PARTIAL FRACTIONS

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PARTIAL FRACTIONS

Partial fractions is a method used in mathematics particularly calculus to decompose a complex rational function into simpler fractions. This technique is particularly useful for integrating functions that are difficult to integrate directly.By breaking down a complicated fraction into simpler components, it allows for easier integration and facilitates the solution of various mathematical problems. The basic concept of partial fraction relates to the technique of splitting difficult fraction into the sum or difference of two or more singular algebraic simpler fractions

For example,

$$\frac{5x+13}{x^2+5x+6}=\frac{2}{x+3}+\frac{3}{x+2}$$

is a single fraction obtained where the right hand side of (i) is summed.

To carry out complicated algebraic processes such as expansion in powers of n, integration with respect to x, limit of a fraction involving variables of x, it is important to study the method of splitting a single fraction to its partial fraction.

Some important rules

1. If the degree of the numerator of a given fraction is greater than or equal to that of the denominator, then we first divide to get a remainder of lower degree to the denominator.

2. Every linear factor $x-a$ in the denominator corresponds to a partial fraction of the form $\frac{A}{x-a}$.

3. Every repeated linear factor of the form $(x-a)^n$ in the denominator corresponds to n number of partial fractions of the form

$$\frac{A}{x-a}+\frac{B}{(x-a)^2}+\frac{C}{(x-a)^3}+\ldots+\frac{Z}{(x-a)^n}$$

. 4. Every non-factorizing quadratic factor like ax^2+bx+c corresponds to a factor of the form $\frac{Ax+B}{ax^2+bx+c}$. In addition, repeated quadratic factor $(x^2+ax+b)^n$ corresponds to n numbers of partial fractions of the form:

$$\frac{Ax+B}{x^2+ax+b}+\frac{Cx+D}{(x^2+ax+b)^2}+\frac{Ex+F}{(x^2+ax+b)^3}+\ldots+\frac{Kx+m}{(x^2+ax+b)^n}$$

The following examples show the basic applications of these rules.

Example 1: [Linear Factors]

Example Decompose the rational function

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

into partial fractions using the cover-up method.

Solution. Since the denominator factors as $(x+1)(x-2)$, we assume

$$\frac{x+5}{(x+1)(x-2)} = \frac{A}{x+1} + \frac{B}{x-2}.$$

Bringing the right-hand side to a common denominator gives

$$\frac{A}{x+1} + \frac{B}{x-2} = \frac{A(x-2)+B(x+1)}{(x+1)(x-2)}.$$

Hence the numerators must be equal:

$$x+5 = A(x-2)+B(x+1).$$

To obtain A, cover the factor $(x+1)$ in the original fraction and substitute $x=-1$:

$$A = \left.\frac{x+5}{x-2}\right|_{x=-1} = \frac{-1+5}{-1-2} = -\frac{4}{3}.$$

To obtain B, cover the factor $(x-2)$ and substitute $x=2$:

$$B = \left.\frac{x+5}{x+1}\right|_{x=2} = \frac{2+5}{2+1} = \frac{7}{3}.$$

Therefore,

$$\frac{x+5}{(x+1)(x-2)} = -\frac{4}{3(x+1)} + \frac{7}{3(x-2)}.$$

Alternatively

Example Expanding and equating the coefficient of:

$$x+5 = A(x-2) + B(x+1).$$

leads to

$$A(x-2) + B(x+1) = Ax - 2A + Bx + B = (A+B)x + (-2A+B).$$

Thus,

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

Equating coefficients of like powers of x on both sides.

$$A+B=1, \qquad -2A+B=5.$$

solving the simultaneous equations

$$\begin{cases} A+B=1, \\ -2A+B=5. \end{cases}$$

Subtracting the first equation from the second:

$$(-2A+B)-(A+B) = 5-1,$$

which simplifies to

$$-3A = 4 \quad \Rightarrow \quad A = -\frac{4}{3}.$$

Substituting $A = -\frac{4}{3}$ into $A + B = 1$:

$$-\frac{4}{3} + B = 1 \quad \Rightarrow \quad B = 1 + \frac{4}{3} = \frac{3}{3} + \frac{4}{3} = \frac{7}{3}.$$

