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Chapter 1

Algebra Fundamentals

True or False Questions

1. An empty set is a set which contains a zero in it.
   False; Easy
2. The smallest prime number is 1.
   False; Easy
3. a ÷0 is undefined.
   True; Easy
4. Subtraction is commutative in nature.
   False; Easy
5. Multiplication is commutative while division is not.
   True; Easy
6. 5 subtracted from the sum of cubes of 2 and 3 is 19.
   False; Moderate
7. The value of $\sqrt{-¿¿}$is 9.
   False; Easy
8. The negative square root is called the principal square root.
   False; Easy
9. Every real number has more than one real cube root.
   False; Easy
10. $a(b+c)=ab+ac$is the associative property.
    False; Easy
11. The term written without a variable factor is called a constant term.
    True; Easy
12. The numerical factor of a term is called the coefficient.
    True; Easy
13. Real numbers expressed using scientific notations have the form $a \times 1^n$.
    False; Easy
14. Any nonzero quantity raised to the 0 power is defined to be 1.
    True; Easy
15. x^{-n} is the same as $\frac{1}{x^n}$
    True; Easy
16. $9x^7-56$ is a binomial with degree 2.
    False; Easy
17. The binomials $(a+b)$ and $(a-b)$ are called conjugate binomials.
    True; Easy
18. $a^2+b^2-2ab$is a perfect square trinomial.
    True; Easy
19. $3x - 5 = 16$ and $x - 7 = 0$ are equivalent equations.
    True; Easy
20. An equation that is never true and has no solution is a contradiction.

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True; Easy

21. Equations that are true for particular values are called conditional equations.
    True; Easy
22. $x \geq 5$ denotes that x is at least 5.
    True; Easy
23. $x \leq 4$ denotes that x is less than 4 and noninclusive.
    False; Easy
24. $4 < x < 20$ denotes that x is a number between 4 and 20.
    True; Easy
25. $17 \leq x \leq 29$ denotes that x is a number in the range of 17 to 29.
    True; Easy

Multiple Choice Questions

26. $\frac{324}{405}$ can be written as _____.
    a. $\frac{5}{4}$
    b. $\frac{3}{5}$
    c. $\frac{4}{5}$
    d. $\frac{9}{4}$
    e. $\frac{9}{8}$
    c; Easy
27. $\frac{301}{387}$ can be written as_____.
    a. $\frac{3}{7}$
    b. $\frac{3}{8}$
    c. $\frac{5}{8}$
    d. $\frac{7}{9}$
    e. $\frac{11}{7}$
    d; Easy
28. The prime factorization of 175 is:
    a. $5 \cdot 5 \cdot 7$.
    b. $5 \cdot 7$.
    c. $3 \cdot 5 \cdot 7$.
    d. $3 \cdot 5 \cdot 5$.
    e. $2 \cdot 5 \cdot 7$.
    a; Easy

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29. All real numbers less than 8 and greater than zero can be expressed as:
    a. $0>x>8$.
    b. $0<x>8$.
    c. $0>x<8$.
    d. $8<x<0$.
    e. $0<x<8$.
    e; Easy
30. ¿∪¿can be expressed as:
    a. $x\le -17$or $x\le 10$.
    b. $x\ge -17$or $x\le 10$.
    c. $x\le -17$or $x\le -10$.
    d. $x\le -17$ or$x>-10$.
    e. $x\le 17$or $x\le 10$.
    d; Moderate
31. −¿is equivalent to _____.
    a. 14
    b. –14
    c. ¿14∨¿
    d. ¿−14∨¿
    e. 0
    b; Easy
32. ¿∪$(-4,\infty)$can be written as:
    a. $x\le -14$ *or*$x>-4$.
    b. $x\le -14$ *or* $x>4$.
    c. $x\ge -14$ *or* $x>-4$.
    d. $x\le -14$ *or* $x\leftarrow 4$.
    e. $x\ge 14$ *or* $x>-4$.
    a; Moderate
33. $-\left(-\left(-\left(-\left(-\left(\frac{4}{5}\right)\right)\right)\right)\right)$is equivalent to _____.
    a. $\frac{5}{4}$
    b. $-\left(\frac{4}{5}\right)$
    c. $-\left(\frac{5}{4}\right)$
    d. $\frac{4}{5}$
    e. 45
    b; Easy
34. Simplifying $\left(\frac{-7}{2}\right)\left(\frac{-3}{2}\right)\div\frac{21}{16}$ leads to _____.
    a. 3
    b. –4

