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MATRIC NUMBER: 19/MHS01/132

DEPARTMENT: MEDICINE AND SURGERY

COURSE: MAT 104

ASSIGNMENT: Integrate

1) $\dfrac{11-3x}{(x+3)(x-1)} \, dx$

SOLUTION

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

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

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

$f(1) \Rightarrow 11 - 3(1) = B(1+3)$

$\qquad 8 = 4B$

$\qquad B = \dfrac{8}{4}$

$\qquad B = 2$

$f(-3) \longrightarrow 11 - 3(-3) = A(-3-1)$

$\qquad 20 = A(-4)$

$\qquad A = \dfrac{20}{-4}$

$\qquad A = -5$

Substitute the value of A and B in the equation.

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

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

let $u = x+3$

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

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

$\int \dfrac{-5}{x+3} \, dx = \int \dfrac{-5}{u} \cdot du = -5 \int \dfrac{1}{u} \, du$

$= -5 \ln u = -5 \ln(x+3)$

let $u = x-1$

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

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

$\int \dfrac{2}{x-1} \, dx = \int \dfrac{2}{u} \cdot du = 2 \int \dfrac{1}{u} \, du$

1.

$$= 2 \ln 4 \qquad = 2 \ln (x-1)$$

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

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

2) Integrate $\dfrac{4x-16}{(x+3)(x+1)}$

SOLUTION

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

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

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

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

$$12 = 2B$$

$$B = \frac{12}{2}$$

$$B = 6$$

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

$$4 = (-2) A$$

$$A = \frac{4}{-2}$$

$$A = -2$$

Substitute the values for A and B

$$\frac{4x-16}{(x-3)(x+1)} = \frac{-2}{x-3} + \frac{6}{x+1}$$

$$\int \frac{4x-16}{(x-3)(x+1)} dx = \int \frac{-2}{x-3} dx + \int \frac{6}{x+1} dx$$

let $u = x-3$

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

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

$$\int \frac{-2}{x-3} dx = \int \frac{-2}{u} \cdot dy = -2 \int \frac{y \, dy}{u}$$

$$= -2 \ln u$$

$$= -2 \ln (x-3)$$

let $u = x+1$

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

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

2.

$$\int \frac{6}{x+1}\,dx = \int \frac{6}{u}\cdot \frac{dy}{1} = 6\int \frac{1}{u}\,du$$

$$= 6\ln u$$
$$= 6\ln(x+1)$$

$$\therefore \int \frac{+x-16}{(x-3)(x+1)} = -2\ln(x-3) + 6\ln(x+1)$$
$$= -2\ln(x-3) + 6\ln(x+1) + C$$

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

SOLUTION

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

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

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

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

$$-45 = 15B$$
$$B = \frac{-45}{15}$$
$$B = -3$$

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

$$-24 = 6A$$
$$A = \frac{-24}{6}$$
$$A = -4$$

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

$$10 = 10C$$
$$C = \frac{10}{10}$$
$$C = 1$$

3.

Put in the values of A, B and C

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

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

let $x + 1 = u$

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

$dx = dy$,

$$\int \frac{-4}{x+1} dx = \int \frac{-4}{u} \cdot du = -4 \int \frac{1}{u} du$$

$= -4 \ln u$

$= -4 \ln(x+1)$

let $x - 2 = u$

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

$dx = dy$,

$$\int \frac{3}{x-2} dx = \int \frac{3}{u} \cdot du = 3 \int \frac{1}{u} du$$

$= 3 \ln u$

$= 3 \ln(x-2)$

let $u = x + 3$

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

$dx = dy$,

$$\int \frac{1}{x+3} dx = \int \frac{1}{u} \cdot du = \int \frac{1}{u} du$$

$= \ln u$

$= \ln(x+3)$

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

$(x-2) + \ln(x+3)$

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