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

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

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

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

$$\text{using } x = -3 \Rightarrow 11-3(-3) = A(-3-1)$$

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

$$\text{using } x = 1 \Rightarrow 11-3(1) = B(1+3)$$

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

Substitute A and B

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

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

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

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

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

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

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

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

$$\text{using } x=3 \Rightarrow 4(3)-16 = A(3+1)$$

$$\frac{-4}{4} = \frac{4A}{4} \therefore A = -1$$

$$\text{using } x=-1 \Rightarrow 4(-1)-16 = B(-1-3)$$

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

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

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

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

$$\therefore \int \frac{4x-16}{(x-3)(x+1)} dx = -1 \ln|x-3| + 5 \ln|x+1| + C$$

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

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

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

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

$$\text{using } x=2 \Rightarrow 2(2)^2 - 9(2) - 35 = B(2+1)(2+3)$$

$$2(4) - 18 - 35 = B(3)(5)$$

$$\frac{-45}{15} = \frac{15B}{15} \quad \therefore B = -3$$

$$\text{using } x=-3 \Rightarrow 2(-3)^2 - 9(-3) - 35 = C(-3+1)(-3-2)$$

$$2(9) + 27 - 35 = C(-2)(-5)$$

$$10 = 10C \quad \therefore C = 1$$

$$\text{using } x=-1 \Rightarrow 2(-1)^2 - 9(-1) - 35 = A(-1-2)(-1+3)$$

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

$$\frac{-24}{-6} = \frac{-6A}{-6} \quad \therefore A = 4$$

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

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

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

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