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Mechatronics Engineering
MAT 104

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

Solution

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

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

When $x = 1$

$$3(1) - 1 = A(1-1) + B(1-2) + C(1-3)$$
$$3 - 1 \quad A(0) + B(-1) + C(-2)$$
$$2 = -B - 2C$$

When $x = 2$

$$3(2) - 1 = A(2-1) + B(2-2) + C(2-3)$$
$$6 - 1 = A(1) + B(0) + C(-1)$$
$$5 = A - C$$

When $x = 3$

$$3(3) - 1 = A(3-1) + B(3-2) + C(3-3)$$
$$9 - 1 = A(2) + B(1) + C(0)$$
$$8 = 2A + B$$

Hence $\frac{(3x-1)}{(x-1)(x-2)(x-3)} = \frac{2}{x-1} + \frac{5}{x-2} + \frac{8}{x-3}$

3 $(x^2+1)/(x-3)(x-2)^2\,dx$

solution

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

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

$$x^2+1 = A(x-3) + B(x^2-4x-4)$$

When $x = 3$

$$3^2+1 = A(3-3) + B(3^2-4(3)-4)$$

$$9+1 = A(0) + B(9-12-4)$$

$$10 = A(0) + B(-7)$$

$$10 = -7B$$

When $x = 2$

$$2^2+1 = A(2-3) + B(2^2-4(2)-4)$$

$$4+1 = A(-1) + B(-8)$$

$$5 = -1A - 8B$$

Hence

$$\frac{x^2+1}{(x-3)(x-2)^2} = \frac{10}{(x-3)} + \frac{5}{(x-2)^2}$$

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

Solution

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

$$x^2+x+1 = A(x+2) + B(x^2+1)$$

When $x=-2$

$$(-2)^2+(-2)+1 = A(-2+2) + B((-2)^2+1)$$

$$4-2+1 = 5B$$

$$3 = 5B$$

When $x = 1$

$$1^2+1+1 = A(1+2) + B(1^2+1)$$

$$3 = A(3) + B(2)$$

$$3 = 3A + 2B$$

Hence

$$\frac{x^2+x+1}{(x+2)(x^2+1)} = \frac{3}{5B} + \frac{3}{3A+2B}$$

$$\frac{x^2+x+1}{(x+2)(x^2+1)} = \frac{3}{x+2} + \frac{3}{x^2+1}$$

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

soln

$$\frac{(x^3+x^2+x+1)}{\cancel{(x-1)}} = \frac{A}{\cancel{x-1}}$$

$$x^3+x^2+x+1 = A(x-1)$$

when $x=1$

$$1^3+1^2+1+1 = A(1-1)$$

$$4 = A(0)$$

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