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1.3 Partial Fractions

1a] $\frac{8x-1}{(x+1)(x-2)} = \frac{A}{x+1} + \frac{B}{x-2}$

$\Rightarrow \frac{A(x-2) + B(x+1)}{(x+1)(x-2)}$

when $x = -1$, when $x = 2$

$-9 = -3A$ $\quad$ $15 = 3B$

$A = 3$ $\quad$ $B = 5$

$\Rightarrow \frac{3}{x+1} + \frac{5}{x-2}$

b] $\frac{2x+13}{(2x-1)(x+3)} = \frac{A}{2x-1} + \frac{B}{x+3}$

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

when $x = -3$, when $x = \frac{1}{2}$

$7 = -7B$ $\quad$ $14 = \frac{7}{2}A$

$B = -1$ $\quad$ $A = 4$

$\Rightarrow \frac{4}{2x-1} - \frac{1}{x+3}$

c] $\frac{7-11x}{(3x-1)(2x+1)} = \frac{A}{3x-1} + \frac{B}{2x+1}$

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

1.3 Partial Fractions

1c] Cont.

When $x = \frac{1}{3}$

$\frac{10}{3} = \frac{5}{3}A$

$A = 2$

, when $x = -\frac{1}{2}$

$\frac{25}{2} = \frac{-5}{2}B$

$B = -5$

$\Rightarrow \frac{2}{3x-1} - \frac{5}{2x+1}$

2a] $\frac{7x-15}{x^2-5x} \Rightarrow \frac{7x-15}{x(x-5)}$

$\Rightarrow \frac{A}{x} + \frac{B}{x-5} \Rightarrow \frac{A(x-5) + B(x)}{x(x-5)}$

When $x = 5$

$20 = 5B$

$B = 4$

, when $x = 0$

$-15 = -5A$

$A = 3$

$\Rightarrow \frac{3}{x} + \frac{4}{x-5}$

b] $\frac{3(x+7)}{(x-3)(x+3)} = \frac{A}{x-3} + \frac{B}{x+3}$

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

When $x = 3$

$30 = 6A$

$A = 5$

, when $x = -3$

$12 = -6B$

$B = -2$

1.3 Partial Fractions

2b Cont.

$$\Rightarrow \frac{5}{x-3} - \frac{2}{x+3}$$

c] $$\frac{9x-1}{(x-5)(2x+1)} = \frac{A}{x-5} + \frac{B}{2x+1}$$

$$\Rightarrow \frac{A(2x+1) + B(x-5)}{(x-5)(2x+1)}$$

when $x = 5$

$44 = 11A$

$A = 4$

when $x = -\frac{1}{2}$

$\frac{-11}{2} = -\frac{11}{2}B$

$B = 1$

~~3a] $\frac{6x^2 - 43x + 50}{x(x-2)(x}$~~ $\Rightarrow \frac{4}{x-5} + \frac{1}{2x+1}$

3a] $$\frac{6x^2 - 43x + 50}{x(x-2)(x-5)} \Rightarrow \frac{A}{x} + \frac{B}{x-2} + \frac{C}{x-5}$$

$$\Rightarrow \frac{A(x-2)(x-5) + B(x)(x-5) + C(x)(x-2)}{x(x-2)(x-5)}$$

when $x = 0$

$50 = 10A$

$A = 5$

when $x = 2$

$-12 = -6B$

$B = 2$

when $x = 5$

$-15 = 15C$

$C = -1$

1.3 Partial Fractions

3 a] Cont.

$$\frac{5}{x} + \frac{2}{x-2} - \frac{1}{x-5}$$

b] $\dfrac{4x^2+11x+9}{(x-1)(x+2)(x+3)} \Rightarrow \dfrac{A}{x-1} + \dfrac{B}{x+2} + \dfrac{C}{x+3}$

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

when $x = 1$
$24 = 12A$
$A = 2$

when $x = -2$
$3 = -3B$
$B = -1$

when $x = -3$
$12 = 4C$
$C = 3$

$$\Rightarrow \frac{2}{x-1} - \frac{1}{x+2} + \frac{3}{x+3}$$

c] $\dfrac{5x^2-22x+6}{x(x-3)(2x-1)} \Rightarrow \dfrac{A}{x} + \dfrac{B}{x-3} + \dfrac{C}{2x-1}$

