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Medicine and Surgery

MAT 104

①  $\int \frac{11-3x}{x^2+2x-3} dx$ , expressing  $\frac{11-3x}{x^2+2x-3}$  as partial fraction

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

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

where  $x+3=0$ ,  $x=-3$

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

$$11+9 = 0 - 4B$$

$$\frac{20}{-4} = \frac{-4B}{-4} \quad B = -5$$

When  $x-1=0$ ,  $x=1$

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

$$11-3 = 4A$$

$$\frac{8}{4} = \frac{4A}{4}$$

$$A=2$$

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

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

Since  $\int \frac{A}{ax+b} dx = A \ln \frac{ax+b}{a} + c$

We have

$$2 \ln(x-1) - 5 \ln(x+3)$$

$$2 \ln(x-1) - 5 \ln(x+3)$$

$$\int \frac{11-3x}{x^2+2x-3} = 2 \ln(x-1) - 5 \ln(x+3)$$

②  $\int \frac{4x+6}{x^2-2x-3}$

Resolve  $\frac{4x+6}{x^2-2x-3}$  into partial fraction.

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

$$4x+6 = A(x-3) + B(x+1)$$

When  $x=3$

$$4x+6 = A(x-3) + B(x+1)$$

$$4(3)+6 = A(3-3) + B(3+1)$$

$$\frac{18+6}{4} = \frac{4B}{4} \quad \frac{24}{4} = B$$

When  $x=-1$

$$4(-1)+6 = A(-1-3) + B(-1+1)$$

$$\frac{2}{-4} = \frac{-4A}{-4} \quad A = -\frac{1}{2}$$

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

$$\int \frac{-1}{2(x+1)} + \int \frac{9}{2(x-3)}$$

$$-\frac{1}{2} \ln(2x+2) + \frac{9}{2} \ln(2x-6)$$

$$\int \frac{4x+6}{x^2-2x-3} = \frac{-1}{2} \ln(2x+2) + \frac{9}{2} \ln(2x-6)$$

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

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

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

When  $x+1=0$ ,  $x=-1$

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

$$2+9-35 = A(-3)(2)$$

$$-24 = -6A$$

$$\frac{+2A^4}{+6} = \frac{-6A}{+6}$$

$$A = -1$$

$$\text{When } x-2=0$$

$$x=2$$

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

$$8 - 18 - 35 = B(3)(5)$$

$$\frac{-45}{15} = \frac{15B}{15}$$

$$B = -3$$

$$\text{When } x+3=0$$

$$x=-3$$

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

$$18 + 27 - 35 = C(-2)(-5)$$

$$\frac{10}{10} = \frac{10C}{10}$$

$$C = 1$$

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

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

$$= 4 \ln(x+1) - 3 \ln(x-2) + 1 \ln(x+3)$$