

## Elementary Algebra Topics And Sample Questions

### I. Substitution in algebraic expressions

1. Evaluate  $\frac{a-b}{a}$  if  $a = 3$  and  $b = -5$ .
2. If  $y = 2x^2 - 4x - 5$ , what is the value of  $y$  when  $x = -3$ ?
3. If  $a = -2$ , find the value of  $3(a-2) - 2(a+1)$ .
4. Evaluate  $\frac{xy - y^2}{2x^2}$  if  $x = -2$  and  $y = 3$ .

### II. Addition, subtraction, multiplication, and division of monomials and polynomials

For problems 5-15, perform the indicated operation and simplify your answer.

5.  $13a - 15b - a + 2b$
6.  $(2x - 1)(4x + 3)$
7.  $(2m + 3)^2$
8.  $(x^2 - 3x + 2) - (3x^2 - 5x - 1)$
9.  $\frac{6a}{3a}$
10.  $4x(x + 2)$
11.  $5x - 3y - (x + 4y)$
12.  $\frac{2y^2 + 8xy}{2y}$
13.  $(x + 2)(x^2 - 3x + 1)$
14.  $\frac{18b^4}{6b^3}$
15.  $(3y - 5x)^2$
16. Find the result if  $3x^2 + 2x - 1$  is subtracted from  $5x^2 + 2x + 3$ .
17.  $\frac{16x^2y^3}{2xy^3}$
18.  $4xy^2(x^2 + 2y + 3)$

### III. Simplification of algebraic expressions containing multiplication and addition of polynomials.

For problems 19-23, simplify the given expression.

19.  $5(a + 2) + 2(3 - a)$
20.  $6(x - 2) - (2x + 3)$
21.  $3x(2y - 4) - 2y(2x + 3)$
22.  $2y[y - (3 + 2y)]$
23.  $(3 + m)m + m^2$

### IV. Simplification of terms containing integer exponents

For problems 24-29, simplify the given expression.

24.  $\frac{a^6}{a^3}$
25.  $3x^2y(2xy^4)$
26.  $(2ab^2)^3$
27.  $(-3x^4)^2$
28.  $\frac{x^{-2}}{x^{-3}}$
29.  $\left(\frac{3x}{4y}\right)^2$

## V. Simplification of expressions containing square roots

For problems 30-34, simplify the given expression.

30.  $\sqrt{8} + \sqrt{18}$     31.  $(4\sqrt{3})^2$     32.  $3\sqrt{5} + 7\sqrt{5} - \sqrt{5}$   
33.  $2\sqrt{12} - 7\sqrt{3}$     34.  $\frac{16\sqrt{12k^2}}{3\sqrt{3k}}$

## VI. Factoring

For problems 35-38, factor the given expression.

35.  $2x^2 + 5x - 3$     36.  $x^2 + x - 12$     37.  $x^2 - 4y^2$     38.  $1 - 16y^2$   
39. Is  $x + \frac{1}{2}$  a factor of  $x^2 - \frac{1}{4}$ ?    40. Factor  $2x^2 - 11x - 21$   
41. Factor completely:  $x^3 - 4x^2 - 5x$     42. Factor completely:  $a^4 - b^4$

## VII. Addition, subtraction, multiplication, and division of algebraic fractions.

For problems 43-55, perform the indicated operation and simplify.

43.  $\frac{1}{x} + \frac{1}{x+4}$     44.  $\frac{1}{2x} + \frac{1}{3x}$     45.  $\frac{2r}{3s} \times \frac{9s}{4r^2}$     46.  $\frac{a}{a+a^2}$     47.  $\frac{5a}{6} - \frac{a}{4} + \frac{2a}{3}$   
48.  $\frac{3}{x+2} + \frac{2}{x+1}$     49.  $\frac{2x+x^2}{2x}$     50.  $\frac{5}{1+\frac{3}{x}}$     51.  $\frac{4}{a} + \frac{5}{b}$     52.  $\frac{1}{y-1} - \frac{1}{y}$   
53.  $\frac{5x-1}{3} - \frac{2x+1}{2}$     54.  $\frac{\left[\frac{1}{x} + \frac{1}{y}\right]}{\frac{3}{xy}}$     55.  $\frac{8x}{15y^3} \div \frac{5y^2}{2x^4}$