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

when $x = 0$
$6 = 3A$
$A = 2$

when $x = 3$
$-15 = 15B$
$B = -1$

1.3 Partial Fractions

3c] Cont.

when $x = \frac{1}{2}$

$$-\frac{15}{4} = -\frac{5}{4}C$$

$$C = 3$$

$$\Rightarrow \frac{2}{x} - \frac{1}{x-3} + \frac{3}{2x-1}$$

4] $\frac{1+15x-10x^2}{(x-2)(1-2x)} \Rightarrow \frac{A}{1} + \frac{B}{x-2} + \frac{C}{1-2x}$

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

when $x = 2$

$-9 = -3B$

$B = 3$

, when $x = \frac{1}{2}$

$6 = -\frac{3}{2}C$

$-4 = C$

when $x = 0$

$1 = -2A + B - 2C$

$1 = -2A + 3 + 8$

$-10 = -2A$

$A = 5$

$$\Rightarrow 5 + \frac{3}{x+2} - \frac{4}{1-2x}$$

1.3 Partial Fractions

5] $\frac{4}{(x+1)(3x-2)} \equiv \frac{A}{x+1} + \frac{B}{3x-2}$

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

When $x = -1$

$4 = -5A$

$A = \frac{-4}{5}$

, When $x = \frac{2}{3}$

$4 = \frac{5}{3}B$

$B = \frac{12}{5}$

$\Rightarrow \frac{-4}{5(x+1)} + \frac{12}{5(3x-2)}$

6] $\frac{5x-3}{(2x+3)(x+2)} \equiv \frac{A}{2x+3} + \frac{B}{x+2}$

$\Rightarrow \frac{A(x+2) + B(2x+3)}{(2x+3)(x+2)}$

When $x = -\frac{3}{2}$

$-\frac{21}{2} = \frac{1}{2}A$

$A = -21$

, When $x = -2$

$-13 = -B$

$B = 13$

$\Rightarrow \frac{-21}{2x+3} + \frac{13}{x+2}$

1.3 Partial Fractions

7] $\frac{3}{(3-y)(3+y)} = \frac{A}{3-y} + \frac{B}{3+y}$

$\Rightarrow \frac{A(3+y) + B(3-y)}{(3-y)(3+y)}$

When $y = 3$, $3 = 9A$, $A = \frac{1}{2}$

When $y = -3$, $3 = 9B$, $B = \frac{1}{2}$

$\Rightarrow \frac{1}{2(3-y)} + \frac{1}{2(3+y)}$

8] $\frac{33x - x^2 - 44}{(x-1)(x+5)(2x-3)} \Rightarrow \frac{A}{x-1} + \frac{B}{x+5} + \frac{C}{2x-3}$

$\Rightarrow \frac{A(x+5)(2x-3) + B(x-1)(2x-3) + C(x-1)(x+5)}{(x-1)(x+5)(2x-3)}$

When $x = 1$, $-12 = -6A$, $A = 2$

When $x = -5$, $-234 = 78B$, $B = -3$

When $x = \frac{3}{2}$, $\frac{13}{4} = \frac{13C}{4}$, $C = 1$

$\Rightarrow \frac{2}{x-1} - \frac{3}{x+5} + \frac{1}{2x-3}$

1.3 Partial Fractions

9] $\frac{2x^2 - 11}{(x+1)(x-2)} \equiv \frac{A}{1} + \frac{B}{x+1} + \frac{C}{x-2}$

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

When $x = -1$

$-9 = -3B$

$B = 3$

When $x = 2$

$-3 = 3C$

$C = -1$

When $x = 0$

$-11 = -2A - 2B + C$

$-11 = -2A - 6 - 1$

$-4 = -2A$

$A = 2$

$\Rightarrow 2 + \frac{3}{x+1} - \frac{1}{x-2}$