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MECHATRONICS ENGINEERING

$$\int \frac{3x-1}{(x-1)(x-2)(x-3)} dx$$

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

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

$$= A(x^2 - 5x + 6) + B(x^2 - 4x + 3) + C(x^2 - 3x + 2)$$

$$3x - 1 = (Ax^2 + Bx^2 + Cx^2) + (-5Ax - 4Bx - 3Cx) + (6A + 3B + 2C)$$

By comparison

$$0x^2 = (A + B + C)x^2 \Rightarrow A = -B - C \quad \text{--- (1)}$$

$$3x = (-5A - 4B - 3C)x \Rightarrow 3 = -5A - 4B - 3C \quad \text{--- (2)}$$

$$-1 = 6A + 3B + 2C \quad \text{--- (3)}$$

By putting (1) in (2) and (3)

$$3 = -5(-B - C) - 4B - 3C = 5B + 5C - 4B - 3C$$

$$3 = B + 2C \quad \text{--- (4)} \quad \text{In (3)}$$

$$-1 = 6(-B - C) + 3B + 2C = -6B - 6C + 3B + 2C$$

$$-1 = -3B - 4C \quad \text{--- (5)}$$

$$3 = B + 2C \Rightarrow B = 3 - 2C$$

$$\text{In (5)} \quad -1 = -3(3 - 2C) - 4C$$

$$-1 = -9 + 6C - 4C = -9 + 2C$$

$$2C = 8$$

$$C = 8/2 = 4$$

$$B = 3 - 2C$$

$$B = 3 - 2(4) = 3 - 8$$

$$B = -5$$

$$A = -B - C = -(-5) - 4 = 5 - 4 = 1$$

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

$$\int \frac{3x-1}{(x-1)(x-2)(x-3)} = \ln|x-1| - 5\ln|x-2| + 4\ln|x-3| + C$$

$$2. \int \frac{x^2+x+1}{(x+2)(x^2+1)} dx = \int \frac{A}{x+2} + \frac{B}{x^2+1}$$

$$\frac{x^2+x+1}{(x+2)(x^2+1)} = \frac{A(x^2+1) + B(x+2)}{(x+2)(x^2+1)}$$

$$x^2+x+1 = Ax^2 + A + Bx + 2B$$

$$x^2 = Ax^2 \quad \therefore A = 1$$

$$x = Bx \quad \therefore B = 1$$

$$\int \frac{x^2+x+1}{(x+2)(x^2+1)} dx = \int \frac{1}{x+2} + \int \frac{1}{x^2+1} dx$$

$$\int \frac{x^2+x+1}{(x+2)(x^2+1)} = \ln|x+2| + \frac{1}{2} \tan^{-1} \frac{x}{2} + C$$

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

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

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

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

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

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

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

$x^3 + x^2 + x + 1$	$x^2 + 2x + 3$
$-x^3 - x^2$	\downarrow
$-2x^2 + x$	\downarrow
$-2x^2 - 2x$	\downarrow
	$3x + 1$
	$3x - 3$
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