Partial Fraction

* This method is used to decompose a given rational expression into simpler fractions.

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

multiplying both sides by $(x+1)(2-x)$

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

putting $x=-1$ in eqn. ①

$$-3 = 3A + 0 \cdot B \Rightarrow A = -1$$

putting $x = 2$ in eqn. ①

$$6 = A(2-2) + B(2+1)$$

$$6 = 0 + 3B \Rightarrow 3B = 6 \Rightarrow B = 2.$$

$$\therefore \frac{3x}{(x+1)(2-x)} = \frac{-1}{(x+1)} + \frac{2}{(2-x)}.$$

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

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

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

④ $$\frac{3x}{x^2+6x+5} = \frac{3x}{(x+5)(x+1)} = \frac{A}{(x+5)} + \frac{B}{(x+1)}$$

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

Improper fraction.

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

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

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