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c. 7
d. 4
e. –8
d; Easy

35. Simplifying $\frac{-1}{5}-\frac{3}{2}-\left(\frac{-7}{10}\right)$ leads to _____.
a. –1
b. –10
c. 2
d. 1
e. –2
a; Easy

36. Simplifying the expression $\frac{1}{4}\left\{-6\left[-\left(\frac{1}{2}-\frac{5}{3}\right)\right]\right\}$ gives _____.
a. –7
b. $\frac{-1}{3}$
c. $\frac{-7}{3}$
d. $\frac{-7}{4}$
e. 7
d; Moderate

37. The value of $\frac{¿9-12\vee-(-3)}{¿-16\vee-3(4)}$ is _____.
a. –2
b. $\frac{-3}{2}$
c. $\frac{-2}{3}$
d. $\frac{2}{3}$
e. $\frac{3}{2}$
e; Moderate

38. The value of $\left(4^2-3^2\right)-¿$ is _____.
a. 16
b. –16
c. 26
d. 36
e. 25
c; Moderate

39. The value of ¿ is _____.
a. 36
b. 26

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c. –16
d. 18
e. –36
e; Moderate

40. What is 7 subtracted from the sum of the cubes of 2 and 3?
a. 29
b. 24
c. 27
d. 28
e. 35
d; Moderate

41. $\sqrt{0.64}$ is _____.
a. 0.08
b. 0.16
c. 0.8
d. 0.4
e. 4
c; Easy

42. $\sqrt[3]{\frac{135}{64}}$ is _____.
a. $\frac{5\sqrt[3]{3}}{2}$
b. $\frac{3\sqrt[3]{5}}{2}$
c. $\frac{5\sqrt[3]{3}}{4}$
d. $\frac{3\sqrt[3]{5}}{4}$
e. $\frac{5\sqrt[3]{5}}{2}$
d; Moderate

43. If the sides of a right angle triangle are 3 m and 2 m respectively, its hypotenuse is _____ m.
a. 13
b. 5
c. 26
d. $\sqrt{13}$
e. $\sqrt{5}$
d; Easy

44. The hypotenuse and a side of a right angle triangle measure $\sqrt{15}$ units and $\sqrt{6}$ units respectively. What is the measurement of the unknown side?
a. $\sqrt{21}$units
b. 3 units
c. $\sqrt{11}$units
d. $\sqrt{12}$units

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e. 9 units

b; Easy

45. $-2\sqrt[3]{-162}$ is _____.
    a. $6\sqrt[3]{3}$
    b. $6\sqrt[3]{6}$
    c. $\sqrt[3]{6}$
    d. $6\sqrt[3]{-3}$
    e. $-6\sqrt[3]{6}$

    b; Moderate

46. The value of $\frac{9x^2+x-2}{3x-4}$ where $x=\frac{-2}{3}$ is _____.
    a. –9
    b. 2
    c. 3
    d. $\frac{-2}{9}$
    e. –29

    d; Moderate

47. Simplifying $6m^2-4mn-\left(2m^2-4mn+n^2\right)$ gives _____.
    a. $3m^2-n^2$
    b. $6m^2-n^2$
    c. $4m^2-n^2$
    d. $3m^2+n^2$
    e. $4m^2+n^2$

    c; Easy

48. Simplifying the equation $5a^{2x}-3a^x+1-3a^{2x}-2a^x-1$ gives _____.
    a. $5a^{2x}-5a^x$
    b. $5a^{2x}+5a^x$
    c. $2a^{2x}+5a^x$
    d. $5a^{2x}-a^x$
    e. $2a^{2x}-5a^x$

    e; Easy

49. The value of a^2b^2-ab+2 where $a=-3$ and $b=-2$ is _____.
    a. 34
    b. 33
    c. 32
    d. 31
    e. 23

    c; Easy

50. 0.000004056 is equivalent to _____.
    a. 4.056×10^{-5}
    b. 4.056×10^{7}
    c. 4.056×10^{-7}
    d. 4.056×10^{-6}

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e. 4.056×10^6

d; Easy

51. Which of the following is the true value of $\frac{7^3 \cdot 7^5}{7^7}$?

a. 7
b. 7^2
c. 7^8
d. 7^3
e. 2,401

a; Easy

52. Which of the following is the true value of¿?

a. ¿
b. ¿
c. ⊘
d. $(a-3b)$
e. $(3b-a)$

b; Moderate

53. $(m^3 \cdot m^2 \cdot m)^2$can be simplified as _____.