Hence,

$$\frac{x+5}{(x+1)(x-2)} = \frac{A}{x+1} + \frac{B}{x-2} = \frac{-\frac{4}{3}}{x+1} + \frac{\frac{7}{3}}{x-2} = -\frac{4}{3(x+1)} + \frac{7}{3(x-2)}.$$

Verification

To verify the decomposition

$$\frac{x+5}{(x+1)(x-2)} = -\frac{4}{3(x+1)} + \frac{7}{3(x-2)},$$

the two fractions are written over a common denominator $(x+1)(x-2)$:

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

The numerators are combined to obtain:

$$\frac{-4(x-2) + 7(x+1)}{3(x+1)(x-2)}.$$

Expanding the brackets gives

$$-4(x-2)+7(x+1)=-4x+8+7x+7.$$

Collecting like terms:

$$(-4x+7x)+(8+7)=3x+15.$$

Factorising the numerator:

$$3x+15=3(x+5).$$

Thus,

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

This agrees with the original function, and therefore the partial fraction decomposition is correct.

Example 2: Resolve $\frac{1}{x^2+5x+6}$ into partial fractions.

In this case, the quadratic denominator is factorizable as

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

Which gives two linear fractions. Taking the L.C.M,

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

By cross multiplication we obtain

$A(x+2) + B(x+3) =$. This expression can be termed the general equation.

From the factors, let $(x+3)=0, x=-3$, and substituting $x=-3$ into the general equation,

$$A(-3+2)=1, \quad A(-1)=-1$$

Similarly, letting $x+2=0, x=-2$, substituting this into the general equation,

$$B(-2+3)=1, \quad B=1$$

Substituting the values of A and B into (10.1)

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

Which are the partial fractions of $\frac{1}{(x+3)(x+2)}$.

<u>Example 3</u> [Non factorisable quadratic factors]

Resolve $\frac{2x-3}{(x-1)(x^2-x-1)}$ into a partial fraction.

In this case, there is a linear factor $(x+1)$ and a non factorizable quadratic factor (x^2-x+1) : From the above rules, we can express the fractions as

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

Taking the L.C.M and by cross multiplicationnb + we obtain the following general equation

$$2x+3=A(x^2+x+1)+(Bx+C)(x+1)$$

For convenience, the linear factor is used to first obtain one of the constants.

i.e letting $x+1=0,\ x=-1,$ substituting -1 into the general equation.

$$2(-1)+3=A(1)\ \ A=1.$$

The quadratic factor cannot be applied to obtain B and C like the linear factor. Hence expand the general equation and compare the coefficients of equal powers of n.

Such that

$$2x+3 = Ax^2 + Bx^2 + Ax + Bx + Cx + A + C$$

Comparing coefficients,

$x^2 : 0 = A+B,$. (i)

$x^1 : 2 = A+B+C$ .. (ii)

$x^0 : 3 = A+C$ (iii)

Since $A=1$ as obtained earlier, substituting this into (i),

$B=-1$, and substituting into (iii) $C=2$.

Hence, the required partial fractions of

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

Example 4

Decompose the rational function $\frac{2x^2-7x-1}{(x-2)(x^2+3)}$ into partial fractions.

Solution. Since the denominator factors as $(x-2)(x^2+3)$, where $x-2$ is linear and x^2+3 is an irreducible quadratic, the decomposition has the form

$$\frac{2x^2-7x-1}{(x-2)(x^2+3)} \equiv \frac{A}{x-2} + \frac{Bx+C}{x^2+3},$$

for constants A, B and C.

