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MATH 104

OLATOMIWA PRECIOUS OLANIKE

19/MHS01/332

MBBS

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

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

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

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

$11-3(-3) = -4A+0$

$20 = -4A$

$A = -5$ — ②

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

$8 = 0+4B$

$B = 2$ — ③

Substitute equ 3 & 2 in 1

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

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

Let $u = x+3$, let $u = x-1$

$du = dx$ $du = dx$

$-5\int \frac{du}{u} + 2\int \frac{du}{u} \Rightarrow -5\ln u + 2\ln u + c$

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

Or $2\int \frac{du}{u} - 5\int \frac{du}{u} = 2\ln(x-1) - 5\ln(x+3) + c$

$\int \frac{11-3x}{x^2+2x-3} = -5\ln(x+3) + 2\ln(x-1) + c$, where c is the constant of the equation

Or

$2\ln(x-1) - 5\ln(x+3) + c$, where c is the constant of the equation

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

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

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

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

$= 12-16 = 4A + \cancel{B}$

$-4 = 4A$

$= A = -1$ — ②

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

$-4-16 = -20$

$B = 5$ — ③

Substitute equ 2 and 3 in ①

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

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

Let $u = x-3$, let $u = x+1$

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

$-1\int \frac{du}{u} + 5\int \frac{du}{dx} \Rightarrow -\ln u + 5\ln u + c$

$\int \frac{4x-16\,dx}{x^2-2x-3} = -\ln(x-3) + 5\ln(x+1) + c$, where c is the constant of the equation

or

$5\ln(x+1) - \ln(x-3) + c$, where c is the constant of the equation.

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

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

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

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

$= \quad -45 = 0+15B+0$

$B = 45/15 = -3$ — (2)

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

$= -2+9-35 = -6A+0+0$

$-24 = -6A$

$A = 4$ — (3)

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

$= 10 = 0+0+10C$

$10 = 10C$

$C = 1$ — (4)

Sub eqn 2, 3, 4 in 1

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

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

let $u = x+1$, let $u = x-2$, let $u = x+3$

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

$4\int \frac{du}{u} + -3\int \frac{du}{u} + \int \frac{du}{u} \Rightarrow 4\ln u - 3\ln u + \ln u + c$

$\Rightarrow 4\ln(x+1) - 3\ln(x-2) + \ln(x+3) + c$,

where c is constant of the equation