1. Select the answer that best completes the given statement.

A rational expression is a (1) _____ of two polynomials.

(1) ○ product
○ quotient

2. Choose the word that best completes the statement.

A rational expression is simplified when the numerator and the denominator have no ____ (other than 1) in common.

A rational expression is simplified when the numerator and the denominator have no (1) _____ (other than 1) in common.

(1) ○ factors
○ terms

3. Identify the list of numbers for which the following rational expression is undefined.

$$\frac{4t}{(t+4)(t-5)}$$

Choose the correct answer below.

○ **A.** $-4, 5$
○ **B.** $-5, 4$
○ **C.** $-4, 4, 5$
○ **D.** $-5, 4, 4$

4. Identify the list of numbers for which the following rational expression is undefined.

$$\frac{a+9}{a^2-a-2}$$

Choose the correct answer below.

○ **A.** $-1, 2$
○ **B.** $-2, -9, 1$
○ **C.** $-2, 1$
○ **D.** $-1, 2, 9$

5. Find all numbers for which the rational expression is undefined.

$$-\frac{20}{13z}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The rational expression is not defined for $z =$ _____.
(Use a comma to separate answers as needed.)
○ **B.** The rational expression is defined for every real number.

6. List all numbers for which each rational expression is undefined.

$$\frac{z-3}{4z-12}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** The rational expression is undefined when z is _____.
  (Use a comma to separate answers as needed.)
- **B.** There are no values of z for which the rational expression is undefined.

7. Find all numbers for which the rational expression is undefined.

$$\frac{w^2+19}{w^2-w-72}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** The rational expression is undefined for w = _____.
  (Use a comma to separate answers.)
- **B.** There are no values of w for which the rational expression is undefined.

8. List all numbers for which the rational expression is undefined.

$$\frac{y+7}{4y^2+3y-1}$$

Select the correct choice below and fill in any answer boxes within your choice.

- **A.** The function is undefined for y = _____.
  (Use a comma to separate answers as needed.)
- **B.** There are no values for which the expression is undefined.

9. Simplify by removing factors of 1.

$$\frac{324w^6z^{10}}{48w^2z^8}$$

The simplified form is _____.

10. Simplify by removing factors of 1.

$$\frac{3x-9}{3x+9}$$

The simplified form is _____.

11. Simplify by removing factors of 1. $\dfrac{p^2-16}{p^2-8p+16}$

The simplified form is _____.

12. Simplify by removing factors of 1.

$$\frac{9v-9}{9v}$$

The simplified form is _____.

13. Simplify.

$$\frac{z^2-4z+4}{z^2-4}$$

$$\frac{z^2-4z+4}{z^2-4} = \_\_\_\_\_$$

14. Simplify by removing factors of 1.

$$\frac{h^2-9}{h-3}$$

The simplified form is _____.

15. Simplify by removing factors of 1.

$$\frac{14z^2-686}{4z^2-196}$$

The simplified form is _____.
(Type a fraction.)

16. Simplify by removing factors of 1.

$$\frac{1-z}{z-1}$$

The simplified form is _____.

17. Fill in the blank below to complete the sentence.

To simplify rational expressions, _____.

To simplify rational expressions, (1) _____

(1)
- interchange the numerator and denominator.
- multiply in the numerator and multiply in the denominator.
- multiply by the reciprocal of the denominator.
- remove a factor equal to 1.

18. Fill in the blank below to complete the sentence.

To find a reciprocal, _____.

To find a reciprocal, (1) _____

(1)
- multiply by -1.
- multiply in the numerator and in the denominator.
- interchange the numerator and denominator.
- remove a factor equal to 1.

19. Multiply and, if possible, simplify.

$$\frac{20a^3}{17a} \cdot \frac{7}{10a}$$

$\frac{20a^3}{17a} \cdot \frac{7}{10a} =$ _____ (Use integers or fractions for any numbers in the expression.)

20. Multiply and, if possible, simplify.

$$\frac{n^2-25}{2n+6} \cdot \frac{n+3}{n-5}$$

$\frac{n^2-25}{2n+6} \cdot \frac{n+3}{n-5} =$ _____
(Use integers or fractions for any numbers in the expression. Factor completely.)

