

MATH 020 Support 1: Operations with Real Numbers

Fractions

Multiplying Fractions: $\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$

Dividing Fractions: $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$ (division means multiply by the reciprocal)

To add or subtract fractions, you need a common denominator.

Adding Fractions: $\frac{a}{b} + \frac{c}{b} = \frac{a+c}{b}$

Subtracting Fractions: $\frac{a}{b} - \frac{c}{b} = \frac{a-c}{b}$

Exponents

Exponents are used to represent repeated multiplication. For example, $5^3 = 5 \cdot 5 \cdot 5$. In this exponential expression, the base is 5 and the exponent is 3.

Operations with Real Numbers

Adding Real Numbers with the Same Sign: Add the absolute value of the numbers and keep the sign.

Adding Real Numbers with Opposite Signs: Subtract the smaller absolute value from the larger absolute value, and keep the sign of the larger absolute value.

Subtracting Real Numbers: If a and b are real numbers, $a - b = a + (-b)$. Subtractions means adding the opposite.

Multiplying Real Numbers: The product of two numbers with the same sign is positive. The product of two numbers with opposite signs is negative.

Dividing Real Numbers: The quotient of two numbers with the same sign is positive. The quotient of two numbers with opposite signs is negative.

Order of Operations

1. Parentheses/grouping symbols
2. Exponents
3. Multiply & Divide in order from left to right
4. Add & Subtract in order from left to right

Examples

Simplify the fraction.

$$1. \frac{3}{12} = \frac{\cancel{3} \times 1}{\cancel{3} \times 4} = \frac{1}{4}$$

$$2. \frac{55}{25} = \frac{\cancel{5} \times 11}{\cancel{5} \times 5} = \frac{11}{5}$$

Perform the indicated operation. Simplify all answers.

$$3. \frac{3}{8} \cdot \frac{5}{7} = \frac{3 \times 5}{8 \times 7} = \frac{15}{56}$$

$$4. \frac{4}{15} \cdot \frac{1}{2} = \frac{\cancel{2} \times 2}{15 \times \cancel{2}} = \frac{2}{15}$$

$$5. \left(\frac{3}{4}\right)^2 = \frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$$

$$6. \frac{3}{2} \div \frac{7}{5} = \frac{3}{2} \times \frac{5}{7} = \frac{15}{14}$$

$$7. \frac{5}{2} \div 10 = \frac{5}{2} \div \frac{10}{1} = \frac{5}{2} \cdot \frac{1}{10} = \frac{5}{20} = \frac{1}{4}$$

$$8. \frac{\frac{7}{12}}{\frac{3}{4}} = \frac{7}{12} \div \frac{3}{4} = \frac{7}{12} \times \frac{4}{3} = \frac{7}{9}$$

$$\text{OK } 9. \frac{0}{5} = 0$$

$$\text{No } 10. \frac{5}{0} = \text{undefined}$$

$$11. \frac{1}{2} + \frac{1}{2} = 1$$

$$\frac{1}{2} + \frac{1}{2} = \frac{1+1}{2} = \frac{2}{2} = 1$$

$$12. \frac{8}{15} - \frac{2}{15} = \frac{6}{15} = \frac{\cancel{3} \times 2}{\cancel{3} \times 5} = \frac{2}{5}$$

$$13. \frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$$

$$14. \frac{1}{2} - \frac{1}{3} = \frac{3}{6} - \frac{2}{6} = \frac{1}{6}$$

$$15. -3(7) = -21$$

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$$16. 2(3-5) = 2(-2) = -4$$

$$17. -\frac{15}{5} = -3$$

$$18. -6 + 10 = 4$$

$$19. 2 \cdot 3 - 4 \cdot 5 = 6 - 20 = -14$$

$$20. -6 + 6 = 0$$

$$21. 14 - 20 = -6$$

$$22. 5^2 = 25$$

$$23. -5^2 = -5^2 = -5 * 5 = -25$$

$$24. (-5)^2 = (-5)(-5) = 25$$

$$25. 2 \cdot 3^2 = 2 * 9 = 18 \quad \text{PEMDAS}$$

$$26. (-10) + (4 \cdot 2) = -10 + 8 = -2$$

$$27. 8 - (3 \cdot 2) + 2^3 = 8 - 6 + 8 = 16 - 6 = 10$$

$$28. \sqrt{16} = 4$$

29. Evaluate the expression $x^2 - y$ when $x = 2$ and $y = 3$.

$$2^2 - 3 = 4 - 3 = \boxed{1}$$

30. Evaluate the expression $y^2 - 4xy$ when $x = 2$ and $y = 3$.

$$3^2 - 4(2)(3)$$

$$= 9 - 24$$

$$= \boxed{-15}$$