

**Los Angeles Southwest College**

**Mathematics Department**

**MATH 110 – Common Final Exam**

**Study Guide**

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# Chapter 1

A **digit** is a number 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9 that names a place-value location.

Place-value chart														
Trillions			Billions			Millions			Thousands			Ones		
Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones

## Numbers.

The set or collection 1, 2, 3, 4, 5, ... , is called the set of **natural numbers**.

The set of natural numbers with additional 0 is called as set of **whole numbers**.

## Operations:

**Addition** of whole numbers.

$$3 + 4 = 7$$

*Addend Addend Sum*

**Property of addition:**

Commutative property:  $a + b = b + a$

Associative property:  $a + (b + c) = (a + b) + c$

Identity:  $a + 0 = a$

**Subtraction** of whole numbers.

$$7 - 4 = 3$$

*Minuend Subtrahend Difference*

The difference  $a - b$  is that unique number  $c$  for which  $a = c + b$  :  $3 + 4 = 7$

**Property of multiplication:**

Commutative property:  $a \cdot b = b \cdot a$

Associative property:  $a \cdot (b \cdot c) = (a \cdot b) \cdot c$

Identity:  $a \cdot 1 = a$

Zero property  $a \cdot 0 = 0$

**Division** of whole numbers:

$$22 \div 6 = 3 \text{ R } 4$$

*Divident Divisor Quotient Remainder*

The quotient  $\frac{a}{b}$  is the number  $c$ , if there is one, that when multiplied by  $b$  gives  $a$  :  $a = b \cdot c$

To get the related multiplication sentence, we use:  $Divident = Quotient \cdot Divisor$

**Property of division:**

Any number divided by 1 is that same number:  $a \div 1 = \frac{a}{1} = a$

Any nonzero number divided by itself is 1:  $\frac{a}{a} = 1, a \neq 0$

Zero divided by any nonzero number is 0:  $\frac{0}{a} = 0, a \neq 0$

Devision by zero is not defined. (We agree not to divide by 0):  $\frac{a}{0}$  is *undefined* or *is not defined*

Exponential notation is  $6^4 = 6 \cdot 6 \cdot 6 \cdot 6 = 1296$ , 4 is the exponent, 6 is the base

**Order of operations: PMDAS** (*parentheses, multiplications or divisions, additions or subtractions*)

**Order of whole numbers.**

For any whole numbers  $a$  and  $b$  :

1.  $a < b$  (read “ $a$  is less than  $b$ ”) is true when  $a$  is to the left of  $b$  on the number line.
2.  $a > b$  ( read “ $a$  is greater than  $b$ ”) is true when  $a$  is to the right of  $b$  on the number line.

**Rounding whole numbers:**

- a) Locate the digit in that place (RD).
- b) Consider the next digit to the right.
- c) If the digit to the right is **5 or higher**, round the RD digit **up**. If the digit to the right is **4 or lower**, keep the RD digit as is.
- d) Change all digits to the right of the rounding location to zeros.

**Properties of equations:**

The Addition property:  $A = B$  then  $A + C = B + C$

The Multiplication property:  $A = B$  then  $A \cdot C = B \cdot C$   $C \neq 0$

**Solving linear equations in one variable**  $Ax + B = C$

1. Simplify each side separately;
2. Isolate the variable term on one side by using the addition property of equations;
3. Isolate the variable by using multiplication property of equations.

The distance around an object is its **perimeter**.

The **average** of a set of numbers is the sum of the numbers divided by the number of addends.

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- |   |                    |   |
|---|--------------------|---|
| 1. Divide.                                  | $\frac{76}{0}$     | $\boxed{\text{Undefined}}$                          |
| 2. Divide.                                  | $277 \div 5$       | $\boxed{55.4}$                                      |
| 3. Divide.                                  | $699 \div 3$       | $\boxed{233}$                                       |
| 4. Divide.                                  | $127,000 \div 100$ | $\boxed{1,270}$                                     |
| 5. Write a related multiplication sentence. | $18 \div 3$        | $\boxed{6 \bullet 3 = 18}$                          |
| 6. Write a related multiplication sentence. | $72 \div 9$        | $\boxed{9 \bullet 8 = 72}$                          |
| 7. Write a related multiplication sentence. | $54 \div 6$        | $\boxed{9 \bullet 6 = 54}$                          |
| 8. Write two related division sentence.     | $9 \cdot 5 = 45$   | $\boxed{45 \div 9 = 5 \text{ or } 45 \div 5 = 9}$   |
| 9. Write two related division sentence.     | $2 \cdot 7 = 14$   | $\boxed{14 \div 2 = 7 \text{ or } 14 \div 7 = 2}$   |
| 10. Write two related division sentence.    | $4 \cdot 12 = 48$  | $\boxed{48 \div 12 = 4 \text{ or } 48 \div 4 = 12}$ |
| 11. Solve. Be sure to check.                | $13 + x = 42$      | $\boxed{x = 29}$                                    |

12. Solve. Be sure to check.	$15 + t = 22$	$t = 7$
13. Solve. Be sure to check.	$12 = 12 + m$	$m = 0$
14. Solve. Be sure to check.	$3 \cdot x = 24$	$x = 8$
15. Solve. Be sure to check.	$6x = 42$	$x = 7$
16. Solve. Be sure to check.	$p = 908 - 458$	$p = 450$
17. Solve. Be sure to check.	$9007 - 5667 = m$	$3340 = m$
18. Solve. Be sure to check.	$t = 125 \div 5$	$t = 25$
19. Solve. Be sure to check.	$w = 256 \div 16$	$w = 16$
20. Solve. Be sure to check.	$10,534 \div 458 = q$	$q = 23$
21. Evaluate.	$7^2$	49
22. Evaluate.	$5^3$	125
23. Evaluate.	$9^3$	729
24. Evaluate.	$11^2$	121
25. Simplify.	$12 + (6 + 4)$	22
26. Simplify.	$(12 + 6) + 18$	36
27. Simplify.	$52 - (40 - 8)$	20
28. Simplify.	$(52 - 40) - 8$	0
29. Simplify.	$1000 \div (100 \div 10)$	100
30. Simplify.	$(1000 \div 100) \div 10$	1
31. Simplify.	$7 \cdot (10 - 3)^2 - 2 \cdot (3 + 1)^2$	311
32. Simplify.	$4^2 + 8^2 + 2^2$	84

33. Simplify.  $7^2 + 20 \cdot 4 - (28 + 9 \cdot 2)$  83
34. Simplify.  $8 \cdot 9 - (12 - 8) \div 4 - (10 - 7)$  68
35. Simplify.  $120 - 3^3 \cdot 4 \div (5 \cdot 6 - 6 \cdot 4)$  102
36. Simplify.  $80 - 2^4 \cdot 15 \div (7 \cdot 5 - 45 \div 3)$  68
37. Simplify.  $8 \cdot 13 + \{42 \div [18 - (6 + 5)]\}$  110
38. Simplify.  $72 \div 6 - \{2 \cdot [9 - (4 \cdot 2)]\}$  10
39. Simplify.  $[14 - (3 + 5) \div 2] - [18 \div (8 - 2)]$  7
40. Simplify.  $[92 \cdot (6 - 4) \div 8] + [7 \cdot (8 - 3)]$  58

41. Natasha has \$196 and wants to buy a computer workstation for \$698. How much more does she need?

*She needs \$502 more*

42. A beverage company packed 228 cans of soda into 12-can cartons. How many cartons did they fill?

*They fill 19 cartons*

43. An apartment builder bought 13 gas stoves at \$425 each and 13 refrigerators at \$620 each. What was the total cost?

*The total cost was \$13585*

44. A sack of oranges weighs 27 lb. A sack of apples weighs 32 lb. Find the total weight of 16 bags of oranges and 43 bags of apples.

