Name _____

Block _____ Date _____

Answer the following true/false questions by circling the correct word.

1. A common denominator is needed to multiply rational expressions.   True / False

2. A common denominator is needed to add or subtract rational expressions. True / False

3. The same rules apply to fractions with variables and fractions without variables. True / False

Multiplication of Rational Expressions
  1) Factor the numerators and denominators so there is only multiplication
  2) Cancel anything in the numerator with anything in the denominator

Division of Rational Expressions
  1) Flip any fraction being divided and change to a multiplication problem

Perform the indicated operation.   Simplify the result.

4. $\dfrac{x^3}{4} \bullet \dfrac{2}{x^2}$

5. $\dfrac{x+1}{x} \bullet \dfrac{x^3}{(x+1)^2}$

6. $\dfrac{x+5}{x} \div \dfrac{x+5}{2x}$

7. $\dfrac{2x+8}{-3x^4} \bullet \dfrac{9x^3}{8x+32}$

8. $\dfrac{4x^2 y^3}{x^5 y^6} \bullet \dfrac{xy}{20x^3}$

9. $\dfrac{81x^9}{y^4} \bullet \dfrac{x^2}{36x^5 y}$

10. $\dfrac{12x^2 y}{5y^2} \div \dfrac{3x^2}{2xy}$

11. $\dfrac{x^2 - 3x + 2}{25x} \div \dfrac{x-1}{5x^2}$

12. $\dfrac{5x^2 - 20}{25x^2} \div \dfrac{x^2 + 6x + 8}{x^2 + 10x + 24}$

Adding/Subtracting Rational Expressions
  1) Factor the denominators
  2) Find the LCD
  3) Multiply by $\dfrac{missing}{missing}$
  4) Multiply out the numerators
  5) Combine Like Terms
      Keep the denominators the same

13. $\dfrac{5x^2 - 8x}{x^2 - 9} - \dfrac{4x + 9x^2}{x^2 - 9}$

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

15. $\dfrac{7}{x-2} - \dfrac{x}{x-2}$

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

17. $\dfrac{x}{x^2 - x - 30} - \dfrac{1}{x+5}$

18. $\dfrac{5x}{x^2 - 2x - 15} + \dfrac{2x}{x-5}$

19. $\dfrac{2x}{x-6} - \dfrac{3}{x+3}$

Name _____

Block _____ Date _____

Answer the following true/false questions by circling the correct word.

1. A common denominator is needed to multiply rational expressions.   True / False

2. A common denominator is needed to add or subtract rational expressions. True / False

3. The same rules apply to fractions with variables and fractions without variables. True / False

---

Multiplication of Rational Expressions

　　　3) Factor the numerators and denominators so there is only multiplication

　　　4) Cancel anything in the numerator with anything in the denominator

Division of Rational Expressions

　　　2) Flip any fraction being divided and change to a multiplication problem

Perform the indicated operation.   Simplify the result.

4. $\dfrac{x^3}{4} \bullet \dfrac{2}{x^2}$

5. $\dfrac{x+1}{x} \bullet \dfrac{x^3}{(x+1)^2}$

6. $\dfrac{x+5}{x} \div \dfrac{x+5}{2x}$

7. $\dfrac{2x+8}{-3x^4} \bullet \dfrac{9x^3}{8x+32}$

8. $\dfrac{4x^2 y^3}{x^5 y^6} \bullet \dfrac{xy}{20x^3}$

9. $\dfrac{81x^9}{y^4} \bullet \dfrac{x^2}{36x^5 y}$

10. $\dfrac{12x^2 y}{5y^2} \div \dfrac{3x^2}{2xy}$

11. $\dfrac{x^2 - 3x + 2}{25x} \div \dfrac{x-1}{5x^2}$

12. $\dfrac{5x^2 - 20}{25x^2} \div \dfrac{x^2 + 6x + 8}{x^2 + 10x + 24}$

Adding/Subtracting Rational Expressions

　　　1) Factor the denominators

　　　2) Find the LCD

　　　3) Multiply by $\dfrac{\text{missing}}{\text{missing}}$

　　　4) Multiply out the numerators

　　　5) Combine Like Terms

　　　　　Keep the denominators the same

13. $\dfrac{5x^2 - 8x}{x^2 - 9} - \dfrac{4x + 9x^2}{x^2 - 9}$

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

15. $\dfrac{7}{x-2} - \dfrac{x}{x-2}$

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

17. $\dfrac{x}{x^2 - x - 30} - \dfrac{1}{x+5}$

18. $\dfrac{5x}{x^2 - 2x - 15} + \dfrac{2x}{x-5}$

19. $\dfrac{2x}{x-6} - \dfrac{3}{x+3}$

Simplify the complex fraction.