Bringing the right-hand side to a single fraction with denominator $(x-2)(x^2+3)$ gives

$$\frac{A}{x-2}+\frac{Bx+C}{x^2+3}=\frac{A(x^2+3)+(Bx+C)(x-2)}{(x-2)(x^2+3)}.$$

Hence,

$$\frac{2x^2-7x-1}{(x-2)(x^2+3)}\equiv\frac{A(x^2+3)+(Bx+C)(x-2)}{(x-2)(x^2+3)}.$$

Since the denominators are the same, the numerators are *identically equivalent*, that is,

$$2x^2-7x-1\equiv A(x^2+3)+(Bx+C)(x-2).$$

Expanding the right-hand side,

$$A(x^2+3)=Ax^2+3A,$$

$$(Bx+C)(x-2)=Bx^2-2Bx+Cx-2C.$$

Therefore,

$$A(x^2+3)+(Bx+C)(x-2)=(A+B)x^2+(-2B+C)x+(3A-2C).$$

Thus the identity $2x^2-7x-1\equiv(A+B)x^2+(-2B+C)x+(3A-2C)$ holds for all x.

Equating coefficients of like powers of x gives

Coefficientofx^2: $A+B=2$,
Coefficientof$x$: $-2B+C=-7$,
Constantterm: $3A-2C=-1$.

Hence

$$\begin{cases} A+B=2, \\ -2B+C=-7, \\ 3A-2C=-1. \end{cases}$$

From $A+B=2$,

$$A=2-B.$$

Substituting $A=2-B$ into $3A-2C=-1$,

$$3(2-B)-2C=-1 \Rightarrow 6-3B-2C=-1 \Rightarrow -3B-2C=-7.$$

Now use

$$\begin{cases} -2B+C=-7, \\ -3B-2C=-7. \end{cases}$$

From $-2B+C=-7$,

$$C=-7+2B.$$

Substitute into $-3B-2C=-7$:

$$-3B-2(-7+2B)=-7 \Rightarrow -3B+14-4B=-7 \Rightarrow -7B+14=-7,$$

so

$$-7B=-21 \Rightarrow B=3.$$

Then

$$A=2-B=2-3=-1,$$

and

$$C=-7+2B=-7+2\cdot 3=-1.$$

Thus

$$A=-1,\quad B=3,\quad C=-1,$$

and the required partial fraction decomposition is

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

Example 5: Repeated Factors

We wish to resolve the expression

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

into partial fractions.

First, notice that the quadratic factor can be simplified:

$$x^2+2x-1=(x+1)^2.$$

Substituting this gives

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

Since the denominator is a repeated linear factor, we express the fraction in the standard partial-fraction form:

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

Taking the common denominator $(x-1)^3$ and equating numerators, we obtain

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

To determine the constants, we proceed as follows. Setting $x = -1$ immediately isolates C:

$$2(-1) - 3 = C \quad \Rightarrow \quad C = 1.$$

Next, expand the right-hand side:

$$A(x+1)^2 = A(x^2 - 2x + 1) = Ax^2 + 2Ax - A$$

$$B(x-1) = Bx - B.$$

Thus,

$$2x + 3 = Ax^2 + (2A + B)x + (A - B + C).$$

Equating coefficients gives:

$$\begin{aligned} x^2 &: \quad 0 = A, \\ x^1 &: \quad 2 = 2A + B, \\ x^0 &: \quad 3 = A + B + C. \end{aligned}$$

With $A = 0$ and $C = 1$, substitution yields:

$$B = 2.$$

Therefore, the required partial-fraction decomposition is

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

Example 6

Decompose the rational function $\frac{7x^2+8}{(1+x)^2(2-3x)}$ into partial fractions.

