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COLLEGE: MEDICINE AND HEALTH SCIENCES

DEPARTMENT: MEDICINE AND SURGERY

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

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

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

Comparing numerators of both sides:

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

When $x = +1$

$$11-3(1) = A(1+3)+0$$

$$11-3 = 4A$$

$$4A = \frac{8}{4}$$

$$A = 2$$

When $x = -3$

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

$$11+9 = 0-4B$$

$$20 = -4B$$

$$B = -5$$

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

In $\int \frac{2}{x-1}\,dx$

Let $u = x-1$

$du/dx = 1$

$du = dx$

In $\int \frac{-5}{x-3}\,dx$

Let $p = x-3$

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

$dp = dx$

$$= \int \frac{2}{u}\,du + \int \frac{-5}{p}\,dp$$

$$= 2\int u^{-1}\,du - 5\int p^{-1}\,dp$$

$$= 2\ln u - 5\ln p + c$$

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

2

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

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

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

Comparing numerators of both sides:

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

When $x = -1$

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

$$-4-16 = -4A+0$$

$$-20 = -4A$$

$$A = 5$$

When $x = +3$

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

$$12-16 = 0+4B$$

$$-4 = 4B$$

$$B = -1$$

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

In $\int \frac{5}{x+1}\,dx$

Let $u = x+1$

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

$du = dx$

In $\int \frac{-1}{x-3}\,dx$

Let $p = x-3$

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

$dp = dx$

$$= \int \frac{5}{u}\,du + \int \frac{-1}{p}\,dp$$

$$= 5\int u^{-1}\,du - \int p^{-1}\,dp$$

$$= 5\ln u - \ln p + c$$

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

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

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

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

Comparing numerators of both sides

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

When $x = -1$

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

$$2 + 9 - 35 = A(-3)(2) + 0 + 0$$

$$-24 = -6A$$

$$A = 4$$

When $x = 2$

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

$$8 - 18 - 35 = 0 + B(3)(5) + 0$$

$$-45 = 15B$$

$$B = -3$$

When $x = -3$

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

$$18 + 27 - 35 = 0 + 0 + C(-2)(-5)$$

$$10 = +10C$$

$$C = 1$$

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

3

In $\int \frac{4}{x+1}\,dx$ In $\int \frac{-3}{x-2}\,dx$ In $\int \frac{1}{x+3}\,dx$

Let $u = x+1$ Let $p = x-2$ Let $w = x+3$

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

$du = dx$ $dp = dx$ $dw = dx$

$$= \int \frac{4}{u}\,du + \int \frac{-3}{p}\,dp + \int \frac{1}{w}\,dw$$

$$= 4\int u^{-1}\,du - 3\int p^{-1}\,dp + \int w^{-1}\,dw$$

$$= 4\ln u - 3\ln p + \ln w + c$$

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