20. $\dfrac{5+\dfrac{1}{4}}{2+\dfrac{2}{3}}$

21. $\dfrac{\dfrac{x}{3}-4}{5+\dfrac{1}{x}}$

22. $\dfrac{\dfrac{x+3}{3x^2}}{\dfrac{(x+3)^2}{6x^2}}$

23. $\dfrac{\dfrac{2}{x^2-4}-\dfrac{1}{x+2}}{\dfrac{2}{4x-12}}$

24. $\dfrac{\dfrac{x}{8}-\dfrac{3}{4x}}{\dfrac{4}{x+4}-\dfrac{5}{x}}$

25. $\dfrac{\dfrac{1}{6}+\dfrac{1}{8x}}{\dfrac{4x}{x-2}+\dfrac{6}{2x-4}}$

Solving Rational Expressions
1) Get each fraction to have the LCD (to find the LCD, you might need to factor the denominator)
2) Multiply the entire problem by the LCD(distribute the LCD)
3) Solve for x
   a. If x^2 problem: set = 0
   b. If x problem: get x's on one side and the numbers on the other side

Solve the equation using any method. Check each solution.

26. $\dfrac{3x}{4}=\dfrac{(x+1)}{2}$

27. $\dfrac{10}{x+3}+\dfrac{10}{3}=6$

28. $\dfrac{2x-9}{x-7}+\dfrac{x}{2}=\dfrac{5}{x-7}$

29. $\dfrac{2}{x}=\dfrac{x}{x^2-8}$

30. $\dfrac{4}{x^2+3x-4}+3=\dfrac{7}{x+4}$

31. $\dfrac{x+3}{x-4}=\dfrac{5x+14}{x^2+2x-24}$

APPLICATIONS

32. At a factory, gallons of paint are produced by a machine in accordance to the formula $G=40h-\dfrac{560}{h}$ where

G = the number of gallons produced, and h = the number of hours the paint-making machine works. How many hours does the machine need to work to produce 200 gallons of paint?

33. The number of bottles produced by a machine at a plant is given by the equation $b=\dfrac{20m^3-120m^2}{m^2-m-30}$.

B = the number of bottles, and m = the number of minutes the machine works.
   a) Simplify the expression above

   b) If the plant's machine works for 10 minutes, how many bottles does it produce?

Simplify the complex fraction.

20. $\dfrac{5+\dfrac{1}{4}}{2+\dfrac{2}{3}}$

21. $\dfrac{\dfrac{x}{3}-4}{5+\dfrac{1}{x}}$

22. $\dfrac{\dfrac{x+3}{3x^2}}{\dfrac{(x+3)^2}{6x^2}}$

23. $\dfrac{\dfrac{2}{x^2-4}-\dfrac{1}{x+2}}{\dfrac{2}{4x-12}}$

24. $\dfrac{\dfrac{x}{8}-\dfrac{3}{4x}}{\dfrac{4}{x+4}-\dfrac{5}{x}}$

25. $\dfrac{\dfrac{1}{6}+\dfrac{1}{8x}}{\dfrac{4x}{x-2}+\dfrac{6}{2x-4}}$

Solving Rational Expressions
   4) Get each fraction to have the LCD (to find the LCD, you might need to factor the denominator)
   5) Multiply the entire problem by the LCD(distribute the LCD)
   6) Solve for x
      a. If x^2 problem: set = 0
      b. If x problem: get x's on one side and the numbers on the other side

Solve the equation using any method. Check each solution.

26. $\dfrac{3x}{4}=\dfrac{(x+1)}{2}$

27. $\dfrac{10}{x+3}+\dfrac{10}{3}=6$

28. $\dfrac{2x-9}{x-7}+\dfrac{x}{2}=\dfrac{5}{x-7}$

29. $\dfrac{2}{x}=\dfrac{x}{x^2-8}$

30. $\dfrac{4}{x^2+3x-4}+3=\dfrac{7}{x+4}$

31. $\dfrac{x+3}{x-4}=\dfrac{5x+14}{x^2+2x-24}$

APPLICATIONS

32. At a factory, gallons of paint are produced by a machine in accordance to the formula $G=40h-\dfrac{560}{h}$ where

G = the number of gallons produced, and h = the number of hours the paint-making machine works. How many hours does the machine need to work to produce 200 gallons of paint?

33. The number of bottles produced by a machine at a plant is given by the equation $b=\dfrac{20m^3-120m^2}{m^2-m-30}$.

B = the number of bottles, and m = the number of minutes the machine works.
      a) Simplify the expression above

      b) If the plant's machine works for 10 minutes, how many bottles does it produce?