Solution. The denominator factors as $(1+x)^2(2-3x)$, where $(1+x)$ is a repeated linear factor and $(2-3x)$ is a distinct linear factor. Therefore, the partial fraction decomposition has the form

$$\frac{7x^2+8}{(1+x)^2(2-3x)} \equiv \frac{A}{1+x} + \frac{B}{(1+x)^2} + \frac{C}{2-3x},$$

for constants A, B and C.

Bringing the right-hand side to a single fraction with denominator $(1+x)^2(2-3x)$ gives

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

Hence,

$$\frac{7x^2+8}{(1+x)^2(2-3x)} \equiv \frac{A(1+x)(2-3x) + B(2-3x) + C(1+x)^2}{(1+x)^2(2-3x)}.$$

Since the denominators are the same, the numerators are identically equivalent:

$$7x^2+8 \equiv A(1+x)(2-3x) + B(2-3x) + C(1+x)^2.$$

Expanding and simplifying the right-hand sides,

$$(1-x)(2-3x) = 2-3x-2x-3x^2 = 2-x-3x^2,$$

so

$$A(1+x)(2-3x) = A(2-x-3x^2) = -3Ax^2 - Ax + 2A.$$

Also,

$$B(2-3x) = 2B - 3Bx,$$

and

$$(1+x)^2 = 1-2x-x^2 \quad \Rightarrow \quad C(1-x)^2 = Cx^2 - 2Cx - C.$$

Adding these three expressions gives

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

Thus the identity becomes

$$7x^2 + 8 = (-3A+C)x^2 - (-A-3B+2C)x + (2A+2B+C).$$

Equating coefficients of like powers of x on both sides, we obtain

$$\begin{aligned} &\text{Coefficient of } x^2: && -3A - C = 7, \\ &\text{Coefficient of } x: && -A - 3B - 2C = 0, \\ &\text{Constant term:} && 2A + 2B + C = 8. \end{aligned}$$

Hence,

$$\begin{cases} -3A - C = 7, \\ -A - 3B - 2C = 0, \\ 2A - 2B + C = 8. \end{cases}$$

From $-3A + C = 7$ we have

$$C = 7 + 3A$$

Substituting this into $2A + 2B - C = 8$:

$$2A - 2B + (7 - 3A) = 8 \Rightarrow 5A - 2B + 7 = 8 \Rightarrow 5A + 2B = 1.$$

substituting $C=7+3A$ into $-A-3B+2C=0$:

$$-A-3B+2(7+3A)=0 \Rightarrow -A-3B+14+6A=0 \Rightarrow 5A-3B+14=0 \Rightarrow 5A-3B=-14.$$

Solving the simultaneous equations

$$\begin{cases} 5A+2B=1, \\ 5A-3B=-14. \end{cases}$$

Subtracting the second equation from the first gives

$$(5A+2B)-(5A-3B)=1-(-14) \Rightarrow 5B=15 \Rightarrow B=3.$$

Substituting $B=3$ into $5A+2B=1$,

$$5A+2\cdot 3=1 \Rightarrow 5A+6=1 \Rightarrow 5A=-5 \Rightarrow A=-1.$$

Finally,

$$C=7+3A=7+3(-1)=4.$$

Thus

$$A=-1, \quad B=3, \quad C=4,$$

and the required partial fraction decomposition is

$$\frac{7x^2+8}{(1+x)^2(2-3x)} \equiv \frac{-1}{1+x} + \frac{3}{(1+x)^2} + \frac{4}{2-3x}.$$

Verification.

Consider

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

Writing this expression over the common denominator $(1+x)^2(2-3x)$ gives

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

Expanding and simplifying the numerator yields

$$7x^2+8,$$

so that

$$-\frac{1}{1+x} + \frac{3}{(1+x)^2} + \frac{4}{2-3x} = \frac{7x^2+8}{(1+x)^2(2-3x)}.$$

This agrees with the original function, and the decomposition is therefore correct.

