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

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

Multiply through by the common LCM $(x-1)(x+3)$

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

F(1)

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

$$11-3 = 4A + 0$$

$$8 = 4A$$

$$A = 2$$

F(-3)

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

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

$$20 = -4B$$

$$B = -5$$

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

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

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

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

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

Test for $x=3$

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

$$12 - 16 = 0 + 4B$$

$$-4 = 4B$$

$$B = -1$$

Test for $x=-1$

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

$$-4-16 = -4A + 0$$

$$-20 = -4A$$

$$A = 5$$

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

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

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

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

$$3) \int \frac{2x^2 - 7x - 35}{(x+1)(x-2)(x+3)} dx$$

$$\frac{A}{x+1} + \frac{B}{x-2} + \frac{C}{x+3} = \frac{2x^2 - 7x - 35}{(x+1)(x-2)(x+3)}$$

$$A(x-2)(x+3) + B(x+1)(x+3) + C(x+1)(x-2) = 2x^2 - 7x - 35$$

$$\text{let } x = 2$$

$$A(2-2)(2+3) + B(2+1)(2+3) + C(2+1)(2-2) = 2(2)^2 - 7(2) - 35$$

$$A(0)(5) + B(3)(5) + C(3)(0) = 8 - 14 - 35$$

$$15B = -41$$

$$B = -3$$

$$\text{let } x = -1$$

$$A(-1-2)(-1+3) + B(-1+1)(-1+3) + C(-1+1)(-1-2) = 2(-1)^2 - 7(-1) - 35$$

$$A(-3)(2) + B(0)(2) + C(0)(-3) = 2 + 7 - 35$$

$$-6A = -24$$

$$A = 4$$

$$\text{let } x = -3$$

$$A(-3-2)(-3+3) + B(-3+1)(-3+3) + C(-3+1)(-3-2) = 2(-3)^2 - 7(-3) - 35$$

$$A(-5)(0) + B(-2)(0) + C(-2)(-5) = 18 + 21 - 35$$

$$10C = 10$$

$$C = 1$$

$$\therefore A = 4, B = -3 \text{ and } C = 1$$

$$\int \frac{2x^2 - 7x - 35}{(x+1)(x-2)(x+3)} = \frac{4}{x+1} + \frac{-3}{x-2} + \frac{1}{x+3}$$

$$\int \frac{4}{x+1} dx - \int \frac{3}{x-2} dx + \int \frac{1}{x+3} dx = 4 \ln|x+1| - 3 \ln|x-2| + \ln|x+3| + C$$