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MATRIC NO: 19/MHSD/006.

DEPT: MEDICINE AND SURGERY.

MATH 104

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

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

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

~~Divide~~ ^{Multiply} through by $(x+3)(x-1)$

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

⑧ when $x = -3$

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

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

$$B = -5$$

when $x = 1$

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

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

$$A = 2$$

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

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

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

SOLUTION

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

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

Multiply through by $(x-3)(x+1)$

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

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

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

$$A+B = 4 \dots 1$$

$$A-3B = 16 \dots 2$$

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

$$B = -5 \dots 3$$

Sub eqn 3 into ①

$$A + (-5) = 4$$

$$A = 9$$

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

$$\text{Let } u = x-3$$

$$\frac{du}{dx} = 1$$

$$dx = du$$

$$\frac{-1 du}{u} + \frac{5 du}{u}$$

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

$$= 5 \ln(x+1) - \ln(x-3) + C$$

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

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

SOLUTION.

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

find the LCM of the RHS.

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

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

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

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

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

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

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

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

$$A+B+C = 2 \dots (i)$$

$$A+4B-C = -9 \dots (ii)$$

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

$$A = 2 - B - C \text{ from eqn (i) and sub into (ii)}$$

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

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

$$3B = -11 + 2C \text{ into eqn (iii)}$$

$$-6A = -11 + 2C - 2C = -35$$

$$-6A - 11 = -35$$

$$-6A = -24$$

$$A = 4$$

continuation of no 3,
But $3B = -11 + 2C$

$$B = \frac{-11 + 2C}{3} \quad \text{put into eqn ①}$$

$$4 + \left[\frac{-11 + 2C}{3} \right] + C = 2$$

$$4 - \left[\frac{11 + 2C}{3} \right] + C = 2$$

Multiply through by 3

$$12 - 11 + 2C + 3C = 6$$

$$1 + 5C = 6$$

$$5C = 5$$

$$C = 1$$

any
put into eqn

$$4 + B + 1 = 2$$

$$B + 5 = 2$$

$$B = -3$$

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

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

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

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

$$4 \ln u \quad -3 \ln u \quad \frac{1}{2} \ln u$$

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