

①  $\frac{(1-3x)}{x^2+2x+3}$

$x^2+2x+3$

$(x-1)(x+3)$

$$\int \frac{1-3x}{(x-1)(x+3)} dx = \int \left[ \frac{A}{x-1} + \frac{B}{x+3} \right]$$

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

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

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

$$1-3 = 4A + B$$

$$8/4 = 4A/4 + 0$$

$$A = 2$$

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

$$11+9 = A(0) - 4B$$

$$20/-4 = -4B/-4$$

$$B = -5$$

$$\int \left[ \frac{2}{x-1} - \frac{5}{x+3} \right] dx$$

$$2 \ln|x-1| - 5 \ln|x+3| + C$$

②  $\frac{2x^2-9x-35}{(x+1)(x-2)(x+3)}$  ∴ Using integration by partial fraction

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

Comparing the LCM

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

Put  $x = -3$

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

$$18 + 27 - 35 = C(10)$$

$$10 = C(10)$$

$$C = 1 \text{ m}$$

Put  $x = 2$  into standard relation

$$2(2)^2 - 9(2) - 35 = B(15)$$

$$-45 = 15B$$

$$B = -3 \text{ m}$$

Put  $x = -1$

$$2(-1)^2 - 9(-1) - 35 = A(-6)$$

$$-24 = 6A$$

$$A = 4$$

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

Now,

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

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

$$= 4 \ln(x+1) - 3 \ln(x-2) + \ln(x+3) + C \text{ m}$$

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$$(3) \int \frac{1}{x^2 + 121} dx$$

$$= \int \frac{1}{121 + x^2} dx$$

$$= \int \frac{1}{11^2 + x^2} dx$$

$$\text{Let } a = 11$$

$$\Rightarrow \frac{1}{a} = \frac{1}{11}$$

Now

$$\Rightarrow \frac{1}{11} \tan^{-1} \frac{x}{11} + C$$