*The total weight is 1808lb*

45. Find the average of 97, 98, 87, and 86.

*The average is 92*

## Chapter 2

**Absolute value:**  $|x| = x$  for  $x \geq 0$  and  $|x| = -x$  for  $x < 0$

### Numbers.

The set of whole numbers with additional negative number is called as set of **integer numbers**.

### Operations:

**Adding (same sign).** Add their absolute values and keep the common sign.

**Adding (different signs).** Subtract their absolute values and keep the sign of the number with greater absolute value

### Property of addition:

Inverse:  $a + (-a) = 0$

**Definition of subtracting:**  $x - y = x + (-y)$

### Multiplying and dividing numbers:

**Same signs** – The product (or quotient) is positive

**Different signs** - The product (or quotient) is negative

Inverse:  $a \cdot \frac{1}{a} = 1$

### Division of whole numbers:

$$22 \div 6 = 3 \text{ R } 4$$

*Divident Divisor Quotient Remainder*

To get the related multiplication sentence, we use:  $Dividend = Quotient \cdot Divisor$

### Property of division:

Any number divided by 1 is that same number:  $a \div 1 = \frac{a}{1} = a$

Any nonzero number divided by itself is 1:  $\frac{a}{a} = 1, a \neq 0$

Zero divided by any nonzero number is 0:  $\frac{0}{a} = 0, a \neq 0$

Division by zero is not defined. (We agree not to divide by 0):  $\frac{a}{0}$  is *undefined* or *is not defined*

Exponential notation is  $6^4 = 6 \cdot 6 \cdot 6 \cdot 6 = 1296$ , 4 is the exponent, 6 is the base

### Properties of operations

Distributive property:  $a \cdot (b + c) = a \cdot b + a \cdot c$

### Expressions:

An **algebraic expression** consists of variables, numerals, and operation signs. When we replace a variable with a number, we say that we are **substituting** for the variable.. This process is called **evaluating the expression**.

Two expressions that have the same value for all allowable replacements are called **equivalent**.

A **term** is a number, a variable, a product of numbers and/or variables, or a quotient of numbers and/or variables. **Terms** are separated by addition signs (if there are subtraction signs, we can find an equivalent expression that uses addition signs).

Terms in which the variable factors are exactly the same are called **like, or similar**, terms. When an algebraic expression contains like terms, an equivalent expression can be formed by **combining, or collecting**, like terms.

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1. Subtract.  $2 - 7$  -5

2. Subtract.  $3 - 8$  -5

3. Subtract.	$8 - (-3)$	$\boxed{11}$
4. Subtract.	$-7 - 4$	$\boxed{-11}$
5. Subtract.	$-6 - (-5)$	$\boxed{-1}$
6. Subtract.	$-4 - (-3)$	$\boxed{-1}$
7. Subtract.	$8 - (-10)$	$\boxed{18}$
8. Subtract.	$5 - (-6)$	$\boxed{11}$
9. Simplify.	$5 - (-30) + 30 + 40 - (-12)$	$\boxed{117}$
10. Simplify.	$81 - (-20) - 14 - (-50) + 53$	$\boxed{190}$
11. Simplify.	$-3 + 7 + (-8)$	$\boxed{-4}$
12. Simplify.	$8 - (-9) - 7 + 2$	$\boxed{12}$
13. Multiply.	$(-6)(-7)$	$\boxed{42}$
14. Multiply.	$-8 \cdot (-3)$	$\boxed{24}$
15. Multiply.	$15 \cdot (-8)$	$\boxed{-120}$
16. Multiply.	$19(-7)(-8) \cdot 0 \cdot 6$	$\boxed{0}$
17. Multiply.	$(-7)(-1)(7)(-6)$	$\boxed{-294}$
18. Multiply.	$(-6)6(-4)5$	$\boxed{720}$
19. Simplify.	$(-6)^2$	$\boxed{36}$
20. Simplify.	$(-1)^5$	$\boxed{-1}$
21. Simplify.	$-2^4$	$\boxed{-16}$
22. Simplify.	$(-1)^{18}$	$\boxed{1}$
23. Simplify.	$(-2)^4$	$\boxed{16}$

24. Simplify.	$(-3)^5$	$\boxed{-243}$
25. Divide.	$28 \div (-4)$	$\boxed{-7}$
26. Divide.	$-22 \div (-2)$	$\boxed{11}$
27. Divide.	$-100 \div (-50)$	$\boxed{2}$
28. Divide.	$128 \div 8$	$\boxed{16}$
29. Simplify.	$20 \div 5(-3) + 3$	$\boxed{-9}$
30. Simplify.	$14 \div 2(-6) + 7$	$\boxed{-35}$
31. Simplify.	$17 - 10^3$	$\boxed{-983}$
32. Simplify.	$30 + (-5)^3$	$\boxed{-95}$
33. Simplify.	$8 -  7 - 9  \cdot 3$	$\boxed{2}$
34. Simplify.	$ 8 - 7 - 9  \cdot 2 + 1$	$\boxed{17}$
35. Simplify.	$\frac{6^3 - 7 \cdot 3^4 - 2^5 \cdot 9}{(1 - 2^3)^3 + 7^3}$	$\boxed{\text{Undefined}}$
36. Simplify.	$\frac{4 \div 2 \cdot 4^2 - 3 \cdot 2}{(7 - 4)^3 - 2 \cdot 5 - 4}$	$\boxed{2}$
37. Simplify.	$\frac{(-5)^3 + 17}{10(2 - 6) - 2(5 + 2)}$	$\boxed{2}$
38. Simplify.	$\frac{(3 - 5)^2 - (7 - 13)}{(2 - 5) \cdot 3 + 2 \cdot 4}$	$\boxed{-10}$
39. Evaluate.	$3(a + b)$ , for $a = 2$ and $b = -4$	$\boxed{-6}$
40. Evaluate.	$\frac{49t^2}{10}$ , for $t = 10$	$\boxed{490}$
41. Evaluate.	$\frac{5(F - 32)}{9}$ , for $F = 50$	$\boxed{10}$



