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Mat 204

Matric No: 19/ENG05/050

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

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

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

divide multiply all by $(x+3)(x-1)$

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

at $x = 1$

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

$$B = 2$$

at $x = -3$

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

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

$$A = -5$$

we can now write

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

$$\Rightarrow \int \begin{matrix} \text{let } u = x+3 & u = x-1 \\ du = dx & du = dx \end{matrix}$$

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

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

$$= -5 \ln u$$

$$= 2 \ln u$$

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

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

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

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

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

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

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

$$A+B+C = 2 \quad (1)$$

$$A+4B-C = -9 \quad (2)$$

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

From ~~A+B+C =~~

$$\text{From (1) } A = -B-C+2 \quad (4) \quad \text{put (4) in (2)}$$

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

$$3B-2C = -9$$

$$3B = -9+2C$$

$$B = \frac{-9+2C}{3} \quad (5) \quad \text{put eqn (5) in eqn (4)}$$

$$\frac{-9+2C}{3} - C + 2 + 4\left(\frac{-9+2C}{3}\right) - C = -9$$

multiply through by 3.

$$3(-9+2C) - 3C + 6 + 12(-9+2C) - 3C = -27$$

$$-27+6C-3C+6-108+24C-3C = -27$$

$$6C-3C+24C-3C = -27+27-6+108$$

$$24C = 102$$

$$C = 102/24 = 4.25$$

Mat 104,

Integrated

1) $(11-3x) / (x^2 + x - 3)$

2) $(2x^2 - 9x - 35) / (x+1)(x-2)(x+3)$

3) $1 / (x^2 + 121)$

3) $1 / (x^2 + 121)$

$$\int \frac{dx}{x^2 + 121} = \int \frac{dx}{x^2 + 11^2}$$

$$x = 11 \tan \theta$$

$$\frac{dx}{d\theta} = 11 \sec^2 \theta$$

$$dx = 11 \sec^2 \theta d\theta$$

$$x^2 + 11^2 = 11^2 \tan^2 \theta + 11^2 = 11^2 (\tan^2 \theta + 1) = 121 \sec^2 \theta$$

$$\Rightarrow \int \frac{11 \sec^2 \theta d\theta}{121 \sec^2 \theta} = \int \frac{d\theta}{11} = \frac{1}{11} \int d\theta$$

$$= \frac{1}{11} [\theta] + C$$

$$= \frac{1}{11} \tan^{-1} \frac{x}{11} + C$$

when $\theta = \tan^{-1} x/a$