a. m^5
b. m^9
c. m^{15}
d. m^3
e. m^{12}

e; Easy

54. ¿is _____.

a. ⊘
b. $-2m$
c. $2m$
d. 1
e. –1

d; Easy

55. The standard form of the polynomial $-x+2+x^2$ is _____.

a. x^2+x+2
b. x^2-x+2
c. $2+x^2-x$
d. $2-x+x^2$
e. x^2+x-2

b; Easy

56. The degree of the equation x^4-x+2 is _____.

a. 3
b. 2
c. 4
d. 1
e. 5

c; Easy

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57. The leading coefficient of $5x^2-9x^4+6$ is _____.
    a. –6
    b. –9
    c. 6
    d. 9
    e. 5
    b; Easy
58. On subtracting $4a-3$ from $a^2+7a-10$ we get _____.
    a. $a^2+3a-13$
    b. $3a-7$
    c. a^2+3a+7
    d. $a^2+3a-17$
    e. a^2+3a-7
    e; Easy
59. $\frac{a^4+a-1}{a^2+1}$ is equivalent to _____.
    a. $a^2+\frac{a^2}{a^2+1}$
    b. $-1+\frac{a^2}{a^2+1}$
    c. $\frac{a^2}{a^2+1}$
    d. $a^2-1+\frac{a}{a^2+1}$
    e. $\frac{1}{a^2+1}$
    d; Moderate
60. The quotient of $10m^2-11m+3$ and $2m-1$ is _____.
    a. $6m+3$
    b. $5m-3$
    c. $6m-3$
    d. $5m+3$
    e. $m-3$
    b; Moderate
61. What is y in$4y-3=-7$?
    a. 1
    b. 0
    c. –1
    d. –3
    e. 2
    c; Easy
62. The sum of 3 times a number and 12 is equal to 3. What is the unknown number?
    a. 3
    b. –3

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c. –6
d. 18
e. 6
b; Easy

63. If the sum of 3 consecutive odd integers is 81, the middle integer is _____.
a. 25
b. 29
c. 31
d. 27
e. 23
d; Easy

64. If the sum of 3 consecutive even integers is 174, the middle integer is _____.
a. 56
b. 58
c. 60
d. 62
e. 64
b; Easy

65. If Nash takes $2\frac{3}{4}$ hours to drive 176 miles, what is his average speed?
a. 62 miles per hour
b. 63 miles per hour
c. 64 miles per hour
d. 65 miles per hour
e. 66 miles per hour
c; Moderate

66. How long will it take $1,000 to earn $248 in simple interest earning 12.4% annual interest?
a. 2 years
b. 6 months
c. 12 months
d. 3 years
e. 4 years
a; Easy

67. Jacob scored 80, 85, 83, and 85 on the first four chemistry exams. To maintain an average score of 80, he should at least score _____ in his last exam.
a. 67
b. 76
c. 85
d. 58
e. 83
a; Moderate

68. Which of the following is the true value of x in $2x-3\leftarrow 5$?
a. 0
b. 1

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c. 3
d. 2
e. –1
c; Easy

69. The interval notation for $6x - 4 < -16$ *or* $6x + 20 > 2$ is _____.
a. $\sim$
b. $\varnothing$
c. $(-\infty, 6) \cup (-16, \infty)$
d. $(-\infty, 2) \cup (20, \infty)$
e. $(-\infty, -4) \cup (-16, \infty)$
a; Moderate

70. The interval notation for $9 - 2x \leq 15$ and $5x - 3 \leq 7$ is _____.
a. ¿
b. ¿
c. $[-7, 15]$
d. $[-3, 2]$
e. $[-15, 7]$
d; Moderate

Fill in The Blanks

71. Numbers of the form $\frac{a}{b}$, where a and b are integers and b is nonzero, are called _____.
rational numbers; Easy

72. Any integer greater than 1 that is not prime is called a(n) _____.
composite number; Easy

73. The prime factorization of 42 is _____.
$2 \cdot 3 \cdot 7$; Easy

74. A(n) _____ changes depending on the value of the variable.
piecewise definition; Moderate

75. $a + (-a) = (-a) + a = 0$ is an example of the _____ property.
additive inverse; Easy