21. Multiply and simplify.

$$\frac{25z^2}{3z^2-12z+12} \cdot \frac{3z-6}{5z}$$

$\frac{25z^2}{3z^2-12z+12} \cdot \frac{3z-6}{5z} =$ _____
(Type exponential notation with positive exponents.)

22. Multiply and simplify.

$$\frac{x^2+3x-54}{x^2+2x-48} \cdot \frac{x^2-5x-24}{x^2+12x+27}$$

The simplified product is _____.
(Simplify your answer.)

23. Multiply and, if possible, simplify.

$$\frac{n^2+10n+25}{(n-1)^2} \cdot \frac{n^2-2n+1}{(n+5)^2}$$

$\frac{n^2+10n+25}{(n-1)^2} \cdot \frac{n^2-2n+1}{(n+5)^2} =$ _____

(Use integers or fractions for any numbers in the expression. Factor completely.)

24. Divide and, if possible, simplify.

$$\frac{x}{5} \div \frac{7}{x}$$

$\frac{x}{5} \div \frac{7}{x} =$ _____

(Use integers or fractions for any numbers in the expression. Simplify your answer.)

25. Divide and simplify.

$$\frac{b}{f^2} \div \frac{b^2}{f^3}$$

$\frac{b}{f^2} \div \frac{b^2}{f^3} =$ _____

26. Divide and, if possible, simplify.

$$\left(y^2-81\right) \div \frac{(y-6)(y+9)}{y^2+36}$$

The answer is _____.

(Simplify your answer.)

27. Divide and, if possible, simplify.

$$\frac{x^2-4x+4}{3x^2-2x-33} \div \frac{7x^2-13x-2}{x^2-5x-24}$$

$\frac{x^2-4x+4}{3x^2-2x-33} \div \frac{7x^2-13x-2}{x^2-5x-24} =$ _____

(Simplify your answer. Type your answer in factored form.)

28. Divide and, if possible, simplify.

$$\frac{y^2+10y+21}{y^2-3y-18} \div \left(4y^2+25y-21\right)$$

$\frac{y^2+10y+21}{y^2-3y-18} \div \left(4y^2+25y-21\right) =$ _____

(Use integers or fractions for any numbers in the expression. Factor completely.)

29. Divide and simplify.

$$\frac{-2+2w}{17} \div \frac{w-1}{7}$$

$\frac{-2+2w}{17} \div \frac{w-1}{7} =$ _____
(Simplify your answer.)

30. Divide and, if possible, simplify.

$$\frac{b-5a}{b^2+10ba+25a^2} \div \frac{b^2-25a^2}{b^2-9ba+20a^2}$$

$\frac{b-5a}{b^2+10ba+25a^2} \div \frac{b^2-25a^2}{b^2-9ba+20a^2} =$ _____
(Simplify your answer. Type your answer in factored form.)

31. Choose the words to complete the following statement.

To add two rational expressions when the denominators are the same, add _____ and keep the common _____.

To add two rational expressions when the denominators are the same, add (1) _____ and keep the common (2) _____

(1)
- denominator
- numerators
- factors
- terms

(2)
- denominator.
- factors.
- term.
- numerator.

32. Choose the words to complete the following statement.

The least common multiple of two denominators is usually referred to as the _____and is abbreviated _____ .

The least common multiple of two denominators is usually referred to as the (1) _____ and is abbreviated (2) _____

(1)
- least common denominator
- least common expression
- least common term
- least common form

(2)
- LCM.
- GCM.
- LCD.
- GCD.

33. Perform the indicated operation. Simplify, if possible.

$$\frac{8}{y} + \frac{7}{y}$$

$\frac{8}{y} + \frac{7}{y} =$ _____ (Simplify your answer.)

34. Add.

$$\frac{z}{18} + \frac{2z+1}{18}$$

The sum is _____.
(Simplify your answer. Use integers or fractions for any numbers in the expression.)

35. Add.

$$\frac{4}{3+x} + \frac{8}{3+x}$$

$$\frac{4}{3+x} + \frac{8}{3+x} = \_\_\_\_\_$$
(Simplify your answer.)

36. Subtract. Simplify, if possible.

$$\frac{16}{z+12} - \frac{7}{z+12}$$

The difference is _____.

37. Subtract. Simplify if possible.

$$\frac{7y+30}{6y} - \frac{y+1}{6y}$$

$$\frac{7y+30}{6y} - \frac{y+1}{6y} = \_\_\_\_\_$$ (Simplify your answer.)

