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3)

$$\frac{5x+3}{(2x-3)(x+2)} \equiv \frac{A}{2x-3} + \frac{B}{x+2}$$

$$5x+3 = A(x+2) + B(2x-3)$$

$x=-2$

$$5(-2)+3 = B(2(-2)-3)$$

$$-7 = -7B$$

$$B = 1$$

$x=\frac{3}{2}$

$$5\left(\frac{3}{2}\right)+3 = A\left(\frac{3}{2}+2\right)$$

$$\frac{21}{2} = \frac{7}{2}A$$

$$A = 3$$

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

Check with $x=0$

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

$$-\frac{1}{2} = -1 + \frac{1}{2} \quad \checkmark$$

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5)

$$\frac{3x^2+16}{(1-3x)(2+x)^2} \equiv \frac{A}{1-3x} + \frac{B}{2+x} + \frac{C}{(2+x)^2}$$

$$3x^2+16 \equiv A(2+x)^2 + B(1-3x)(2+x) + C(1-3x)$$

$x = \frac{1}{3}$

$$3\left(\frac{1}{3}\right)^2+16 = A\left(2+\frac{1}{3}\right)^2$$

$$\frac{49}{3} = \frac{49}{9}A$$

$$A = 3$$

$x = -2$

$$3(-2)^2+16 = C(1-3(-2))$$

$$28 = 7C$$

$$C = 4$$

Coeff of x^2

$$3 = A - 3B$$

$$3 = 3 - 3B$$

$$B = 0$$

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

Check with $x = 0$

$$\frac{16}{(1)(2)^2} = \frac{3}{1} + \frac{4}{2^2}$$

$$4 = 3 + 1 \quad \checkmark$$

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

$$3x-1 \equiv A(1-2x) + B$$

$x = \frac{1}{2}$ $\quad 3\left(\frac{1}{2}\right) - 1 = B$

$$B = \frac{1}{2}$$

Coeff of x

$$3 = -2A$$

$$-\frac{3}{2} = A \qquad A = -\frac{3}{2}$$

$$\frac{3x-1}{(1-2x)^2} \equiv -\frac{3}{2(1-2x)} + \frac{1}{2(1-2x)^2}$$

Check with $x = 0$

$$\frac{-1}{1^2} = -\frac{3}{2(1)} + \frac{1}{2(1)^2}$$

$$-1 = -\frac{3}{2} + \frac{1}{2} \quad \checkmark$$

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4)

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

$$2x-1 \equiv A(2x-3) + B(x-1)$$

$x=1$ $\quad 2(1)-1 = A(2(1)-3)$

$$1 = -A$$

$$A = -1$$

$x = \frac{3}{2}$ $\quad 2\left(\frac{3}{2}\right)-1 = B\left(\frac{3}{2}-1\right)$

$$2 = \frac{1}{2}B$$

$$B = 4$$

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

Check with $x = 0$

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

$$-\frac{1}{3} = 1 - \frac{4}{3}$$ ✓

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4) $$\frac{2(4x^2+1)}{(2x+1)(2x-1)} \equiv A + \frac{B}{2x+1} + \frac{C}{2x-1}$$

$$2(4x^2+1) \equiv A(2x+1)(2x-1) + B(2x-1) + C(2x+1)$$

$x = \frac{1}{2}$ $\quad 2(4(\frac{1}{2})^2+1) = C(2(\frac{1}{2})+1)$

$$4 = 2C$$

$$C = 2$$

$x = -\frac{1}{2}$

$$2(4(-\tfrac{1}{2})^2+1) = B(2(-\tfrac{1}{2})-1)$$

$$4 = -2B$$

$$B = -2$$

Coeff of x^2

$$8 = 4A$$

$$A = 2$$

$$\frac{2(4x^2+1)}{(2x+1)(2x-1)} \equiv 2 - \frac{2}{2x+1} + \frac{2}{2x-1}$$

Check with $x = 0$

$$\frac{2(1)}{(1)(-1)} = 2 - \frac{2}{1} + \frac{2}{-1}$$

$$-2 = 2 - 2 - 2 \quad \checkmark$$