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COLLEGE / DEPT: MHS / MBBS

COURSE CODE: MAT 104

MATRIC NO: 19 / MHS 01 / 030

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

$$\frac{11-3x}{x^2+2x-3} = \frac{11-3x}{(x-1)(x+3)} = \frac{A}{(x-1)} + \frac{B}{(x+3)} = \frac{A(x+3) + B(x-1)}{(x-1)(x+3)}$$

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

multiply both sides by $(x-1)(x+3)$

$$11-3x = A(x+3) + B(x-1)$$

At $x = -3$, we have;

$$11 - 3(-3) = A(-3+3) + B(-3-1)$$

$$11 + 9 = B(-4)$$

$$-4B = 20$$

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

$$B = -5$$

At $x = +1$, we have;

$$11 - 3(+1) = A(+1+3) + B(+1-1)$$

$$11 - 3 = A(4)$$

$$4A = 8$$

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

$$A = 2$$

∴ We now write;

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

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

let $u = x-1$

$dx = du$

$$\Rightarrow \int \frac{2 du}{u}$$

let $u = x+3$

$du = dx$

$$\int \frac{-5 du}{u}$$

$$\Rightarrow 2 \ln(x-1) - 5 \ln(x+3)$$

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

$$\frac{4x-16}{x^2-2x-3} = \frac{4x-16}{(x+1)(x-3)} = \frac{A}{x+1} + \frac{B}{x-3} = \frac{A(x-3) + B(x+1)}{(x+1)(x-3)}$$

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

Multiply both sides by $(x+1)(x-3)$

$$4x-16 = A(x-3) + B(x+1)$$

At $x=+3$, we have

$$4[3]-16 = A[3-3] + B[3+1]$$

$$12-16 = B[4]$$

$$-4 = 4B$$

$$B = \frac{-4}{4}$$

$$B = -1$$

When $x=-1$, we have

$$4[-1]-16 = A[-1-3] + B[-1+1]$$

$$-4-16 = A[-4]$$

$$-20 = -4A$$

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

$$A = 5$$

We now write,

$$\int \frac{5}{x+1} dx + \int \frac{-1}{x-3} dx = \int \frac{4x-16}{x^2-2x-3} dx$$

$$\Rightarrow \int \frac{5dx}{x+1} + \int \frac{-1dx}{x-3} = \int \frac{4x-16}{x^2-2x-3} dx$$

$$\text{let } u = x+1 \quad \text{let } u = x-3$$

$$du = dx \quad du = dx$$

$$\Rightarrow \int \frac{5du}{u} + \int \frac{-1du}{u} = 5 \ln|x+1| - 1 \ln|x-3|$$

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

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

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

Multiply both sides by $(x+1)(x+2)(x+3)$

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

When $x = -2$, we have;

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

$$8 + 18 - 35 = B[-1][1]$$

$$-9 = -1B$$

$$B = \frac{-9}{-1}$$

$$B = 9$$

When $x = -3$, we have;

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

$$18 + 27 - 35 = C[-2](-1)$$

$$10 = 2C$$

$$C = \frac{10}{2}$$

$$C = 5$$

When $x = -1$, we have;

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

$$2 + 9 - 35 = A[-1][2]$$

$$-24 = -2A$$

$$-2A = -24$$

$$A = \frac{-24}{-2}$$

$$A = 12$$

We now write's

$$\int \frac{12}{x+1} dx + \int \frac{9}{x+2} dx + \int \frac{5}{x+3} dx = \int \frac{2x^2 - 9x - 35}{(x+1)(x+2)(x+3)} dx$$

$$\Rightarrow \int \frac{12 dx}{x+1} + \int \frac{9 dx}{x+2} + \int \frac{5 dx}{x+3}$$

$$\text{let } u=x+1 \quad \text{let } u=x+2 \quad \text{let } u=x+3$$

$$du = dx \quad du = dx \quad du = dx$$

$$\Rightarrow \int \frac{12 du}{u} + \int \frac{9 du}{u} + \int \frac{5 du}{u} = 12 \ln|x+1| + 9 \ln|x+2| + 5 \ln|x+3|$$