38. Perform the indicated operation.

$$\frac{x^2}{x-7} + \frac{x-56}{x-7}$$

$$\frac{x^2}{x-7} + \frac{x-56}{x-7} = \_\_\_\_\_$$ (Simplify your answer.)

39. Perform the indicated operation. Simplify if possible.

$$\frac{a^2}{a-7} - \frac{16a-63}{a-7}$$

The difference is _____.

40. Perform the indicated operation. Simplify if possible.

$$\frac{2w^2+4}{w^2-11w+10} - \frac{w^2-20w+25}{w^2-11w+10}$$

The difference is _____.
(Simplify your answer.)

41. Find the LCM by factoring.

28, 98

The LCM is _____.

42. Find the LCM of the set of numbers.

2, 25

The LCM is _____.

43. Find the LCM of 27, 14 and 63.

The LCM is _____.

44. Find the LCM of $15z^3$ and $75z^3$.

The LCM is _____.

45. Find the LCM.

$75x^9y^2$, $25x^3y^9$

The LCM is _____.

46. Find the LCM of $3(v-5)$ and $15(v-5)$.

The LCM is _____.

47. Find the LCM of q^2-64 and $q^2+15q+56$.

The LCM is _____.

48. Find the LCM of $c+6$, $(c-6)^2$, and c^2-36.

The LCM is _____.

49. Find the least common multiple (LCM).

$5n^2+29n-6$, $5n^2+24n-5$

The LCM is _____. (Type your answer in factored form.)

50. Find equivalent expressions that have the LCD.

$\frac{19}{10x^4}$, $\frac{y}{20x^2}$

$\frac{19}{10x^4} =$ _____

$\frac{y}{20x^2} =$ _____

51. Find equivalent expressions that have the least common denominator.

$\frac{7}{3v^3b}, \frac{10}{27vb^3}$

$\frac{7}{3v^3b} =$ _____

$\frac{10}{27vb^3} =$ _____

52. Find equivalent expressions that have the least common denominator.

$\frac{a+5}{a^2-36}, \frac{a-6}{a^2+13a+42}$

$\frac{a+5}{a^2-36} =$ _____
(Type your answer in factored form. Factor completely.)

$\frac{a-6}{a^2+13a+42} =$ _____
(Type your answer in factored form. Factor completely.)

53. The four steps for adding rational expressions with different denominators are listed. Fill in the missing word for each step.

1. To add or subtract when the denominators are different, first find the _____.
2. Multiply each rational expression by a form of 1 made up of the factors of the LCD that are _____ from that expression's _____.
3. Add or subtract the _____, as indicated. Write the sum or difference over the _____.
4. _____, if possible.

1. To add or subtract when the denominators are different, first find the (1) _____

2. Multiply each rational expression by a form of 1 made up of the factors of the LCD that are (2) _____ from that expression's (3) _____

3. Add or subtract the (4) _____ as indicated. Write the sum or difference over the (5) _____

4. (6) _____ if possible.

(1) ○ like terms. ○ common factor. ○ LCD. ○ factors.
(2) ○ missing ○ subtracted
(3) ○ denominator. ○ numerator.
(4) ○ numerators, ○ denominators, ○ common factors, ○ like terms,

(5) ○ LCD. ○ denominator. ○ numerator. ○ like terms.
(6) ○ Simplify, ○ Subtract, ○ Add,

54. Add. Simplify, if possible.

$$\frac{5}{w}+\frac{1}{w^2}$$

$$\frac{5}{w}+\frac{1}{w^2}=\_\_\_\_\_$$

55. Subtract. Simplify, if possible.

$$\frac{1}{6r}-\frac{4}{9r}$$

The difference is _____.
(Simplify your answer. Use integers or fractions for any numbers in the expression.)

56. Perform the indicated operation. Simplify, if possible.

$$\frac{x+9}{8}+\frac{x-7}{12}$$

The sum is _____.
(Simplify your answer. Use integers or fractions for any numbers in the expression.)

57. Subtract. Simplify, if possible.

$$\frac{f-7}{121}-\frac{f+5}{11}$$

Which choice is correct?

