Multiplying and Dividing Rational Expressions and Functions

1. A student compares an answer of $\dfrac{a-3b}{2b-a}$ to an answer of $\dfrac{3b-a}{a-2b}$. Are the two answers the same?

2. In which parts can you divide out the 4's?

   a. $\dfrac{4x+4y}{4z}$ b. $\dfrac{4x}{x+4}$ c. $\dfrac{4+x}{4+y}$ d. $\dfrac{4x}{4+4y}$ e. $\dfrac{4x+4y}{4a-4b}$

3. Since rational expressions are to be expressed in simplest form, explain what is wrong in simplifying:

   $$\dfrac{y+3xy}{4xy+5x}=\dfrac{1+3y}{4x+5}$$

4. When you multiply two rational expressions, is it possible that the product will be zero? Give an example.

Simplify:

5. $\dfrac{x^3+x^2-42x}{2x^2+8x-42}$ 6. $\dfrac{x+5}{5x+25}$ 7. $\dfrac{3y-18}{y-6}$

Find the domain:

8. $\dfrac{4x-7}{20x-35}$ 9. $\dfrac{x+4}{x^2+3x-4}$

Multiply:

10. $\dfrac{25-n^2}{n^2-2n-35}\bullet\dfrac{n^2-8n-20}{n^2-3n-10}$ 11. $\dfrac{x^2-4x-32}{x^2-8x-48}\bullet\dfrac{3x^2+17x+10}{3x^2-22x-16}$

Divide:

12. $\dfrac{5a^2y+3a^2}{2x^3+5x^2}\div\dfrac{10ay+6a}{6x^3+15x^2}$ 13. $\dfrac{x^2-x-2}{x^2-7x+10}\div\dfrac{x^2-3x-4}{40-3x-x^2}$

14. Find $f(-1), f(3)$ for $f(x)=\dfrac{x^2-3x-4}{3-x}$. Then, find $g(-1), g(0)$ for $g(x)=\dfrac{2t^3-1}{t^2+4}$

15. Explain how to simplify a rational expression with opposite factors in the numerator and the denominator.

Adding and Subtracting Rational Expressions, Functions and Equations

1. Let $f(x)=\dfrac{x+3}{2}$ and $g(x)=\dfrac{2}{x+3}$. Find $f(x) + g(x)$ and $f(x) - g(x)$.

2. What is the LCD of the denominators of two rational expressions if one denominator is a multiple of the other denominator?

Simplify:

3. $\dfrac{x+2y}{x^2+4xy+4y^2}-\dfrac{2x}{x^2-4y^2}$

4. $\dfrac{3x-y}{x^2+2x+1}-\dfrac{3}{2x-2}+\dfrac{x}{x^2-1}$

5. $\dfrac{5}{2m^2-5m-3}+\dfrac{3}{2m^2+5m+2}-\dfrac{1}{m^2-m-6}$

Selected problems were taken from Blitzer <u>Algebra For College Students</u>

Complex Rational Expressions

Simplify:

1. $\dfrac{12x^{-2} - 3x^{-1}}{15x^{-1} - 9x^{-2}}$

2. $\dfrac{\dfrac{1}{x+6} - \dfrac{1}{x}}{6}$

3. $\left(x^{-1} + y^{-1}\right)^{-1}$

4. $\dfrac{\dfrac{x+1}{x-1} - \dfrac{x-1}{x+1}}{\dfrac{x-1}{x+1} + \dfrac{x+2}{x-1}}$

5. $\dfrac{\dfrac{3}{x+1} - \dfrac{3}{x-1}}{\dfrac{5}{x^2-1}}$

6. Let $f(x) = \dfrac{1+x}{1-x}$. Find $f\left(\dfrac{1}{x-6}\right)$ and simplify.

Dividing Polynomials

Simplify:

1. $\dfrac{22r^2u^2 - 16r^2u^4 - 12r^2u5}{2r^2u^4}$

2. $\dfrac{4y^5 - 12n^4y^5 - 24n^5y^6}{4n^5y^2}$

3. $\dfrac{14xy^2 - 7x^2y + 21x^2y^2}{-7x^2y^2}$

Simplify:

4. $\left(10x^2 - 30\right) \div (x+3)$

5. $\left(6 - 19x + 15x^2\right) \div (3x - 2)$

6. Find the quotient: $\dfrac{10x^2 - 11x - 6}{2x + 3}$

7. Find the quotient: $\dfrac{y^2 - 5y - 6}{y + 2}$

8. Find the quotient: $\dfrac{t^3 - t^2 - 4}{2t - 2}$

9. Find the quotient: $\dfrac{t^3 - 8}{5t - 2}$

10. Find a simplified version for $\dfrac{f}{g}(x)$
    a. $f(x) = 2x^3 - 9x^2 - 17x + 39,\ g(x) = 2x - 5$
    b. $f(x) = 4x^4 + 6x^3 + 3x - 1,\ g(x) = 2x^2 + 1$

11. When performing polynomial long division, explain when to stop dividing.

12. After performing polynomial long division, explain how to check the answer.

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