42. Evaluate.

$$a^6 - a, \text{ for } a = -2 \quad \boxed{66}$$

43. Write two equivalent expressions with negative signs in different places.  $\frac{-x}{5}$

$$\boxed{\frac{-x}{5}; \frac{x}{-5}; -\frac{x}{5}}$$

44. Write two equivalent expressions with negative signs in different places.  $\frac{-14}{y}$

$$\boxed{\frac{-14}{y}; \frac{14}{-y}; -\frac{14}{y}}$$

45. Use the distributive law.

$$4(1 - y) \quad \boxed{4 - y}$$

46. Use the distributive law.

$$-6(5x - 2) \quad \boxed{-30x + 12}$$

47. Use the distributive law.

$$-5(9x - y + 8z) \quad \boxed{-45x + 5y - 40z}$$

48. Use the distributive law.

$$(4a - 5b + c - 29)5 \quad \boxed{20a - 25b + 5c - 145}$$

49. Combine like terms.

$$9 + 5t + 7y - t - y - 13 \quad \boxed{-4 + 4t + 6y}$$

50. Combine like terms.

$$8 - 4a + 9b + 7a - 3b - 15 \quad \boxed{-7 + 3a + 6b}$$

51. Combine like terms.

$$3a^2 + 7a^3 - a^2 + 5 + a^3 \quad \boxed{2a^2 + 8a^3 + 5}$$

52. Combine like terms.

$$x^3 - 5x^2 + 2x^3 - 3x^2 + 4 \quad \boxed{3x^3 - 8x^2 + 4}$$

53. Combine like terms.

$$9x^3y + 4xy^3 - 6xy^3 + 3xy \quad \boxed{9x^3y - 2xy^3 + 3xy}$$

54. Combine like terms.

$$3x^4 - 2y^4 + 8x^4y^4 - 7x^4 + 8y^4 \quad \boxed{-4x^4 + 6y^4 + 8x^4y^4}$$

55. Combine like terms.

$$3a^6 - 9b^4 + 2a^6b^4 - 7a^6 - 2b^4 \quad \boxed{-4a^6 - 11b^4 + 2a^6b^4}$$

56. Combine like terms.

$$9x^6 - 5y^5 + 3x^6y - 8x^6 + 4y^5 \quad \boxed{x^6 - y^5 + 2x^6y}$$

57. Solve.

$$-7x - 4 = -46 \quad \boxed{x = 6}$$

58. Solve.

$$-x - 6 = 8 \quad \boxed{x = -14}$$

59. Solve.

$$9 = 4x - 7 \quad \boxed{x = 4}$$

60. Solve.

$$33 = 5 - 4x \quad \boxed{x = -7}$$

61. Solve.  $13 = 5 - x$   $x = -8$
62. Solve.  $18 = 4 - 2x$   $x = -7$
63. Solve.  $6a + 1 = -17$   $a = -3$
64. Solve.  $-2x + 1 = 17$   $x = -8$
65. Solve.  $-x + 9 = -15$   $x = 24$
66. Solve.  $13 = 3 + 2x$   $x = 5$
67. Find the perimeter of a rectangular 8-ft by 10-ft bedroom.  $36\text{ft}$
68. Find the perimeter of a rectangular 3-ft by 4-ft doghouse.  $14\text{ft}$
69. Find the perimeter of a square skylight that is 2 m on each side.  $8\text{m}$
70. Find the perimeter of a 12-ft by 20-ft rectangular deck.  $64\text{ft}$

## Chapter 3.

### Tests for **Divisibility**:

A number is divisible by 2 (is even) if it has a ones digit of 0, 2, 4, 6, or 8.

A number is divisible by 5 if it has a ones digit of 0 or 5.

A number is divisible by 10 if its ones digit is 0.

A number is divisible by 3 if the sum of its digits is divisible by 3.

A number is divisible by 9 if the sum of its digits is divisible by 9.

A number is divisible by 6 if its ones digit is 0, 2, 4, 6, or 8 (is even) and the sum of its digits is divisible by 3.

A natural number that has exactly two different factors, only itself and 1, is called a **prime** number. The number 1 is not prime. A natural number, other than 1, that is not prime is **composite**. Prime numbers from 2 to 157 are: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 139, 149, 151, 157.

### **Factorization.**

A number  $c$  is a **factor** of  $a$  if  $a$  is divisible by  $c$ .

A **factorization** of  $a$  expresses  $a$  as a product of two or more numbers.

The **prime factorization** of  $a$  expresses  $a$  as a product of two or more **prime** numbers.

Each **composite number** is uniquely determined by its prime factorization.

### Operations

**The main property** of fraction is:  $\frac{a}{b} = \frac{a \cdot c}{b \cdot c}$  - we can multiply numerator and denominator of the fraction by any nonzero number.

**For adding or subtracting fractions** make the same denominator using **LCD**, add or subtract numerator, and keep the

common denominator  $\frac{a}{b} + \frac{c}{b} = \frac{(a+c)}{b}$

**The multiplying of fractions** - multiply numerators and keep as a new numerator, multiply the denominators and keep as a

new denominator  $\frac{a}{b} \cdot \frac{c}{d} = \frac{a \cdot c}{b \cdot d}$

**Definition of division**  $\frac{x}{y} = x \cdot \frac{1}{y}$

**Division of fractions** - multiply the first fraction by the reciprocal of the second  $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$

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- |   |                                   |                                      |
|---|-----------------------------------|--------------------------------------|
| 1. Find the prime factorization of each number. | 110                               | $110 = 2 \cdot 5 \cdot 11$           |
| 2. Find the prime factorization of each number. | 273                               | $273 = 3 \cdot 7 \cdot 13$           |
| 3. Find the prime factorization of each number. | 78                                | $78 = 2 \cdot 3 \cdot 13$            |
| 4. Find the prime factorization of each number. | 1122                              | $1122 = 2 \cdot 3 \cdot 11 \cdot 17$ |
| 5. Multiply. Don't forget to simplify.          | $\frac{3}{8} \cdot \frac{7}{3}$   | $\frac{7}{8}$                        |
| 6. Multiply. Don't forget to simplify.          | $-4 \cdot \frac{-5}{7}$           | $\frac{20}{7}$                       |
| 7. Multiply. Don't forget to simplify.          | $\frac{9}{-5} \cdot \frac{12}{8}$ | $-\frac{27}{10}$                     |

