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MA1104

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

Solution

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

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

To find A $x=1$

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

$$8 = 4A$$

$$\therefore A = 2$$

To find B, $x=-3$

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

$$11+9 = -4B$$

$$20 = -4B$$

$$B = -5$$

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

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

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

$$2 \int \frac{4x-6}{x^2-2x-3} dx.$$

$$2 \int \frac{4x-6}{x^2-2x-3}$$

Sol

$$\frac{4x-6}{x^2-2x-3} = \frac{A}{x+1} + \frac{B}{x-3}$$
$$\therefore 4x-6 = A(x-3) + B(x+1)$$

To get A, $x = -1$.

$$4(-1) - 6 = A(-1-3)$$

$$-4 - 6 = 4A$$

$$-10 = 4A$$

$$A = \frac{-10}{4}$$

To get B, $x = 3$

$$4(3) - 6 = B(3+1)$$

$$12 - 6 = 4B$$

$$6 = 4B$$

$$B = \frac{6}{4}$$

$$\int \frac{4x-6}{x^2-2x-3} dx = \int \frac{-10}{2(x+1)} dx + \int \frac{6}{2(x-3)} dx \Rightarrow$$

$$\frac{-10}{2} \ln(x+1) + \frac{6}{2} \ln(x-3) + C$$

$$\therefore \int \frac{4x-6}{x^2-2x-3} dx = \frac{-10}{2} \ln(x+1) + \frac{6}{2} \ln(x-3) + C.$$

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

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

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

To get A, $x = -1$

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

$$2 + 9 - 35 = -6A$$

$$-24 = -6A$$

$$A = 4$$

To get B, $x = 2$

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

$$8 - 18 - 35 = 15B$$

$$-45 = 15B ; B = -3$$

To get C, $x = -3$

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

$$18 + 27 - 35 = C(-2)(-5)$$

$$10 = 10C$$

$$C = 1$$

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

$$4 \ln(x+1) - 3 \ln(x-2) + \ln(x+3) + C$$

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