Example 7

Resolve into partial fractions:

$$\frac{2x^3+6x^2+5x-1}{(x+2)(x+1)}$$

Solution: First, perform polynomial division since the numerator degree is higher than the denominator:

Quotient	$2x$
x^2+3x+2	$2x^3+6x^2+5x-1$
	$-(2x^3+6x^2+4x)$
	$x-1$

this yields

$$\frac{2x^3+6x^2+5x-1}{x^2+3x+2}=2x+\frac{x-1}{x^2+3x+2}$$

Next, factor the quadratic in the denominator:

$$x^2+3x+2=(x+2)(x+1)$$

So we write:

$$\frac{x-1}{x^2+3x+2}=\frac{A}{x+2}+\frac{B}{x+1}$$

Multiply both sides by $(x+2)(x+1)$:

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

Using the method of equating values:

- Let $x=-1$:

$$-1-1=A(0)+B(1)\,B=-2$$

- Let $x=-2$:

$$-2-1=A(-1)+B(0)\,A=3$$

Therefore:

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

Finally, the required partial fraction decomposition is:

$$\frac{2x^3+6x^2+5x-1}{(x+2)(x+1)}=2x+\frac{3}{x+2}-\frac{2}{x+1}$$

Exercise A

1. Resolve $\dfrac{3x^2-5}{(x+2)^3}$ into partial fractions.

2. Find the constants A, B, and C such that

$$\frac{2x+1}{(x+1)^2(2x-5)}=\frac{A}{x+1}+\frac{B}{(x+1)^2}+\frac{C}{2x-5}.$$

3. Resolve $\dfrac{f(x)}{(x-a)(x-b)(x-c)}$ into partial fractions.

4. Write the appropriate forms of the partial fractions for the following expressions and then resolve them:

(a) $\dfrac{2x-3}{(x^2+2x-1)^2}$

(b) $\dfrac{4x-3}{(x^2-1)(x^2-4)}$

(c) $\dfrac{3x+4}{(x^2-1)(x^2-4)}$

(d) $\dfrac{2x+3}{(x^2-1)(x^2+4)}$

Exercise B

1. Resolve $\dfrac{3x^2-4x+5}{(x+1)(x-3)(2x-1)}$ into partial fractions

A. $\dfrac{1}{(x+1)}+\dfrac{1}{(x-3)}+\dfrac{1}{(2x-1)}$

B. $\dfrac{1}{(x+1)}-\dfrac{1}{(x-3)}-\dfrac{1}{(2x-1)}$

C. $\dfrac{1}{(x-1)}+\dfrac{1}{(x+3)}+\dfrac{1}{(2x-1)}$

A. $\dfrac{1}{(x+1)}+\dfrac{1}{(x-3)}-\dfrac{1}{(2x-1)}$

2. Resolve $\frac{4x+11}{x^2+4x-5}$ into partial fractions

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

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

C. $\frac{5}{2(x-1)}+\frac{5}{2(x+5)}$

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

3. Resolve $\frac{x^2}{(x+1)^3}$ into partial fractions

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

B. $\frac{1}{(x+1)}+\frac{1}{(x+1)^2}+\frac{1}{(x+1)^3}$

C. $\frac{1}{(x+1)}+\frac{1}{(x+1)}+\frac{1}{(x+1)^3}$

D. $\frac{1}{(x+1)^2}+\frac{1}{(x+1)}+\frac{1}{(x+1)^3}$

4. Resolve $\frac{6x-10}{(x)^2-2x-3}$ into partial fractions

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

B. $\frac{1}{(x+1)^2}+\frac{1}{(x+1)^3}$

C. $\frac{1}{(x+1)}+\frac{1}{(x+1)}+$

D. $\frac{1}{(x+1)^2}++\frac{1}{(x+1)^3}$

5. Resolve $\frac{3x^2+8x+13}{(x-1)(x^2+2x+5)}$ into partial fractions