- **A.** $\frac{121}{-10f-62}$
- **B.** $\frac{-10f-62}{11}$
- **C.** $\frac{-10f-62}{121}$
- **D.** $\frac{-12}{110}$

58. Perform the indicated operation. Simplify, if possible.

$$\frac{5a-1}{7a^4}+\frac{2a+1}{49a^3}$$

The sum is _____.

59. Add.

$$\frac{2}{w-6}+\frac{2}{w+6}$$

$$\frac{2}{w-6}+\frac{2}{w+6}=\_\_\_\_\_$$
(Simplify your answer.)

60. Add.

$$\frac{1}{y+9}+\frac{9}{7y}$$

$\frac{1}{y+9}+\frac{9}{7y}=$ _____ (Simplify your answer.)

61. Perform the indicated operation. Simplify, if possible.

$$\frac{t}{t-3}-\frac{4}{3t-9}$$

The difference is _____.
(Simplify your answer. Use integers or fractions for any numbers in the expression.)

62. Add. Simplify, if possible.

$$\frac{v}{v^2+18v+81}+\frac{9}{v^2+11v+18}$$

$\frac{v}{v^2+18v+81}+\frac{9}{v^2+11v+18}=$ _____
(Simplify your answer.)

63. Subtract.

$$\frac{v}{v^2+19v+90}-\frac{9}{v^2+17v+72}$$

$\frac{v}{v^2+19v+90}-\frac{9}{v^2+17v+72}=$ _____
(Simplify your answer.)

64. Perform the indicated operation. Simplify, if possible.

$$\frac{2z}{z^2-8z+16}+\frac{4}{z^2+2z-24}$$

$\frac{2z}{z^2-8z+16}+\frac{4}{z^2+2z-24}=$ _____
(Simplify your answer.)

65. Perform the indicated operation. Simplify, if possible.

$$2+\frac{7}{2x+1}$$

$2+\frac{7}{2x+1}=$ _____ (Simplify your answer.)

66. Perform the indicated operation. Simplify, if possible.

$$\frac{2x}{3} - \frac{x-2}{-3}$$

$\frac{2x}{3} - \frac{x-2}{-3} =$ _____
(Simplify your answer.)

67. Simplify.

$$\frac{\frac{4}{5}+\frac{3}{4}}{\frac{5}{6}-\frac{1}{3}}$$

The quotient is _____.

68. Simplify.

$$\frac{\frac{1}{z}+3}{\frac{1}{z}-8}$$

The simplified expression is _____.
(Simplify your answer.)

69. Simplify.

$$\frac{\frac{w}{10}-\frac{5}{w}}{\frac{1}{5}+\frac{1}{w}}$$

$\frac{\frac{w}{10}-\frac{5}{w}}{\frac{1}{5}+\frac{1}{w}} =$ _____

70. Simplify the complex rational expression by the method of your choice.

$$\frac{y-2+\frac{5}{y}}{y+7-\frac{2}{y}}$$

$\frac{y-2+\frac{5}{y}}{y+7-\frac{2}{y}} =$ _____
(Simplify your answer. Use integers or fractions for any numbers in the expression.)

71. Find all x-values for which the given expression is undefined.

$$\frac{\frac{x-2}{x-5}}{\frac{x-3}{x-9}}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** The rational expression is undefined for x = _____.
  (Use a comma to separate answers as needed.)
- **B.** There are no values of x for which the rational expression is undefined.

72. Solve.

$$\frac{3}{5} - \frac{1}{3} = \frac{x}{9}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** The solution is x = _____.
  (Simplify your answer.)
- **B.** There is no solution.

73. Solve.

$$\frac{3}{z} = \frac{6}{z} - \frac{1}{2}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** The solution is z = _____.
  (Simplify your answer. Type an integer or a fraction.)
- **B.** The equation has no solution.

74. Solve.

$$\frac{z-2}{z+1} = \frac{1}{7}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** The solution is z = _____. (Simplify your answer. Type an integer or a fraction.)
- **B.** There is no solution.

75. Solve.

$$t + \frac{8}{t} = -9$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** The solution(s) is/are t = _____. (Use a comma to separate answers as needed.)
- **B.** There is no solution.

76. Solve.

$$\frac{5}{x+6} = \frac{4}{x-1}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** The solution is x = _____. (Simplify your answer. Type an integer or a fraction.)
- **B.** There is no solution.

77. Solve.

$$\frac{6}{x+5} = \frac{8}{x}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your answer.