- |   |   |                           |
|---|---|---------------------------|
| 8. Multiply. Don't forget to simplify.  | $\frac{1}{4} \cdot 12$  | $\boxed{3}$               |
| 9. Multiply. Don't forget to simplify.  | $-16 \cdot \left(-\frac{3}{4}\right)$                         | $\boxed{12}$              |
| 10. Multiply. Don't forget to simplify. | $\left(-\frac{3}{8}\right) \cdot \left(-\frac{8}{3}\right)$   | $\boxed{1}$               |
| 11. Multiply. Don't forget to simplify. | $\frac{1}{26} \cdot 143a$                                     | $\boxed{\frac{11a}{2}}$   |
| 12. Multiply. Don't forget to simplify. | $\frac{7}{10} \cdot \frac{34}{150}$                           | $\boxed{\frac{119}{750}}$ |
| 13. Multiply. Don't forget to simplify. | $\frac{-98}{99} \cdot \frac{27a}{175a}$                       | $\boxed{-\frac{42}{275}}$ |
| 14. Multiply. Don't forget to simplify. | $\left(-\frac{11}{24}\right) \cdot \frac{3}{5}$               | $\boxed{-\frac{11}{40}}$  |
| 15. Divide. Don't forget to simplify.   | $\frac{12}{7} \div (4x)$                                      | $\boxed{\frac{3}{7x}}$    |
| 16. Divide. Don't forget to simplify.   | $\left(-\frac{10}{21}\right) \div \left(-\frac{2}{15}\right)$ | $\boxed{\frac{50}{14}}$   |
| 17. Divide. Don't forget to simplify.   | $120a \div \frac{45}{14}$                                     | $\boxed{\frac{112a}{3}}$  |
| 18. Divide. Don't forget to simplify.   | $360a \div \frac{27n}{8}$                                     | $\boxed{\frac{320a}{3n}}$ |
| 19. Divide. Don't forget to simplify.   | $\frac{\frac{7}{20}}{\frac{8}{5}}$                            | $\boxed{\frac{7}{32}}$    |
| 20. Divide. Don't forget to simplify.   | $\frac{\frac{8}{21}}{\frac{6}{5}}$                            | $\boxed{\frac{20}{63}}$   |

21. Divide. Don't forget to simplify.  $\frac{\frac{15}{8}}{\frac{9}{10}}$   $\boxed{\frac{25}{12}}$
22. Divide. Don't forget to simplify.  $\frac{\frac{27}{10}}{\frac{21}{20}}$   $\boxed{\frac{18}{7}}$
23. Divide. Don't forget to simplify.  $\frac{\frac{9}{16}}{\frac{6}{5}}$   $\boxed{\frac{15}{32}}$
24. Divide. Don't forget to simplify.  $\frac{\frac{35}{18}}{\frac{14}{27}}$   $\boxed{\frac{15}{4}}$
25. Simplify.  $\frac{\frac{5}{8} + \frac{2}{3}}{\frac{7}{3} - \frac{1}{4}}$   $\boxed{\frac{31}{50}}$
26. Simplify.  $\frac{\frac{6}{5} - \frac{1}{9}}{\frac{2}{5} + \frac{5}{3}}$   $\boxed{\frac{49}{63}}$
27. Simplify.  $\frac{\frac{2}{3} - \frac{1}{6}}{\frac{1}{4} + \frac{2}{5}}$   $\boxed{\frac{10}{13}}$
28. Solve. Don't forget to simplify.  $\frac{4}{5}x = 12$   $\boxed{x = 15}$
29. Solve. Don't forget to simplify.  $\frac{2}{9}x = -10$   $\boxed{x = -45}$
30. Solve. Don't forget to simplify.  $\frac{1}{4}x = \frac{3}{5}$   $\boxed{x = \frac{12}{5}}$

31. Solve. Don't forget to simplify.  $\frac{4}{5} = -10x$   $x = -\frac{2}{25}$

32. Solve. Don't forget to simplify.  $-\frac{9}{10}x = 8$   $x = -\frac{80}{9}$

33. Solve. Don't forget to simplify.  $-x = \frac{7}{13}$   $x = -\frac{7}{13}$

34. Solve. Don't forget to simplify.  $-\frac{49}{45} = -\frac{28}{27}a$   $a = \frac{21}{20}$

35. Solve. Don't forget to simplify.  $-\frac{14}{9} = \frac{10}{3}t$   $t = -\frac{7}{15}$

36. Solve. Don't forget to simplify.  $-\frac{7}{20}x = -\frac{21}{10}$   $x = 6$

37. Solve. Don't forget to simplify.  $-\frac{25}{17} = -\frac{35}{34}a$   $a = \frac{10}{7}$

38. The recipe for Cherry Brie Tossed Salad calls for  $\frac{3}{4}$  cups of sliced almonds. How much is needed to make  $\frac{1}{2}$  of the recipe?  $\frac{3}{8} \text{ cups}$

39. It takes  $\frac{2}{3}$  **yd** of ribbon to make a bow. How much ribbon is needed to make 5 bows?  $\frac{10}{3} \text{ yd}$

40. A rectangular table top measures  $\frac{4}{5}$  **m** long by  $\frac{3}{5}$  **m** wide. What is its area?  $\frac{12}{25} \text{ m}^2$

41. If each piece of pie is  $\frac{1}{6}$  of a pie, how much of the pie is  $\frac{1}{2}$  of a piece?  $\frac{1}{12} \text{ of a pie}$

42. Benny uses  $\frac{2}{5}$  **g** of toothpaste each time he brushes his teeth. If Benny buys a 30-**g** tube, how many times will he be able to brush his teeth?  $75 \text{ times}$

43. A piece of coaxial cable  $\frac{4}{5}$  **m** long is to be cut into 8 pieces of the same length. What is the length of

each piece?

$$\frac{1}{10}m$$

44. A tanker that delivers gasoline to gas stations had **1400 gal** of gasoline when it was  $\frac{7}{8}$  full. How much could the tanker hold when it is full?

$$1600gal$$

45. How many  $\frac{2}{3}$ -**cup** cereal bowls can be filled from 10 **cups** of cornflakes?

$$15bowls$$

## Chapter 4.

### Numbers.

The set of **rational numbers** consists of the integers and fractions.

The **least common multiple**, or **LCM**, of two natural numbers is the smallest number that is a multiple of both.

**Finding LCD (Least common denominator) or LCM (least common multiplier):**

1. **Factor.** Write each number (expression) in prime factored form.
2. **List** each *different* denominator.
3. **Chose as exponents** the *greatest* exponents from the prime factored forms.
4. **Multiply** the factors from step 3 to get the **LCD** or **CLM**.

### Operations

**The main property** of fraction is:  $\frac{a}{b} = a \cdot \frac{c}{b \cdot c}$  - we can multiply numerator and denominator of the fraction by any nonzero number.