A. $\frac{1}{2(x^2+2x+5)}+\frac{3}{(x-2)}$

B. $\frac{2}{(x^2+2x+5)}+\frac{3}{(x-1)}$

C. $\frac{1}{(x^2+2x+5)}+\frac{3}{(x-1)}$

D. $\frac{-2}{2(x^2+2x+5)}+\frac{3}{(x-2)}$

6. Resolve $\frac{3x^2+8x+13}{(x-1)(x^2+2x+5)}$ into partial fractions

A. $x+\frac{2}{(x+1)}-\frac{4}{(x+2)}$

B. $x+\frac{2}{(x-1)}+\frac{4}{(x-2)}$

C. $x-\frac{2}{(x+1)}+\frac{4}{(x+2)}$

D. $x+\frac{2}{(x-1)}+\frac{4}{(x+2)}$

7. Resolve $\frac{3x^2+8x+13}{(x-1)(x^2+2x+5)}$ into partial fractions

A. $\frac{1}{(x+1)}-\frac{x+1}{(x^2+9)}$

B. $\frac{x+1}{(x^2+1)}-\frac{1}{(x^2+9)}$

C. $\frac{2}{(x+1)}+\frac{4}{(x^2+9)}$

D. $\frac{2}{(x-1)}+\frac{4}{(x^2+9)}$

8. Resolve $\frac{3x^2+8x+13}{(x-1)(x^2+2x+5)}$ into partial fractions

A. $\frac{1}{x+x}-\frac{1}{(x-2)}+\frac{2}{(x+2)^2}$

B. $\frac{1}{x+1}-\frac{1}{(x-2)}+\frac{1}{(x-2)^2}$

C. $\frac{1}{x+2}+\frac{1}{(x-2)}+\frac{1}{(x+2)^2}$

D. $\frac{1}{x+1}-\frac{2}{(x-2)}+\frac{2}{(x+2)^2}$

9. Resolve $\frac{x^3-x^2-4}{x^2-1}$ into partial fractions

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

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

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

D. $x-1+\frac{3}{(x-1)}-\frac{2}{(x+1)}$

10. Resolve $\frac{4x+11}{X^2+4X-5}$ into partial fractions

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

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

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

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

11. Resolve $\frac{7x+2}{(2X-3)(X+1)^2}$ into partial fractions

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

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

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

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

12. Resolve $\frac{x^2+4x-7}{(x-1)(x^2-4)}$ into partial fractions

A. $\frac{3x-1}{x^2-4}-\frac{2}{x-1}$

B. $\frac{3x-1}{x^2-4}-\frac{2}{x+1}$

C. $\frac{3x+1}{x^2+4}-\frac{2}{x-1}$

D. $\frac{3x^2-1}{x^2+4}-\frac{2}{x-1}$

13. Resolve $\frac{7x-5}{(x+1)(x-2)}$ into partial fraction

A. $\frac{3x-1}{x^2-4}-\frac{2}{x-1}$

B. $\frac{3}{x-1}-\frac{4}{x-2}$

C. $\frac{3x+1}{x^2+4}-\frac{2}{x-1}$

D. $\frac{3x^2-1}{x^2+4}-\frac{2}{x-1}$

14. Resolve $\frac{5x-1}{(x-3)(x+4)}$ into partial fraction

A. $\frac{3x+1}{x^2+4}-\frac{2}{x-1}$

B. $\frac{3}{x+1}+\frac{4}{x-2}$

C. $\frac{3x+1}{x^2+4}-\frac{2}{x+1}$

D. $\frac{1}{x-3}+\frac{4}{x+4}$

15. Resolve $\frac{9x+2}{(x+5)(x-1)}$ into partial fraction

A. $\frac{3x+1}{x^2+4}-\frac{2}{x-1}$

B. $\frac{2}{x+5}+\frac{7}{x-1}$

C. $\frac{3x+1}{x^2+4}-\frac{2}{x+1}$

D. $\frac{1}{x-3}+\frac{4}{x+4}$