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 DEPT: MBBS
 MATRIC NO: 19/MH501/028
 COURSE: MAT 104

Assignment

1. $\int \frac{11-3x}{x^2+2x-3} dx$
2. $\int \frac{4x-16}{x^2-2x-3} dx$ $(x=2)$
3. $\int \frac{(2x^2-9x-35)}{(x+1)(x+5)} dx$

Soln

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

$$x^2+2x-3 = (x-1)(x+3)$$

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

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

$$11-3x = Ax + 3A + Bx - B$$

$$11-3x = Ax + Bx + 3A - B$$

$$11-3x = x(A+B) + 3A - B$$

$$A+B = -3 \quad \text{--- (i)}$$

$$3A - B = 11 \quad \text{--- (ii)}$$

$$\frac{4A}{4} = \frac{8}{4}$$

$$A = 2$$

$$A+B = -3$$

$$2+B = -3$$

$$B = -5$$

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

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

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

$$2 \int \frac{4x-16}{x^2-2x-3}$$

$$x^2-2x-3 = (x+1)(x-3)$$

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

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

$$4x-16 = Ax-3A+Bx+B$$

$$4x-16 = Ax+Bx-3A+B$$

$$4x-16 = x(A+B) - 3A+B$$

$$A+B=4 \quad \text{--- (i)}$$

$$-3A+B=-16 \quad \text{--- (ii)}$$

$$\frac{4A}{4} = \frac{-20}{4}$$

$$A = -5$$

$$A+B=4$$

$$-5+B=4$$

$$B=9$$

$$\int \frac{4x-16}{(x+1)(x-3)} dx = \int \frac{-5}{x+1} dx + \int \frac{9}{x-3} dx$$

$$\int \frac{4x-16}{(x+1)(x-3)} = -5 \ln|x+1| + 9 \ln|x-3| + C$$

$$63 \int \frac{2x^2-9x-35}{(x+1)(x-2)(x+3)} dx$$

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

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

$$2x^2 - 9x - 35 = A(x^2 + x - 6) + B(x^2 + 4x + 3) + C(x^2 - x - 2)$$

$$2x^2 - 9x - 35 = Ax^2 + Ax - 6A + Bx^2 + 4xB + 3B + Cx^2 - Cx - 2C$$

$$2x^2 - 9x - 35 = Ax^2 + Bx^2 + Cx^2 + Ax + 4Bx - Cx - 6A + 3B - 2C$$

$$2x^2 - 9x - 35 = x^2(A+B+C) + x(A+4B-C) - 6A + 3B - 2C$$

$$A+B+C = 2 \quad \text{--- (i)}$$

$$A+4B-C = -9 \quad \text{--- (ii)}$$

$$-6A+3B-2C = -35 \quad \text{--- (iii)}$$

From equ (i)

$$A = 2 - B - C \quad \text{--- (iv), Put equ (iv) in equ (ii) & (iii)}$$

$$A + 4B - C = -9$$

$$2 - B - C + 4B - C = -9$$

$$3B - 2C = -11 \quad \text{--- (v)}$$

$$-6A + 3B - 2C = -35$$

$$-6(2 - B - C) + 3B - 2C = -35$$

$$-12 + 6B + 6C + 3B - 2C = -35$$

$$9B + 4C = -23 \quad \text{--- (vi)}$$

From equ (v) & (vi)

$$3B - 2C = -11 \quad \times 4$$

$$9B + 4C = -23 \quad \times 2$$

$$12B - 8C = -44$$

$$+ 18B + 8C = -46$$

$$\frac{30B}{30} = \frac{-90}{30}$$

$$B = 3$$

$$3B - 2C = -11$$

$$3(3) - 2C = -11$$

$$-9 - 2C = -11$$

$$-2C = -11 + 9$$

$$-2C = -2$$

$$\frac{2C}{-2} = \frac{-2}{-2}$$

$$C = +1$$

$$A = 2 - B - C$$

$$A = 2 - (-3) - 1$$

$$A = 4$$

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

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

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