**For adding or subtracting fractions** make the same denominator using **LCD**, add or subtract numerator, and keep the

common denominator  $\frac{a}{b} + \frac{c}{b} = \frac{(a+c)}{b}$

**The multiplying of fractions** – multiply numerators and keep as a new numerator, multiply the denominators and keep as a

new denominator  $\frac{a}{b} \cdot \frac{c}{d} = \frac{a \cdot c}{b \cdot d}$

**Definition of division**  $\frac{x}{y} = x \cdot \frac{1}{y}$

**Division of fractions** – multiply the first fraction by the reciprocal of the second  $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$

**Mixed numbers** have to be transformed to the **fractional** notation before utilizing any operation.

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- |                   |                        |  |
|-------------------|------------------------|--|
| 1. Find the LCM.  | 36, 48                 | <span style="border: 1px solid black; padding: 2px;"><math>LCM = 144</math></span>         |
| 2. Find the LCM.  | 81, 90                 | <span style="border: 1px solid black; padding: 2px;"><math>LCM = 810</math></span>         |
| 3. Find the LCM.  | 30, 40                 | <span style="border: 1px solid black; padding: 2px;"><math>LCM = 120</math></span>         |
| 4. Find the LCM.  | 35, 45                 | <span style="border: 1px solid black; padding: 2px;"><math>LCM = 315</math></span>         |
| 5. Find the LCM.  | 12, 18, 40             | <span style="border: 1px solid black; padding: 2px;"><math>LCM = 360</math></span>         |
| 6. Find the LCM.  | 24, 36, 60             | <span style="border: 1px solid black; padding: 2px;"><math>LCM = 360</math></span>         |
| 7. Find the LCM.  | 180, 100, 450          | <span style="border: 1px solid black; padding: 2px;"><math>LCM = 900</math></span>         |
| 8. Find the LCM.  | $7x, xy$               | <span style="border: 1px solid black; padding: 2px;"><math>LCM = 7xy</math></span>         |
| 9. Find the LCM.  | $6r^3st^4, 8rs^2t$     | <span style="border: 1px solid black; padding: 2px;"><math>LCM = 24r^3s^2t^4</math></span> |
| 10. Find the LCM. | $3m^2n^4p^5, 9mn^2p^4$ | <span style="border: 1px solid black; padding: 2px;"><math>LCM = 9m^2n^4p^5</math></span>  |



- |                           |  |                          |
|---------------------------|--|--------------------------|
| 11. Add and simplify      | $\frac{-4}{9} + \frac{1}{9}$                 | $\boxed{\frac{-1}{3}}$   |
| 12. Add and simplify      | $\frac{-7}{11} + \frac{3}{-11}$              | $\boxed{\frac{-10}{11}}$ |
| 13. Add and simplify      | $\frac{3}{32}t + \frac{13}{32}t$             | $\boxed{\frac{1}{2}t}$   |
| 14. Add and simplify      | $\frac{1}{8} + \frac{1}{6}$                  | $\boxed{\frac{7}{24}}$   |
| 15. Add and simplify      | $\frac{5}{-8} + \frac{5}{6}$                 | $\boxed{\frac{5}{24}}$   |
| 16. Add and simplify      | $\frac{5}{12} + \frac{8}{15}$                | $\boxed{\frac{19}{20}}$  |
| 17. Add and simplify      | $-\frac{1}{10}x + \frac{1}{15}x$             | $\boxed{-\frac{1}{30}x}$ |
| 18. Add and simplify      | $-\frac{5}{12} + \frac{7}{-24}$              | $\boxed{-\frac{17}{24}}$ |
| 19. Add and simplify      | $\frac{3}{10} + \frac{5}{12} + \frac{8}{15}$ | $\boxed{\frac{5}{4}}$    |
| 20. Add and simplify      | $\frac{2}{9} + \frac{7}{10} + \frac{-4}{15}$ | $\boxed{\frac{59}{90}}$  |
| 21. Add and simplify      | $\frac{1}{3} + \frac{-7}{9} + \frac{-1}{2}$  | $\boxed{-\frac{17}{18}}$ |
| 22. Subtract and simplify | $\frac{-8}{a} - \frac{6}{a}$                 | $\boxed{-\frac{14}{a}}$  |
| 23. Subtract and simplify | $\frac{2}{5}a - \frac{3}{4}a$                | $\boxed{-\frac{7}{20}a}$ |

24. Subtract and simplify	$\frac{7}{15} - \frac{4}{5}$	$\boxed{-\frac{1}{3}}$
25. Subtract and simplify	$\frac{2}{15} - \frac{5}{12}$	$\boxed{-\frac{17}{60}}$
26. Subtract and simplify	$-\frac{5}{18} - \frac{2}{27}$	$\boxed{-\frac{19}{54}}$
27. Solve.	$x - \frac{4}{9} = \frac{3}{9}$	$\boxed{x = \frac{7}{9}}$
28. Solve.	$x + \frac{1}{3} = \frac{7}{9}$	$\boxed{x = \frac{4}{9}}$
29. Solve.	$\frac{2}{3} + x = \frac{4}{5}$	$\boxed{x = \frac{2}{15}}$
30. Solve.	$-3 = \frac{3}{4}t - \frac{1}{2}$	$\boxed{t = -\frac{10}{3}}$
31. Solve.	$\frac{4}{3} - \frac{1}{5}t = \frac{3}{4}$	$\boxed{t = \frac{35}{12}}$
32. Solve.	$\frac{2}{5} - \frac{3}{4}t = \frac{4}{3}$	$\boxed{t = -\frac{56}{45}}$
33. Solve.	$n - \frac{3}{10} = -\frac{1}{6}$	$\boxed{n = \frac{2}{15}}$
34. Combine like term.	$1\frac{3}{14}t + 7\frac{2}{21}t$	$\boxed{8\frac{13}{42}t}$
35. Combine like term.	$9\frac{1}{2}x - 7\frac{3}{8}x$	$\boxed{2\frac{1}{8}x}$
36. Combine like term.	$9\frac{2}{7}x + 2\frac{3}{8}x$	$\boxed{11\frac{37}{56}x}$
37. Combine like term.	$37\frac{5}{9}t - 25\frac{4}{5}t$	$\boxed{11\frac{34}{45}t}$

38. Multiply.

$16 \cdot 1\frac{2}{5}$

$$\boxed{22\frac{2}{5}}$$

39. Multiply.

$-2\frac{3}{10} \cdot 4\frac{2}{5}$

$$\boxed{-16\frac{13}{15}}$$

40. Multiply.

$\left(-6\frac{3}{10}\right) \cdot \left(-5\frac{7}{10}\right)$

$$\boxed{35\frac{91}{100}}$$

41. Divide.

$30 \div 2\frac{3}{5}$

$$\boxed{11\frac{7}{13}}$$

42. Divide.

$5\frac{1}{4} \div 2\frac{3}{5}$

$$\boxed{2\frac{1}{52}}$$

43. Divide.

$5\frac{1}{10} \div 4\frac{3}{10}$

$$\boxed{1\frac{8}{43}}$$

44. Divide.

$1\frac{1}{2} \div (-50)$

$$\boxed{-\frac{3}{100}}$$

45. Kate walked  $\frac{7}{8}$  **mi** to the student union, and then  $\frac{2}{5}$  **mi** to class. How far did Kate walk?

$$\boxed{\frac{51}{40} \text{ mi or } 1\frac{11}{40} \text{ mi}}$$

46. A recipe for muffins calls for  $\frac{1}{2}$  **qt** (quart) of buttermilk,  $\frac{1}{3}$  **qt** of skin milk, and  $\frac{1}{16}$  **qt** of oil. How many quarts of liquid ingredients does the recipe call for?