76. Two real numbers whose product is 1 are called _____.
reciprocals; Easy

77. The side opposite to the right angle in a right angled triangle is called the _____.
hypotenuse; Easy

78. Components of a term separated by multiplication operators are called _____.
factors; Easy

79. The act of replacing a variable with an equivalent quantity is called _____.
substitution; Easy

80. $\left(\frac{1}{5}\right)^{-1}$ is _____.
5; Easy

81. A polynomial with one term is called a(n) _____.
monomial; Easy

82. Leading coefficient is the coefficient of the term with the _____ degree.

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largest; Easy

83. Terms with zero coefficients used to fill in all missing exponents within a polynomial are called _____.
placeholders; Easy
84. Any value that can replace the variable in an equation to produce a true statement is called the _____.
solution; Easy
85. Two or more inequalities in one statement joined by the word "and" or by the word "or" are called _____.
compound inequalities; Easy

Essay Questions

86. Define real numbers and various categories of real numbers.
The set of real numbers, denoted ˜, is defined as the set of all rational numbers combined with the set of all irrational numbers.

Rational numbers, denoted [[, are defined as any number of the form $\frac{a}{b}$ where a and b are integers and b is nonzero. We can describe this set using set notation:

$$I=\left\{\frac{a}{b}\middle| a,b\in Z,b\neq 0\right\}$$ Rational Numbers

Irrational numbers are defined as any number that cannot be written as a quotient of two integers.
Easy

87. Explain prime factorization with an example.
Prime factorization is the unique factorization of a natural number written as a product of primes.
(Students' examples may vary)
Example: Determine the prime factorization of 210.
Solution: Begin by writing 210 as a product with 10 as a factor. Then continue factoring until only a product of primes remains.

$$\begin{aligned} 210 &\wedge ¿ 10\cdot 21 \\ ¿ &= 2\cdot 5\cdot 3\cdot 7 \\ ¿ &= 2\cdot 3\cdot 5\cdot 7 \end{aligned}$$

Since the prime factorization is unique, it does not matter how we choose to initially factor the number, the end result will be the same.
Easy

88. List the specific order of operations followed to ensure a single correct result.
- Perform all calculations within the innermost parentheses or grouping symbol first.
- Evaluate all exponents.
- Apply multiplication and division from left to right.
- Perform all remaining addition and subtraction operations last from left to right.

Easy

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89. List the properties of addition and multiplication.
Properties of addition:

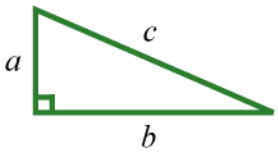
Additive Identity Property:	$a+0=0+a=a$
Additive Inverse Property:	$a+(-a)=(-a)+a=0$
Associative Property:	$(a+b)+c=a+(b+c)$
Commutative Property:	$a+b=b+a$

Properties of multiplication:

Zero Factor Property:	$a\cdot 0=0\cdot a=0$
Multiplicative Identity Property:	$a\cdot 1=1\cdot a=a$
Associative Property:	$(a\cdot b)\cdot c=a\cdot(b\cdot c)$
Commutative Property:	$a\cdot b=b\cdot a$

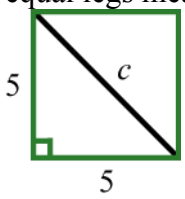
Moderate

90. Explain the Pythagorean Theorem with an example.
The Pythagorean Theorem states that given any right triangle with legs measuring a and b units, the square of the measure of the hypotenuse c is equal to the sum of the squares of the measures of the legs, $c^2 = a^2 + b^2$.
In other words, the hypotenuse of any right triangle is equal to the square root of the sum of the squares of its legs.



$$a^2+b^2=c^2$$
or
$$c=\sqrt{a^2+b^2}$$

(Students' examples may vary)
Example: Calculate the diagonal of a square with sides measuring 5 cm.
Solution: The diagonal of a square will form an isosceles right triangle where the two equal legs measure 5 units.



We can use the Pythagorean Theorem to determine the length of the hypotenuse.

$$\begin{aligned} c &= \sqrt{a^2+b^2} \\ &= \sqrt{5^2+5^2} \\ &= \sqrt{25+25} \\ &= \sqrt{50} \\ &= \sqrt{25\cdot 2} \\ &= \sqrt{25}\cdot\sqrt{2} \\ &= 5\cdot\sqrt{2} \end{aligned}$$

Moderate

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91. Give the product and quotient rule for radicals.

