

Lesson 96 Objective: SWBAT solve by using partial fraction decomposition.

Kickoff

1) Solve:  $\frac{1}{x-5} + \frac{2}{x+3}$

2) Complete question 3 in the homework packet

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

3)  $\frac{3x-7}{x^2-2x-15}$

$\frac{x+3+2x-10}{(x-5)(x+3)}$

$\frac{3x-7}{(x-5)(x+3)}$

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

$3x-7 = A(x+3) + B(x-5)$

$3x-7 = Ax+3A+Bx-5B$

$3x-7 = (A+B)x + (3A-5B)$

$3 = A+B$   
 $-7 = 3A-5B$

$3 = 2+A$   
 $-2 = -2$   
 $1 = A$

$-9 = -3A+3B$   
 $-7 = 3A-5B$

$-16 = -8B$   
 $-8 = -8B$   
 $1 = B$

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

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2)  $\frac{-7}{x} + \frac{3}{x+5}$  3)  $\frac{1}{x} + \frac{2x+4}{x^2+4}$

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

6)  $\frac{1}{x} + \frac{3}{x+1} + \frac{7}{2x-5}$

6)  $\frac{15x^2-11x-5}{x(x+1)(2x-5)} = \frac{A}{x} + \frac{B}{x+1} + \frac{C}{2x-5}$

$15x^2-11x-5 = A(x+1)(2x-5) + Bx(x-5) + Cx(x+1)$

$15x^2-11x-5 = 2Ax^2-5Ax+A+2Bx^2-5Bx+Cx^2+Cx$

$15x^2 = 2Ax^2 + 2Bx^2 + Cx^2 \rightarrow 15 = 2A + 2B + C$   
 $-11x = -5Ax - 5Bx + Cx \rightarrow -11 = -5A - 5B + C$   
 $-5 = -5A \rightarrow A = 1$

$15 = 2A + 2B + C$   
 $-11 = -5A - 5B + C$

$13 = 2B + C$   
 $8 = -5B + C$

$13 = 2B + C$   
 $-1(-8 = -5B + C) \rightarrow 8 = 5B - C$

$21 = 7B$   
 $3 = B$

$13 = 2B + C$   
 $13 = 6 + C$   
 $C = 7$

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3)  $\frac{3x-7}{x^2-2x-15}$

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**Partial Fractions-** decomposing an algebraic fraction.

\*\*You are working backwards!! You are given the answer and must be able to come up with the fractions that you started with\*\*

Partial Fractions Steps:

- 1) Factor the denominator.
- 2) Write the factors as two separate fractions with A, B and C (however many needed) as numerators.
- 3) Find common denominators and start solving like a rational equation.
- 4) Set ONLY the numerators equal once you have common denominators.
- 5) Make two equations: one with x-values and the other with other numbers.
- 6) Solve for the missing letters by using a system! (A, B, C)
- 7) Write the fractions to show the decomposition.

\*\*When you set up the fractions with repeating factors, you need to write TWO partial fractions for it.\*\*

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Example 1:

$\frac{6x+4}{x^2+2x+1} = \frac{6x+4}{(x+1)(x+1)} = \frac{A}{x+1} + \frac{B}{(x+1)^2}$

$6x+4 = Ax + A + B$

$6x = Ax \rightarrow 6 = A$

$4 = A + B$   
 $4 = 6 + B$   
 $-2 = B$

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

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Example 2:

$$\frac{2x^3 - x^2 + 13x - 5}{(x^2 + 5)^2} = \frac{Ax + B}{x^2 + 5} + \frac{Cx + D}{(x^2 + 5)^2}$$

$$2x^3 - x^2 + 13x - 5 = (Ax + B)(x^2 + 5) + Cx + D$$

$$2x^3 = Ax^3 + 5Ax^2 + Bx^2 + 5B + Cx + D$$

$$-x^2 = Bx^2 \rightarrow -1 = B$$

$$13x = 5Ax + Cx \rightarrow 13 = 5A + C$$

$$-5 = 5B + D$$

$$-5 = -5 + D$$

$$D = 0$$

$$13 = 5A + C \quad B = -1 + C$$

$$13 = 5A + C \quad C = 3$$

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

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