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19/MHS01/135.

1

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

$$\Rightarrow \int \frac{11-3x}{x^2+2x-3}\,dx.$$

From the denominator.

$x^2+2x-3=0$

$x^2+3x-x-3=0$

$x(x+3)-1(x+3)=0$

$(x-1)(x+3)=0$

$$\therefore \int \frac{11-3x}{x^2+2x-3}\,dx = \int \frac{11-3x}{(x-1)(x+3)}\,dx.$$

$$\frac{11-3x}{(x-1)(x+3)}$$ (Resolving into partial fraction)

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

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

Equating the numerators.

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

Put $x=1$.

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

$8=4B$.

$B=2$

Put $x=-3$

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

$20=-4A$

$A=-5$

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

$$\int\left(\frac{11-3x}{(x+3)(x-1)}\right)dx = \int\left(\frac{-5}{(x+3)} + \frac{2}{(x-1)}\right)$$

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

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

2.

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

From the denominator.

$x^2-2x-3=0$

$x^2-3x+x-3=0$

$x(x-3)+1(x-3)=0$

$(x-3)(x+1)=0$

$$\therefore \int \frac{4x-16}{x^2-2x-3} = \int \frac{4x-16}{(x-3)(x+1)}$$

$$\frac{4x-16}{(x-3)(x+1)}$$ (Resolving into part fraction)

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2.
$$\frac{4x-16}{(x-3)(x+1)} = \frac{A}{(x-3)} + \frac{B}{(x+1)}$$

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

Equating the numerators.

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

Put $x = 3$.

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

$-4 = 4A$.

$A = -1$.

Put $x = -1$

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

$\cancel{-20} = -4-16 = A(0) + B(-4)$

$\frac{\cancel{-20}}{\cancel{-4}} = \frac{\cancel{-4B}}{\cancel{-4}}$

$B = 5$

$\therefore \frac{4x-16}{(x-3)(x+1)} = \frac{1}{(x-3)} + \frac{5}{(x+1)}$.

$$\int\left(\frac{4x-16}{(x-3)(x+1)}\right)dx = \int\left(\frac{-1}{(x-3)} + \frac{5}{(x+1)}\right)dx$$

$$= \int \frac{-1}{(x-3)}\,dx + \int \frac{5}{(x+1)}\,dx$$

$$= -1\int \frac{1}{(x-3)}\,dx + 5\int\frac{1}{(x+1)}\,dx$$

$\Rightarrow -1\ln(x-3) + 5\ln(x+1)$.

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

Resolving into partial fraction.

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

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

$+ C(x+1)(x-2)$.

Equating the numerators

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

$C(x+1)(x-2)$

Put $x = 2$.

$-4\cancel{5} = \cancel{15}B$

$B = -3$

Put $x = -1$

$-2\cancel{4} = -\cancel{6}A$.

$A = 4$

put $x = -3$

$1\cancel{0} = 1\cancel{0}C$

$C = 1$

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

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

$$= \int\frac{4}{(x+1)}\,dx - \int\frac{3}{(x-2)}\,dx + \int\frac{1}{(x+3)}\,dx.$$

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

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

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