$$\boxed{\frac{43}{48} \text{ qt}}$$

47. A triathlete runs  $\frac{7}{8}$  **mi**, canoes  $\frac{1}{3}$  **mi**, and swims  $\frac{1}{6}$  **mi**. How many miles does the triathlete cover?

$$\boxed{\frac{11}{8} \text{ mi or } 1\frac{3}{8} \text{ mi}}$$

48. For a family barbecue, Kayla bought packages of hamburger weighing  $1\frac{2}{3}$  **lb** and  $5\frac{3}{4}$  **lb**. What was the total weight of the meat?

$$\boxed{7\frac{5}{12}lb}$$

49. A plumber uses pipes of lengths  $10\frac{5}{16}$  **in.** and  $8\frac{3}{4}$  **in** when installing a sink. How much pipe is used?

$$\boxed{19\frac{1}{16}in}$$

50. Executive Car Care sells 45 **-in.** upholstery fabric for car restoration. Art buys  $9\frac{1}{4}$  **yd** and  $10\frac{5}{6}$  **yd** for two car projects. How many total yards Art buy?

$$\boxed{20\frac{1}{12}yd}$$

## Chapter 5.

Place-value chart														
Millions			Thousands			Ones			Fractions					
Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones	Tenths	Hundredths	Thousandths	Ten-Thousandths	Hundred-Thousandths	Millionths
100,000,000	10,000,000	1,000,000	100,000	10,000	1,000	100	10	1	1/10	1/100	1/1,000	1/10,000	1/100,000	1/1,000,000

To **compare** two **positive** numbers in decimal notation, start at the left and compare corresponding digits. When two digits differ, the number with the larger digit is the larger of two numbers. To ease the comparison, extra zeros can be written to the right of the last decimal place. To **compare** two **negative** numbers in decimal notation, start at the left and compare corresponding digits. When two digits differ, the number with smaller digit is the larger of two numbers.

### Operations with decimals.

**Addition or subtraction.** Lining up the decimal points in order to add or subtract numbers.

**Multiplication.** To multiply using decimal notation:

- a). Ignore the decimal points, for the moment, and multiply as though both factors are integers.
- b). Locate the decimal point so that the number of decimal places in the product is the sum of the number of places in the factors. Count off the number of decimal places by starting at the far right and moving the decimal **point to the left.**

**Division.** To perform long division by a whole number, place the decimal point directly above the decimal point in the dividend, and divide as though dividing whole numbers. To divide when the divisor is not a whole number, move the decimal point (multiply by 10, 100, and so on) to make the divisor a whole number; move the decimal point the same number of places (multiply the same way) in the dividend; and place the decimal point for the answer directly above the new decimal point in the dividend and divide as if dividing by the whole number.

When division with decimals ends, or **terminates**, the result is called a **terminating** decimal. If the division does not lead to a remainder of 0, but instead leads to a repeating pattern of nonzero remainders, we have what is called a **repeating** decimal:  $0.5363636\dots = 0.5\overline{36}$ .

\*\*\*\*\*

- |                        |                              |   |
|------------------------|------------------------------|---|
| 1. Add.                | $2.006 + 5.817$              | <span style="border: 1px solid black; padding: 2px;"><math>7.823</math></span>        |
| 2. Add.                | $0.8096 + 0.7856$            | <span style="border: 1px solid black; padding: 2px;"><math>1.5952</math></span>       |
| 3. Subtract.           | $45 - 0.999$                 | <span style="border: 1px solid black; padding: 2px;"><math>44.001</math></span>       |
| 4. Subtract.           | $10.056 - 0.392$             | <span style="border: 1px solid black; padding: 2px;"><math>9.664</math></span>        |
| 5. Combine like terms. | $23.28a - 15.79a$            | <span style="border: 1px solid black; padding: 2px;"><math>7.49a</math></span>        |
| 6. Combine like terms. | $15.2t + 7.9 + 5.9t$         | <span style="border: 1px solid black; padding: 2px;"><math>21.1t + 7.9</math></span>  |
| 7. Combine like terms. | $2.25 + 3.2t - 1.33 + 5.79t$ | <span style="border: 1px solid black; padding: 2px;"><math>0.92 + 9.99t</math></span> |

- |                               |   |                                 |
|-------------------------------|---|---------------------------------|
| 8. Combine like terms.        | $3.2r - 4.1t + 5.6t + 1.9r$                   | $5.1r + 1.5t$                   |
| 9. Combine like terms.        | $5.8 + 9.7x - 7.2 - 12.8x$                    | $-1.4 - 3.1x$                   |
| 10. Combine like terms.       | $4.8x + 1.9y - 5.7x + 1.2y$                   | $-0.9x + 3.1y$                  |
| 11. Multiply.                 | $6.8 \cdot 7$                                 | $47.6$                          |
| 12. Multiply.                 | $28.6 \cdot 0.09$                             | $2.574$                         |
| 13. Multiply.                 | $(-37.4)(-2.4)$                               | $89.76$                         |
| 14. Multiply.                 | $569(-1.05)$                                  | $-618.45$                       |
| 15. Multiply.                 | $(-12.3)(-1.08)$                              | $13.284$                        |
| 16. Divide.                   | $1.581 \div 0.017$                            | $93$                            |
| 17. Divide.                   | $-24.969 \div 82$                             | $-0.3045$                       |
| 18. Simplify.                 | $(5 - 0.04)^2 \div 4 + 8.7 \cdot 0.4$         | $9.6304$                        |
| 19. Simplify.                 | $6 \cdot 0.9 - 0.1 \div 4 + 0.2^3$            | $5.383$                         |
| 20. Simplify.                 | $12^2 \div (12 + 2.4) - [(2 - 2.4) \div 0.8]$ | $10.5$                          |
| 21. Solve. Remember to check. | $12.4 + 3.7x = 2.04$                          | $x = -2.8$                      |
| 22. Solve. Remember to check. | $-4.2x + 3.04 = -4.1$                         | $x = 1.7$                       |
| 23. Solve. Remember to check. | $-2.9x - 2.24 = -17.9$                        | $x = 5.4$                       |
| 24. Solve. Remember to check. | $-4.62 = 5.68 - 2.5t$                         | $x = 4.12$                      |
| 25. Solve. Remember to check. | $3x + 4 = 11x - 6$                            | $x = \frac{5}{4}$ or $x = 1.25$ |
| 26. Solve. Remember to check. | $-6.21 - 4.3t = 9.8(t + 2.1)$                 | $t = -1.9$                      |
| 27. Solve. Remember to check. | $5.9x + 67 = 7.6x + 16$                       | $x = 30$                        |
| 28. Solve. Remember to check. | $4(x - 2) - 9 = 2x + 9$                       | $x = 13$                        |

29. Solve. Remember to check.

$$9(x - 4) + 13 = 4x + 12 \quad \boxed{x = 7}$$

30. Solve. Remember to check.

$$43(7 - 2x) + 34 = 50(x - 4.1) + 744 \quad \boxed{x = -1.5}$$

## Chapter 7.

A **ratio** is the quotient of two quantities. The ratio of  $a$  to  $b$  is written  $\frac{a}{b}$  or  $a \div b$ .