Product Rule for Radicals: $\sqrt[n]{A \cdot B} = \sqrt[n]{A} \cdot \sqrt[n]{B}$

Quotient Rule for Radicals: $\sqrt[n]{\frac{A}{B}} = \frac{\sqrt[n]{A}}{\sqrt[n]{B}}$

Moderate

92. Explain distributive property with an example.
The distributive property states that if given any real numbers a, b and c, then $a(b + c) = ab + ac$.
This property is one that we apply often when simplifying algebraic expressions. To demonstrate how it will be used, we simplify $2(5-3)$ in two ways, and observe the same correct result.
The distributive property states that if given any real numbers a, b and c, then

Working parenthesis first.	*Using the distributive property.*
$2(5-3) \wedge ¿ 2(2)$	$2(5-3) \wedge ¿ 2 \cdot 5 - 2 \cdot 3$
$¿ = 4$	$¿ = 10 - 6$
	$¿ = 4$

Moderate

93. Show the stepwise simplification of $\frac{x^2 - y^2}{2x - 1}$ where $x = \frac{-3}{2}$ and $y = -3$.
To avoid common errors, it is a best practice to first replace all variables with parentheses, and then replace, or substitute, the appropriate given value.

$$\frac{x^2 - y^2}{2x - 1} \wedge ¿ \left(\frac{-3}{2}\right)^2 - ¿ ¿$$
$$¿$$

Moderate

94. State the rules of exponents.

Product rule: $x^m \cdot x^n = x^{m+n}$

Quotient rule: $\frac{x^m}{x^n} = x^{m-n}$

Power rule: $\left(x^m\right)^n = x^{m-n}$

Power rule for a product: ¿

Power rule for a quotient: $\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$

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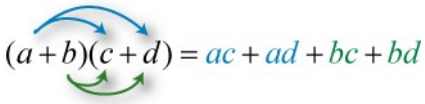
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Moderate

95. Define the following terms:
    - Polynomial
    - Degree of a polynomial
    - Leading coefficient

    A polynomial is a special algebraic expression with terms that consist of real number coefficients and variable factors with whole number exponents.
    The degree of a polynomial is the largest degree of all of its terms.
    The leading coefficient is the coefficient of the variable with the highest power.
    Easy

96. Explain FOIL method with an example.
    In this method the distributive property is applied multiple times to produce the final result.
    This same result is obtained in one step if we apply the distributive property to a and b separately as follows:



    (Students' examples may vary)
    Example: Multiply: $(6x-1)(3x-5)$.
    Solution: Distribute 6*x* and -1 and then combine like terms.

$$(6x-1)(3x-5) \wedge ¿ 6x \cdot 3x - 6x \cdot 5 + (-1) \cdot 3x - (-1) \cdot 5$$
$$¿ = 18x^2 - 30x - 3x + 5$$
$$¿ = 18x^2 - 33x + 5$$

    Moderate

97. List the properties of equality.

Addition property of equality:	If $A=B$, then $A+c=B+c$
Subtraction property of equality:	If $A=B$, then $A-c=B-c$
Multiplication property of equality:	If $A=B$, then $cA=cB$
Division property of equality:	If $A=B$, then $\frac{A}{c}=\frac{B}{c}$

Easy

98. Briefly discuss the general guidelines for solving linear equations.
    Step 1: Simplify both sides of the equation using the order of operations and combine all like terms on the same side of the equal sign.
    Step 2: Use the appropriate properties of equality to combine like terms on opposite sides of the equal sign. The goal is to obtain the variable term on one side of the equation and the constant term on the other.
    Step 3: Divide or multiply as needed to isolate the variable.
    Step 4: Check to see if the answer solves the original equation.
    Moderate

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99. Explain the general guidelines for setting up and solving word problems.
Step 1: Read the problem several times, identify the key words and phrases, and organize the given information.
Step 2: Identify the variables by assigning a letter or expression to the unknown quantities.
Step 3: Translate and set up an algebraic equation that models the problem.
Step 4: Solve the resulting algebraic equation.
Step 5: Finally, answer the question in sentence form and make sure it makes sense (check it).
Moderate

100. List the properties of inequalities.

Addition property of inequalities:	If $A<B$ then, $A+c<B+c$
Subtraction property of inequalities:	If $A<B$, then $A-c<B-c$
Multiplication property of inequalities:	If $A<B$, then $cA<cB$ If $A<B$, then $-cA>-cB$
Division property of inequalities:	If $A<B$, then $\frac{A}{c}<\frac{B}{c}$ If $A<B$, then $\frac{A}{-c}>\frac{B}{-c}$

Easy

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