- **A.** The solution(s) is/are x = _____. (Simplify your answer. Use a comma to separate answers as needed.)
- **B.** There is no solution.

78. Solve.

$$\frac{3}{b-3} + \frac{2b}{b-3} = \frac{18}{b^2-6b+9}$$

Select the correct choice below and fill in any answer boxes present in your choice.

- **A.** The solution is b = _____. (Type an integer or a fraction. Use a comma to separate answers as needed.)
- **B.** There is no solution.

79. Solve the following equation for the variable x.

$$\frac{1}{x-4} + \frac{5}{x+4} = \frac{5x}{x^2-16}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **A.** The solution is x = _____. (Simplify your answer. Type an integer or a fraction.)
- **B.** There is no solution.

80. Solve. If no solution exists, state this.

$$\frac{7}{x-7} + \frac{3}{x+2} = \frac{9x}{x^2-5x-14}$$

Select the correct choice below and fill in any answer boxes in your choice.

- **A.** x = _____ (Type an integer or a simplified fraction.)
- **B.** There is no solution.

81. Classify the following statement as either true or false.

Distance equals rate times time.

Choose the correct answer below.

- ○ True
- ○ False. Distance equals rate divided by time.
- ○ False. Distance equals time divided by rate.

82. Classify the following statement as either true or false.

Time equals distance divided by rate.

Choose the correct answer below.

- ○ False. Time equals rate multiplied by distance.
- ○ False. Time equals rate divided by distance.
- ○ True.

83. If Sandy can decorate a hall in 6 hr, what is her hourly rate?

The unit rate is _____ hall per hour.
(Type an integer or a simplified fraction.)

84. If Sandy can decorate a cake in 3 hr and Eric can decorate the same cake in 5 hr, what is their hourly rate, working together?

Working together, Sandy and Eric's hourly rate is _____ cake per hour.
(Type an integer or a simplified fraction.)

85. If Sandy can decorate a cake in 3 hr, what is her hourly rate?

The unit rate is _____ cake per hour.
(Type an integer or a simplified fraction.)

86. Jack usually mows his lawn in 4 hours. Marilyn can mow the same yard in 3 hours. How much time would it take for them to mow the lawn together?

They could mow the lawn in _____ hours if they worked together.
(Simplify your answer.)

87. Janet, an experienced shipping clerk, can fill a certain order in 11 hours. Jim, a new clerk, needs 12 hours to do the same job. Working together, how long will it take them to fill the order?

The solution is _____ hours.
(Simplify your answer.)

88. Joe can cut and split a cord of firewood in 3 fewer hr(s) than Suzie can. When they work together, it takes them 2 hr(s). How long would it take each of them to do the job alone?

It would take Joe _____ hour(s).
It would take Suzie _____ hour(s).
(Simplify your answer.)

89. Suppose that during a test drive of two cars, one car travels 198 miles in the same time that the second car travels 150 miles. If the speed of one car is 16 miles per hour faster than the speed of the second car, find the speed of both cars.

The speed of the first car is _____ mph, and the speed of the second car is _____ mph.

90. The speed of a stream is 3 mph. A boat travels 7 miles upstream in the same time it takes to travel 13 miles downstream. What is the speed of the boat in still water?

The speed is _____ mph.

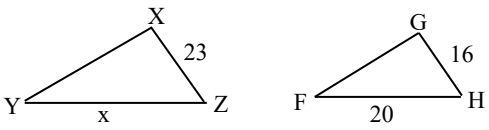
91. A motorboat moves 11 miles per hour in still water. It travels 18 miles upstream and 18 miles downstream in a total time of 5.5 hours. What is the speed of the current?

The speed of the current is _____ miles per hour.

92. A car traveled 432 mi at a certain speed. If the speed had been 12 mph faster, the trip could have been made in 3 hr less time. Find the speed.

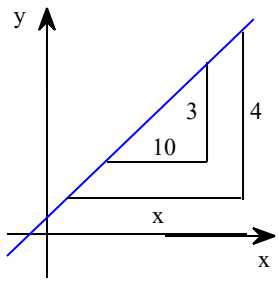
The speed is _____ mph.

93. For the pair of similar triangles, find the value of x.



The solution is x = _____.
(Simplify your answer.)

94. Find the indicated length.



The length is x = _____.
(Simplify your answer. Type an integer or a fraction.)