When two pairs of numbers have the same ratio, we say that they are proportional  $\frac{a}{b} = \frac{c}{d}$ . Such an equation is called a **proportion**.

To solve  $\frac{a}{b} = \frac{c}{d}$  for a specific variable, equate cross products and then divide on both sides to get that variable alone.

Solve  $\frac{a}{b} = \frac{c}{d}$  for  $b$ :  $bc = ad, b = \frac{ad}{c}$ .

\*\*\*\*\*

1. Simplify the ratio.  $10\frac{5}{6}$  to  $7\frac{1}{6}$ .

$$\boxed{\frac{65}{43} \text{ or } 1\frac{22}{43}}$$

2. Simplify the ratio. 0.48 to 0.64.

$$\boxed{\frac{3}{4}}$$

3. Determine whether the two pairs of numbers are proportional: 7, 8 and 63, 72.

$$\boxed{\text{yes } \frac{7}{8} = \frac{63}{72}}$$

4. Solve.

$$\frac{9}{4} = \frac{27}{x}$$

$$\boxed{x = 12}$$

5. Solve.

$$\frac{150}{2.5} = \frac{x}{6}$$

$$\boxed{x = 360}$$

6. Solve.

$$\frac{x}{100} = \frac{27}{64} \quad \boxed{x = 42.1875 \text{ or } x = 42\frac{3}{16}}$$

7. Solve.

$$\frac{68}{y} = \frac{17}{25}$$

$$\boxed{y = 100}$$

8. Solve.

$$\frac{\frac{4}{5}}{\frac{5}{8}} = \frac{\frac{3}{2}}{x}$$

$$\boxed{x = \frac{75}{64}}$$

9. An ocean liner traveled **432 km** in **12 hr**. At that rate, how far would the boat travel in **42 hr**?  $\boxed{1512mi}$

10. A watch loses **2 min** in **10 hr**. At this rate, how much will it lose in **24hr**?  $\boxed{4.8 \text{ min}}$

11. A drama teacher reserves **9** copies of The Complete Works of William Shakespeare for her class. If the ratio of books to students is **3** to **5**, how many students are in the class?  $\boxed{15students}$



12. Fred uses **3 gal** of paint to cover **1275**  $ft^2$  of siding. How much siding can Fred paint with **7 gal** of paint?

$2975\text{ ft}^2$

13. A professor must grade **32** essays in a literature class. She can grade **5** essays in **40** min. At this rate, how long will it take her to grade all **32** essays?

$256\text{ min}$

14. An **8-lb** turkey breast contains **36** servings of meat. How many pounds of turkey breast would be need for **54** servings?

$12\text{ lb}$

## Chapter 8.

Percent notation,  $n\%$  :

Ratio  $\rightarrow n\%$  =the ratio of n to 100  $n\% = \frac{n}{100}$

Fraction notation  $\rightarrow n\% = n \cdot \frac{1}{100}$

Decimal notation  $\rightarrow n\% = n \cdot 0.01$

To solve a percent problem using a proportion, we translate as follows:  $\frac{\text{Number} \rightarrow N}{100 \rightarrow} = \frac{a \leftarrow \text{Amount}}{b \leftarrow \text{Base}}$

Solving percent problems using equations.

Key words in percent translations:

"Of " translates to " $\bullet$ "; "Is " translates to " $=$ "; "What " translates to a variable; % translates to " $\bullet \frac{1}{100}$ " or " $\bullet 0.01$ "

\*\*\*\*\*

- |  |                   |   |
|--|-------------------|---|
| 1. Write a percent as an equivalent decimal.   | 67%               | <span style="border: 1px solid black; padding: 2px;">0.67</span>    |
| 2. Write a percent as an equivalent decimal.   | 0.18%             | <span style="border: 1px solid black; padding: 2px;">0.0018</span>  |
| 3. Write a percent as an equivalent decimal.   | $14\frac{7}{8}\%$ | <span style="border: 1px solid black; padding: 2px;">0.14875</span> |
| 4. Write a percent as an equivalent decimal.   | 23.19%            | <span style="border: 1px solid black; padding: 2px;">0.2319</span>  |
| 5. Write a percent as an equivalent decimal.   | $93\frac{1}{8}\%$ | <span style="border: 1px solid black; padding: 2px;">0.93125</span> |
| 6. Write a decimal as an equivalent percent.   | 0.47              | <span style="border: 1px solid black; padding: 2px;">47%</span>     |
| 7. Write a decimal as an equivalent percent.   | 4                 | <span style="border: 1px solid black; padding: 2px;">400%</span>    |
| 8. Write a decimal as an equivalent percent.   | 0.334             | <span style="border: 1px solid black; padding: 2px;">33.4%</span>   |
| 9. Write a decimal as an equivalent percent.   | 0.8911            | <span style="border: 1px solid black; padding: 2px;">89.11%</span>  |
| 10. Write a fraction as an equivalent percent. | $\frac{7}{25}$    | <span style="border: 1px solid black; padding: 2px;">28%</span>     |
| 11. Write a fraction as an equivalent percent. | $\frac{3}{4}$     | <span style="border: 1px solid black; padding: 2px;">75%</span>     |
| 12. Write a fraction as an equivalent percent. | $\frac{2}{5}$     | <span style="border: 1px solid black; padding: 2px;">40%</span>     |
| 13. Write a fraction as an equivalent percent. | $\frac{11}{16}$   | <span style="border: 1px solid black; padding: 2px;">68.75%</span>  |

14. Write a fraction as an equivalent percent.  $\frac{29}{50}$  58%
15. Write a percent as an equivalent fraction. 62.5%  $\frac{5}{8}$
16. Write a percent as an equivalent fraction.  $33\frac{1}{3}\%$   $\frac{1}{3}$
17. Write a percent as an equivalent fraction.  $83\frac{1}{3}\%$   $\frac{10}{12}$
18. Write a percent as an equivalent fraction. 4.85%  $\frac{97}{2000}$
19. Write a percent as an equivalent fraction. 150%  $\frac{3}{2}$
20. What is 85% of 276? 234.6
21. 150% of 30 is what? 45
22. What is 6% of \$300? 18
23. 3.8% of 50 is what? 1.9
24. \$39 is what percent of \$10? 390%
25. 20 is what percent of 10? 200%
26. What percent of \$300 is \$150? 50%
27. 20 is 50% of what? 40
28. What is  $62\frac{1}{2}\%$  of 10? 6.25
29. What is 8.3% of \$10,200? 846.6
30. Of the **294** million people in the United States, **26%** are smokers. How many are smokers? 76.44million

31. A lab technician has **680 ml** of a solution of water and acid: **3%** is acid. How many milliliters are acids?  
water? *20.4ml of acid and 659.6ml of water*

32. On a test of **40** items, Christina got **91%** correct. (There was a partial credit on some items.) How many items did she get correct? incorrect? *36.4 correct and 3.6 incorrect*

33. In a medical study, it was determined that if **800** people kiss someone who has a cold, only **56** will actually catch a cold. What percent is this? *7%*

## Chapter 9.

To find the *square* of a number, multiply the number by itself. To find a *square root* of a number, find the number that, when squared, gives the original number.

