

7.4 Partial Fractions

Simplify the expression:

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

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

$$= \frac{3x+9+2x-8}{LCD} = \boxed{\frac{5x+1}{(x-4)(x+3)}}$$

Mar 20-11:43 AM

Writing the Decomposition Factors

Write the terms for the partial fraction decomposition of the rational function but do not solve.

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

irreducible quadratic

$$= \frac{A}{x} + \frac{B}{x^2} + \frac{C}{x^3} + \frac{D}{x+3} + \frac{Ex+F}{x^2+1}$$

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Write the terms for the partial fraction decomposition of the rational function but do not solve.

$$a.) x^2(x+3)^2 \rightarrow \frac{A}{x} + \frac{B}{x^2} + \frac{C}{x+3} + \frac{D}{(x+3)^2}$$

$$b.) (x^2+5)^2 \rightarrow \frac{Ax+B}{x^2+5} + \frac{Cx+D}{(x^2+5)^2}$$

$$c.) x^3(x^2+1) \quad \frac{A}{x} + \frac{B}{x^2} + \frac{C}{x^3} + \frac{Dx+E}{x^2+1}$$

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$$\frac{A}{x} + \frac{B}{x^2} + \frac{C}{x^3} + \frac{Dx+E}{x^2+3} + \frac{Fx+G}{(x^2+3)^2} + \frac{H}{x-1}$$

May 10-1:09 PM

Find the partial fraction decomposition.

$$2.) \frac{5x-1}{x^2-2x-15} = \frac{5x-1}{(x-5)(x+3)}$$

$$\frac{A}{x-5} + \frac{B}{x+3}$$

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

$$\frac{Ax + 3A + Bx - 5B}{(x-5)(x+3)}$$

1.) Factor the denominator ✓

2.) Set up the partial fraction decomposition ✓

3.) Give each fraction what it's missing from the LCD ✓

4.) Simplify each numerator ✓

5.) Set up your system using the coefficients of terms from the numerators ✓

6.) Solve each letter ✓

7.) Substitute the values of each letter into your setup from #2. ✓

$$5(A+B=5)$$

$$3A - 5B = -1$$

$$\begin{array}{r} + 5A + 5B = 25 \\ 3A - 5B = -1 \\ \hline 8A = 24 \end{array}$$

$$A = 3$$

$$B = 2$$

$$\boxed{\frac{3}{x-5} + \frac{2}{x+3}}$$

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Quick Review - Rational Functions

$$f(x) = \frac{ax^n + \dots}{bx^m + \dots}$$

← nth degree polynomial
← mth degree polynomial

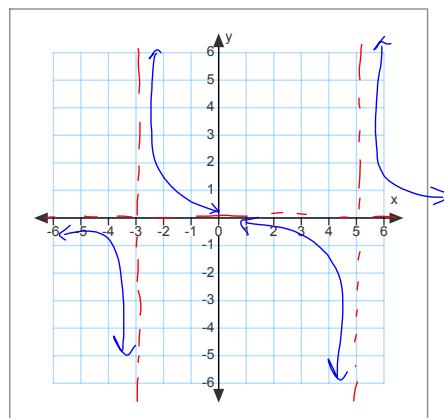
- 1** If $n < m$, then the x-axis is the horizontal asymptote.
- 2** If $n = m$, then the horizontal asymptote is the line $y = \frac{a}{b}$
- 3** If $n > m$, then there is no horizontal asymptote. (There is a slant diagonal or oblique asymptote.)

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Graph the partial fractions from #2 and compare them to the original function.

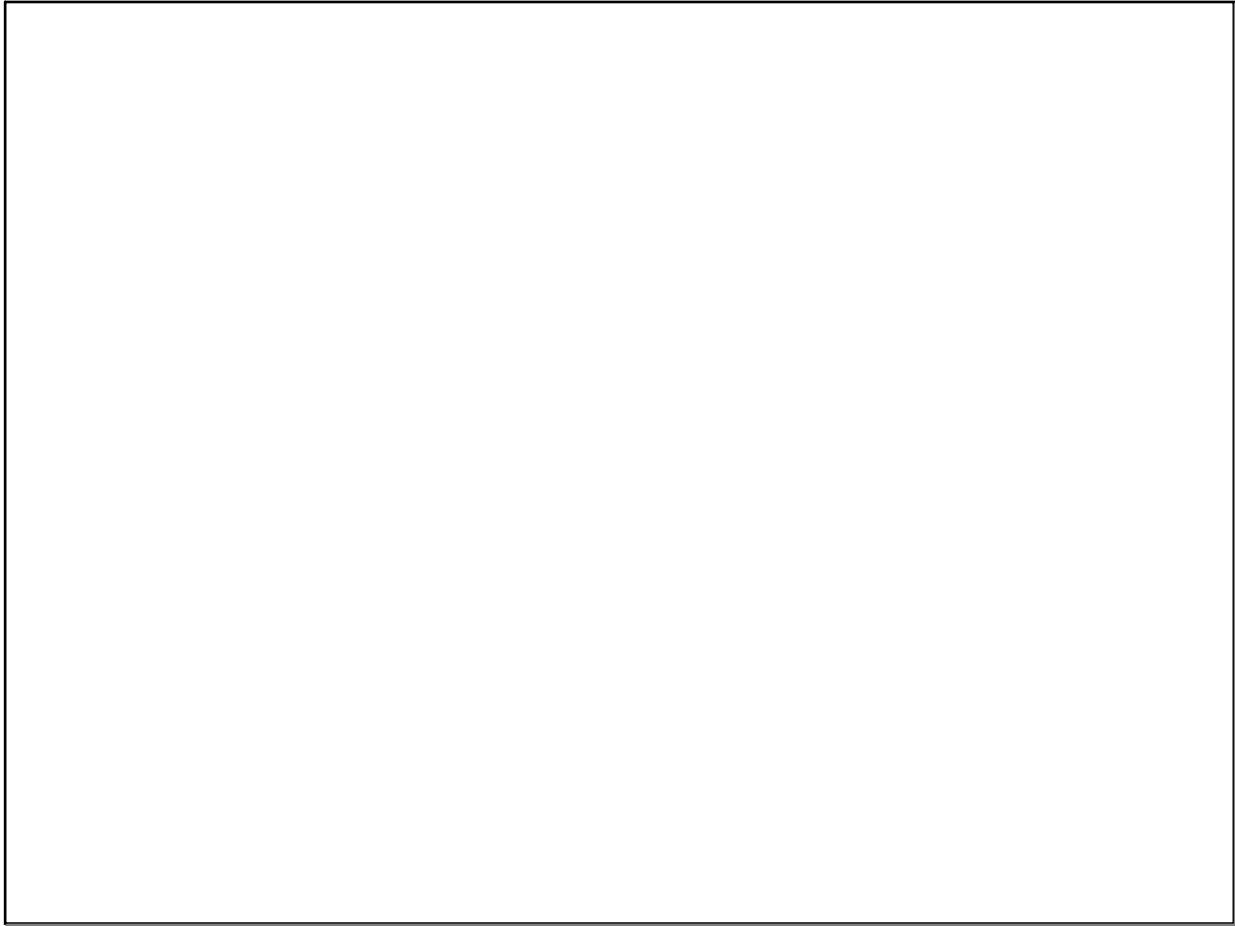
$$y = \frac{2}{x+3}$$

$$y = \frac{3}{x-5}$$



[-10, 10] by [-10, 10]

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