)}dx = \int \frac{-5}{(x+3)}dx + \int \frac{2}{(x-1)}$

* Let $u = (x+3)$ $\frac{du}{dx} = 1$ $\therefore du = dx$

$\int \frac{-5}{(x-3)}dx = \int \frac{-5}{u}du = -5\int \frac{1}{u}du = -5\ln u$

* Let $u' = (x-1)$ $\frac{du}{dx} = 1$ $\therefore dx = du$

$\int \frac{2}{(x-1)}dx = \int \frac{2}{u}du = 2\int \frac{1}{u'}du = 2\ln u'$

Ans $= -5\ln u + 2\ln u' + c$

Ans $= -5\ln(x+3) + 2\ln(x-1) + c$

2 $\int \frac{4x-16}{x^2-2x-3}\,dx = \int \frac{4x-16}{(x-3)(x+1)}\,dx$

$$\frac{4x-16}{(x-3)(x+1)} = \frac{A}{(x-3)} + \frac{B}{(x+1)} \quad \cdots\cdots (1)$$

$$\frac{4x-16}{(x-3)(x+1)} = \frac{A(x+1)+B(x-3)}{(x-3)(x+1)}$$

$$4x-16 = A(x+1)+B(x-3) \quad \cdots\cdots (2)$$

* $F(3) \Rightarrow 4(3)-16 = A(3+1)$

$$\frac{-4}{4} = \frac{\cancel{4}A}{\cancel{4}} \quad \therefore A = -1$$

* $F(-1) \Rightarrow 4(-1)-16 = B(-1-3)$

$$\frac{-20}{-4} = \frac{-4B}{-4} \quad \therefore B = 5$$

Substitute A and B into equation 1

$$\frac{-1}{(x-3)} + \frac{5}{(x+1)}$$

$$\int \frac{4x-16}{(x-3)(x+1)}\,dx = \int \frac{-1}{x-3} + \int \frac{5}{x+1}$$

* Let $u = (x-3)$ $\quad \frac{du}{dx} = 1 \quad \therefore dx = du$

$$\int \frac{-1}{x-3}\,dx = \int \frac{-1}{u}\,du = -1\int \frac{1}{u}\,du = -1 \ln u$$

* Let $u = (x+1)$

$$\int \frac{5}{x+1}\,dx = \int \frac{5}{u}\,du = 5\int \frac{1}{u}\,du = 5 \ln u$$

Answer $= -1 \ln u + 5 \ln u + c$

Answer $= -1 \ln(x-3) + 5 \ln(x+1) + c$

3 $\int \frac{2x^2-9x-35}{(x+1)(x-2)(x+3)}\,dx$

$\frac{2x^2-9x-35}{(x+1)(x-2)(x+3)} \cancel{dx} = \frac{A}{(x+1)} + \frac{B}{(x-2)} + \frac{C}{(x+3)}$

$\frac{2x^2-9x-35}{(x+1)(x-2)(x+3)} \cancel{dx} = \frac{A(x-2)(x+3)+B(x+1)(x+3)+C(x+1)(x-2)}{(x+1)(x-2)(x+3)}$

$2x^2-9x-35 = A(x-2)(x+3)+B(x+1)(x+3)+C(x+1)(x-2)$

$F(2) \Rightarrow 2(2)^2-9(2)-35 = B(2+1)(2+3)$

$2(4)-18-35 = B(3)(5)$

$\frac{-45}{15} = \frac{15B}{15}$ $\therefore B=-3$

$F(-3) \Rightarrow 2(-3)^2-9(-3)-35 = C(-3+1)(-3-2)$

$2(9)+27-35 = C(-2)(-5)$

$10 = 10C$ $\therefore C = 1$

$F(-1) \Rightarrow 2(-1)^2-9(-1)-35 = A(-1-2)(-1+3)$

$2+9-35 = A(-3)(2)$

$\frac{-24}{-6} = \frac{-6A}{-6}$ $\therefore A = 4$

$\therefore \frac{2x^2-9x-35}{(x+1)(x-2)(x+3)} = \frac{4}{(x+1)} + \frac{-3}{(x-2)} + \frac{1}{(x+3)}$

$\int \frac{2x^2-9x-35}{(x+1)(x-2)(x+3}\,dx = \int \frac{4}{x+1}\,dx + \int \frac{-3}{x-2}\,dx + \int \frac{1}{x+3}\,dx$

* Let $u = x+1$ $\frac{du}{dx} = 1$ $\therefore dx = du$

$\int \frac{4}{x+1}\,dx = \int \frac{4}{u}\,du = 4\int \frac{1}{u}\,du = 4\ln u$

* Let $u = x-2$ $\frac{du}{dx} = 1$ $\therefore dx = du$

$\int \frac{-3}{x-2}\,dx = \int \frac{-3}{u}\,du = -3\int \frac{1}{u}\,du = -3\ln u$

* Let $u = x+3$ $\quad \frac{du}{dx} = 1$ $\quad \therefore dx = du$

$$\int \frac{1}{x+3}\,dx = \int \frac{1}{u}\,d\cancel{u} = 1\int \frac{1}{u}\,du = 1\ln u$$

$\therefore$ Ans $= 4\ln u - 3\ln u + 1\ln u + C$

$\therefore$ Answer $= 4\ln(x+1) - 3\ln(x-2) + 1\ln(x+3) + C$