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- |               |                                 |               |
|---------------|---------------------------------|---------------|
| 1. Simplify.  | $\sqrt{64}$                     | $\boxed{8}$   |
| 2. Simplify.  | $\sqrt{4}$                      | $\boxed{2}$   |
| 3. Simplify.  | $\sqrt{81}$                     | $\boxed{9}$   |
| 4. Simplify.  | $-2\sqrt{49}$                   | $\boxed{-14}$ |
| 5. Simplify.  | $-3\sqrt{1} + \sqrt{0}$         | $\boxed{-3}$  |
| 6. Simplify.  | $5(\sqrt{121} - 4)$             | $\boxed{35}$  |
| 7. Simplify.  | $\sqrt{64} - 2^3$               | $\boxed{0}$   |
| 8. Simplify.  | $(-3)^2 - \sqrt{36}$            | $\boxed{3}$   |
| 9. Simplify.  | $-4^2 + \sqrt{81}$              | $\boxed{-7}$  |
| 10. Simplify. | $-2(-\sqrt{100} - 3 \cdot 2^4)$ | $\boxed{116}$ |
| 11. Simplify. | $-2\sqrt{9} + 3\sqrt{81}$       | $\boxed{21}$  |
| 12. Simplify. | $5\sqrt{36} - 7\sqrt{100}$      | $\boxed{-40}$ |

## Chapter 10.

A term is called a **monomial** if there is no division by a variable expression.

A **polynomial** is a monomial or a combination of sums and/or differences of monomials.

Two polynomials are **opposites**, or **additive inverse**, of each other if their sum is zero.

The product rule for exponents: for any number  $a$  and any positive integers  $m$  and  $n$ ,  $a^m \cdot a^n = a^{m+n}$

Negative exponents: for any nonzero numbers  $a$  and  $b$ , and any integer  $n$ ,  $a^{-n} = \frac{1}{a^n}$  and  $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$

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1. Add.  $(-5x^4y^3 + 7x^3y^2 - 4xy^2) + (2x^3y^3 - 3x^3y^2 - 5xy)$   
$$\boxed{-5x^4y^3 + 4x^3y^2 - 4xy^2 + 2x^3y^3 - 5xy}$$

2. Add.  $(8a^3b^2 + 5a^2b^2 + 6ab^2) + (5a^3b^2 - a^2b^2 - 4a^2b)$   
$$\boxed{13a^3b^2 + 4a^2b^2 + 6ab^2 - 4a^2b}$$

3. Add.  $(6x^3y^3 - 4x^2y^2 + 3xy^2) + (x^3y^3 + 7x^3y^2 - 2xy^2)$   
$$\boxed{7x^3y^3 - 4x^2y^2 + xy^2 + 7x^3y^2}$$

4. Add.  $(17.5abc^3 + 4.3a^2bc) + (-4.9a^2bc - 5.2abc)$   
$$\boxed{17.5abc^3 - 0.6a^2bc - 5.2abc}$$

5. Add.  $(23.9x^3yz - 19.7x^2y^2z) + (-14.6x^3yz - 8x^2yz)$   
$$\boxed{9.3x^3yz - 19.7x^2y^2z - 8x^2yz}$$

6. Subtract.  $(8x^4 + 3x^3 - 1) - (4x^2 - 3x + 5)$   
$$\boxed{8x^4 + 3x^3 - 4x^2 + 3x - 6}$$

7. Subtract.  $(1.2x^3 + 4.5x^2 - 3.8x) - (-3.4x^3 - 4.7x^2 + 23)$   
$$\boxed{4.6x^3 + 9.2x^2 - 3.8x - 23}$$

8. Subtract.  $(0.5x^4 - 0.6x^2 + 0.7) - (2.3x^4 + 1.8x - 3.9)$   
$$\boxed{-1.8x^4 - 0.6x^2 - 1.8x + 4.6}$$

9. Subtract.  $(9x^3y^3 + 8x^2y^2 + 7xy) - (3x^3y^3 - 2x^2y + 3xy)$   
$$\boxed{6x^3y^3 + 8x^2y^2 + 2x^2y + 4xy}$$

10. Subtract.  $(3x^4y + 2x^3y - 7x^2y) - (5x^4y + 2x^2y^2 - 2x^2y)$   
 $\boxed{-2x^4y + 2x^3y + 2x^2y^2 - 5x^2y}$
11. Evaluate the polynomial:  $-6 - x$  for  $x = -4$   $\boxed{-2}$
12. Evaluate the polynomial:  $-3x^2 - 2x + 9$  for  $x = 4$   $\boxed{-47}$
13. Evaluate the polynomial:  $-3x^3 + 7x^2 - 3x - 2$  for  $x = 2$   $\boxed{-4}$
14. Multiply.  $(9a^5b^4)(2a^4b^7)$   $\boxed{18a^9b^{11}}$
15. Multiply.  $(4a^3b^4c^2)(3a^5b^4)$   $\boxed{12a^8b^8c^2}$
16. Multiply.  $(7x^3y^5z^2)(8x^3z^4)$   $\boxed{56x^6y^5z^6}$
17. Multiply.  $(3x^2)(-4x^3)(2x^6)$   $\boxed{-24x^{11}}$
18. Multiply.  $(-2y^5)(10y^4)(-3y^3)$   $\boxed{60y^{12}}$
19. Multiply.  $-9x(-x-1)$   $\boxed{9x^2 + 9x}$
20. Multiply.  $x^2(x^3 + 1)$   $\boxed{x^5 + x^2}$
21. Multiply.  $5x(2x^2 - 6x + 1)$   $\boxed{10x^3 - 30x^2 + 5x}$
22. Multiply.  $-4x(2x^3 - 6x^2 - 5x + 1)$   $\boxed{-8x^4 + 24x^3 + 20x^2 - 4x}$
23. Multiply.  $4xy(3x^2 + 2y)$   $\boxed{12x^3y + 8xy^2}$
24. Multiply.  $7xy(3x^2 - 6y^2)$   $\boxed{21x^3y - 42xy^3}$
25. Multiply.  $3a^2b(4a^5b^2 - 3a^2b^2)$   $\boxed{12a^7b^3 - 9a^4b^3}$
26. Multiply.  $4a^2b^2(2a^3b - 5ab^2)$   $\boxed{8a^5b^3 - 20a^3b^4}$