

Maths 104 Assignment 29/4/20

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 Level: 100 level

Integrate the following

1 $\int \frac{11-3x}{x^2+2x-3} dx$

$$= \int \frac{11-3x}{(x+3)(x-1)} = \frac{A}{x+3} + \frac{B}{x-1}$$

$$11-3x = A(x-1) + B(x+3)$$

→ When $x=1$
 $8 = 4B \therefore B=2$

→ When $x=-3$
 $20 = -4A \therefore A=-5$

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

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

2 $\int \frac{4x-16}{x^2-2x-3} dx$ Solution

$$= \int \frac{4x-16}{(x-3)(x+1)} = \frac{A}{x-3} + \frac{B}{x+1}$$

$$4x-16 = A(x+1) + B(x-3)$$

→ When $x=-1$
 $-20 = -4B \therefore B=5$

→ When $x=3$
 $-4 = 4A \therefore A=-1$

$$\int \frac{4x-16}{x^2-2x-3} = \int \frac{-dx}{x-3} + \int \frac{5dx}{x+1}$$

$$= -\ln|x-3| + 5\ln|x+1|$$

$$\Rightarrow -\ln|x-3| + 5\ln|x+1|$$

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

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

$$2x^2-9x-35 = Ax^2 + Ax - 6A + 6x + 4Bx + 3B + Cx^2 - Cx - 2C$$

$$2x^2 - 9x - 35 = Ax^2 + 4Bx + Cx^2 + Ax - Cx - 6A + 3B - 2C$$

$$\therefore A+B+C = 2 \quad \text{--- (i)}$$

$$A+4B-C = -9 \quad \text{--- (ii)}$$

$$-6A+3B-2C = -35 \quad \text{--- (iii)}$$

Solve (i) and (ii) simultaneously

$$A+4B-C = -9$$

$$A+B+C = 2$$

$$3B-2C = -11 \quad \text{--- (iv)}$$

Solve eqn (iii) and (iv) Simultaneously

$$\begin{aligned} -6A + 3B - 2C &= 35 \times 1 = -6A + 3B - 2C = 35 \\ A + 2B - 4C &= 9 \times 6 \quad A + 2B - 4C = 54 \\ \hline 27B - 8C &= 89 \quad \text{--- (v)} \end{aligned}$$

Solve eqn (v) and (vi) Simultaneously

$$\begin{aligned} 27B - 8C &= 89 \times 1 = 27B - 8C = 89 \quad \text{--- (v)} \\ 3B - 2C &= 11 \times 9 = 27B - 8C = 89 \quad \text{--- (vi)} \\ \hline 27B - 8C &= 89 \quad \text{--- (v)} \\ 27B - 18C &= 99 \quad \text{--- (vii)} \\ \hline 10C &= 10 \quad \therefore C = 1 \end{aligned}$$

Substitute $C = 1$ in eqn (iii)

$$\begin{aligned} -6A + 3B - 2C &= 35 \\ -6A + 3B - 2(1) &= 35 \\ -6A + 3B - 2 &= 35 \\ -6A + 3B &= 37 \\ 3B - 2 &= 37 \\ 3B &= 39 \\ B &= 13 \end{aligned}$$

From eqn (iv)

$$\begin{aligned} A + B - 4C &= 9 \\ A + B - 4(1) &= 9 \\ A + B - 4 &= 9 \\ A + B &= 13 \\ A &= 4 \end{aligned}$$

$$\begin{aligned} \int \frac{2x^2 - 9x - 35}{(x+1)(x-2)(x+3)} dx &= \int \frac{4}{x+1} dx - \int \frac{3}{x-2} dx + \int \frac{8x}{x+3} dx \\ \Rightarrow &= 4 \ln|x+1| - 3 \ln|x-2| + \ln|x+3| \end{aligned}$$