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19/mt501/440.

Medicine and Surgery.

MAT 104.

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

Solution

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

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

At $x=1$, we have.

$$A(4) = 11-3 = 8$$

$$A = 2$$

At $x=-3$

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

$$B = -5.$$

We can now write.

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

Let $u = x-1$

$$du = dx$$

$$2 \int \frac{du}{u} = 2 \ln u.$$

Let $u = x+3$

$$du = dx$$

$$-5 \int \frac{du}{u} = -5 \ln u.$$

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

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

Solution

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

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

At $x = 3$

$$A(-2) = -4$$

$$A = 2$$

At $x = -1$

$$B(-4) = 12$$

$$B = -3$$

We can now write.

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

let $u = x-3$

$$du = dx$$

$$2 \int \frac{du}{u} = 2 \ln u$$

let $u = x+1$

$$du = dx$$

$$-3 \int \frac{du}{u} = -3 \ln u$$

$$\rightarrow 2 \ln(x-3) - 3 \ln(x+1)$$

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

Solution

simplify $2x^2-9x-35 = (x-7)(2x+5)$

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

$$\text{At } x = -1 \quad A(-1-2)(-1+3) = (-1-7)(2(-1)+5)$$

$$-6A = -24$$

$$A = 4$$

$$\text{at } x = 2$$

$$B(2+1)(2+3) = (2-7)(4+5)$$

$$B \cdot 15 = -45$$

$$B = -3$$

$$\text{at } x = -3$$

$$C(-3+1)(-3-2) = (-3-7)(2(-3)+5)$$

$$C \cdot 10 = -10$$

$$C = 1$$

We can now write

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

$$\text{let } u = x+1$$

$$du = dx$$

$$4 \int \frac{du}{u} = 4 \ln u$$

$$\text{let } u = x-2$$

$$du = dx$$

$$-3 \int \frac{du}{u} = -3 \ln u$$

$$\text{let } u = x+3$$

$$du = dx$$

$$\int \frac{du}{u} = \ln u$$

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