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DEPT: 19/MHS01/076

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

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

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

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

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

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

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

$$\therefore A+B = -3$$

$$3A-B = 11$$

To Find B

$$A = -3 - B$$

$$\therefore 3(-3-B) - B = 11$$

$$-9 - 3B - B = 11$$

$$-4B = 20$$

$$B = -5$$

To find A

$$B = -3 - A$$

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

$$3A + 3 + A = 11$$

$$4A = 8$$

$$A = 2$$

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

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

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

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

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

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

$$\text{Let } x = -1$$

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

$$0 + B(-4) = -4 - 16$$

$$-4B = -20$$

$$B = 5$$

$$\text{Let } x = +3$$

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

$$4A + 0 = -4$$

$$A = -1$$

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

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

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

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

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

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

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

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

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

Hence

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

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

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

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

\therefore

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

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

Substituting (iv) into (iii)

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

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

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

Using elimination method

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

$$4C+9B=-23$$

$$-6C+9B=-33$$

$$4C+9B=-23$$

$$-10C=-10$$

$$C=1$$

$$4C + 9B = -23$$

$$4(1) + 9B = -23$$

$$9B = -27$$

$$B = -3$$

Using equation (iv)

$$A = 2 - B - C$$

$$A = 2 + 3 - 1$$

$$A = 4$$

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