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MAT 104 Assignment 10

MBS

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

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

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

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

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

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

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

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

Comparing;

$$A+B = -3$$

$$3A-B = 11$$

$$3A + 3B = -9$$

$$3A - B = 11$$

$$4B = -20$$

$$B = -5$$

but $A+B = -3$

$$\therefore A - 5 = -3$$

$$A = 2$$

$$\therefore \int \frac{A}{x-1} + \int \frac{B}{x+3} = \int \frac{11-3x}{x^2+2x-3} \cdot dx$$

$$\int \frac{2}{x-1} \cdot dx + \int \frac{-5}{x+3} \cdot dx$$

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

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

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

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

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

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

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

$$A+B = 4$$

$$-3A+B = -16$$

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

$$A = 5$$

$$A+B = 4$$

$$5+B = 4$$

$$B = -1$$

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

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

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

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

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

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

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

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

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

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

From equation (i) $A + B + C = 2$

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

From equation (ii) $A + 4B - C = -9$

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

From equation (iii) $-6A + 3B - 2C = -35$

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

Using equation (v) and (vi)

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

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

$$B = -3$$

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

$$B = -3$$

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

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

$$-2C = -2$$

$$C = 1$$

$$A = 2 - B - C = 2 - (-3) - 1 = 4$$

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

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