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

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

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

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

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

at $x = 3$

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

$11 - 9 = 4B$

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

$B = 1/2$

at $x = -1$

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

$11 + 3 = -4A$

$14 = -4A$

$A = -7/2$

We can now write

$$= \int -\frac{7/2}{(x+1)}\,dx + \frac{1/2}{(x-3)}\,dx$$

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

$$\int \frac{-7}{2x+2} + \frac{1}{2x-6}\,dx$$

$$-\frac{7}{2}\ln u + \frac{1}{2}\ln u$$

$$\frac{1}{2}\ln(x-3) - \frac{7}{2}\ln(x+1) + C$$ //

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

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

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

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

$$2x^2+9x-35 = A(x^2+x-6)+B(x^2+4x+3)+C(x^2-x-2)$$

$$2x^2+9x-35 = Ax^2+Ax-6A+Bx^2+4Bx+3B+Cx^2-Cx-2C$$

$$2x^2+9x-35 = Ax^2+Bx^2+Cx^2+Ax+4Bx-Cx-6A+3B-2C$$

$A + B + C = 2$ — ①

$A + 4B - C = 9$ — ②

$-6A + 3B - 2C = -35$ — ③

from eqn ① $A = 2 - B - C$

substitute in ② and ③

$(2 - B - C) + 4B - C = 9$

$2 - B - C + 4B - C = 9$

$3B - 2C = 7$ — ④

$6(2 - B - C) + 3B - 2C = -35$

$12 - 6B - 6C + 3B - 2C = -35$

$-3B - 8C = -23$ — ⑤

$3B - 2C = 7 \quad (\times -1)$

$-3B - 8C = -23 \quad (\times 1)$

$-3B + 2C = -7$

$-3B - 8C = -23$

$\frac{10C}{10} = \frac{16}{10}$

$C = 8/5$

Substitute C in ① and ④

$A + B + 8/5 = 2$

$A + B = 2/5$

$$A - 4B - 8/5 = 9$$

$$A - 4B = 53/5$$

$$A + B = 21/5$$

$$-A - 4B = 53/5$$

$$5B = -\frac{51}{5}$$

$$\frac{25B}{25} = -\frac{51}{25}$$

$$B = -51/25$$

Substitute B and C in eqn ①

$$A + (-51/25) + 8/5 = 2$$

$$A - 11/25 = 2$$

$$A = 61/25$$

$$\int \frac{61}{25(x+1)}\,dx - \frac{51}{25(x-2)}\,dx + \frac{8}{5(x+3)}\,dx$$

$$= \frac{61}{25}\ln(x+1) - \frac{51}{25}\ln(x-2) + \frac{8}{5}\ln(x+3)$$

$$= 61\ln(x+1) - 51\ln(x-4) + 40\ln(x+3)$$

31) $$\int \frac{1}{(x^2+121}\,dx \quad \int \frac{1}{(x^2+11^2)}\,dx$$

$x = 11 \tan\theta$

$dx/d\theta = 11 \sec^2\theta$

$dx = 11 \sec^2\theta \, d\theta$

~~$x^2 + 5^2$~~ -

$x^2 + 11^2 = 11^2 \tan^2\theta + 11^2$

$11^2 (\tan^2\theta + 1)$

$11^2 \sec^2\theta$

$$\Rightarrow \int \frac{11 \sec^2\theta \, d\theta}{11^2 \sec^2\theta} = \int \frac{d\theta}{11}$$

$$\frac{1}{11}\int d\theta = \frac{1}{11}[\theta] + C$$

$$= \frac{1}{11} \tan^{-1} x/11 + C \; //$$