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

The denominator $= x^2+2x-3$.

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

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

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

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

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

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

Equate the numerator

$\therefore 11-3x = Ax - A + Bx + 3B$.

Substitute $x=1$

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

$11-3 = A - A + B + 3B$

$\frac{8}{4} = \frac{4B}{4}$ $\therefore B = 2$

Substitute $x=-3$.

$11-3x = Ax - A + Bx + 3B$.

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

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$11 + 9 = -3A - A - 3B + 3B$

$\frac{20}{-4} = \frac{-4A}{4} \quad \therefore A = -5$

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

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

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

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

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

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

The denominator $= x^2-2x-3.$

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

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

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

$= \int \frac{4x-16}{(x-3)(x+1)}\,dx.$

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

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

Equate the numerator

$4x-16 = Ax+A+Bx-3B$

Substitute $x=3$.

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

$12-16 = 3A+A+0$

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

$\therefore A=-1.$

Substitute $x=-1$.

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

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

$-20 = 0-4B$

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

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

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

$= \int -1/x-3\,dx + \int 5/(x+1)\,dx$

$= -1\int 1/(x-3)\,dx + 5\int 1/(x+1)\,dx$

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

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

Resolving into partial fraction.

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

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

Equate the numerators.

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

Substitute $x=2$

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

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

$$B = -3$$

Substitute $x=-1$

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

$$\frac{-24}{6} = \frac{6A}{6}$$

$$A = -4$$

Substitute $x=-3$

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

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

$$\therefore C = 1$$

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

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

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

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

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

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