## VIII. Solutions of linear equations and inequalities in one variable

Solve for the variable

56.  $2y - 3 = 15$     57.  $7y - 4 = 15 + 3y$     58.  $5(2x + 3) - (x + 4) = -1$   
59.  $3p - 5 > p + 7$     60. Solve for  $x$ :  $ax + b = 3$     61.  $\frac{x+1}{4} = \frac{2x-1}{3}$   
62.  $\frac{1}{x} = \frac{1}{3} + \frac{1}{6}$     63. Solve for  $x$ :  $ax = b(x + c)$     64.  $9y - 5 = 2$   
65.  $3x - 7 = 5x$     66. Solve for  $x$ :  $ax = b - x$     67.  $5(p - 4) + 3 = 2p$   
68. Solve for  $c$ :  $a = bx + c$     69.  $\frac{2x}{3} - 1 = \frac{5}{2}$     70. Solve for  $x$ :  $ax = b - cx$   
71. If  $5x - 3 = 7$ , then what is the value of  $x + 3$ ?  
72.  $8(1 - 2x) > 5(8 - 3x)$     73.  $4 - (m - 6) \leq 10$

### IX. Solutions of systems of linear equations in two variables

Solve the given system of equations.

74.  $x - y = 1$   
 $3x + 4y = 24$

75.  $2x + y = 7$   
 $3x - 2y = 4$

76.  $5x + 2y = 3$   
 $7x - 3y = 10$

77.  $2x - y = 2$   
 $6x - 7y = 8$

78.  $4x + 6y = 7$   
 $3x + 5y = 6$

79.  $2x + 6y = 5$   
 $y = 7x - 1$

### X. Solution of quadratic equations

80. Solve for  $t$ :  $s = \frac{1}{2}at^2$

81. Solve for  $x$ :  $7x^2 - b = 0$

82. Solve for  $x$ :  $x^2 + 4x + 4 = 0$

83. Solve for  $x$ :  $2x^2 - 3x - 2 = 0$

84. Solve for  $x$ :  $4x^2 + 4x = 3$

85. Solve for  $x$ :  $x^2 - 2x + 1 = 0$

### XI. Translation of English phrases into algebraic expressions

86. If the sum of three numbers is 80 and one of the numbers is  $x$ , what is the sum of the other two?

87. The area of a rectangle of width  $W$  and length  $L$  is given by the formula  $A = LW$ . Write an expression for the area of a rectangle with length twice  $L$  and width 2 units greater than  $W$ .

88. If  $A$  represents the number of apples purchased at 15 cents each and  $B$  represents the number of bananas purchased at 10 cents each, write an expression for the total value of the purchases.

89. Suppose First-class stamps cost 25 cents each and postcard stamps cost 15 cents each. If  $x$  represents the number of first-class stamps purchased and  $y$  represents the number of postcard stamps purchased, write an expression for the total value of the stamps purchased.

90. Al is 3 years less than twice as old as Vinnie. If  $x$  represents Vinnie's age, write an expression for Al's age.

91. On a scale drawing,  $x$  inches represents 10 feet. How many feet does 6 inches represent?

92. Write an expression for the number of weeks in  $x$  days.

93. The rent of a car costs \$22 per day plus 12 cents per mile for the number of miles driven. If a car is rented for  $d$  days and driven  $m$  miles, write an expression for the total cost of the rental.

94. Write an expression to represent "the sum of a number  $x$  and 3 less than twice  $x$ ".

95. Harriet earns an 8 percent commission on her monthly sales over \$500. If her total sales last month of  $d$  dollars was more than \$500, write an expression for Harriet's commission.

96. If 8 items cost  $x$  cents, write an expression for the cost of 21 items at the same rate.

## XII. Solution of simple word problems

97. Joan has one more than 3 times as many cassette tapes as Paul has. Together they have 25 tapes. How many tapes does Paul have?
98. The sum of two numbers is 48. Four times the smaller number is equal to twice the larger number. Find the two numbers.
99. The price of a new stereo after adding on 6 percent tax is \$583. Find the cost of the stereo before tax.
100. Luis has \$7.60 in dimes and quarters. If he has 40 coins in all, how many coins of each kind does he have?
101. The length of a rectangle is 10 feet more than twice its width. The perimeter of the rectangle is 170 feet. Find the dimensions of the rectangle.

## XIII. The rectangular coordinate system and graphs of linear equations

102. Graph each ordered pair on a rectangular coordinate system:  
(a)  $(2, -3)$  (b)  $(0, -5)$  (c)  $(-1, -2)$  (d)  $(4, 0)$  (e)  $(-3, 2)$
103. Graph the line whose equation is  $2x + y = 5$ .
104. Graph the line whose equation  $2x - y = 8$ .
105. What is the  $x$ -intercept of the line whose equation is  $3x - 5y = 15$ ?
106. Graph the line whose equation is  $2y = -5$ .
107. Graph the line whose equation is  $x = 3$ .
108. Graph the line whose equation is  $2y = x$ .

## Answers

1.  $\frac{8}{3}$  2. 25 3.  $-10$  4.  $-\frac{15}{8}$  5.  $12a - 13b$  6.  $8x^2 + 2x - 3$  7.  $4m^2 + 12m + 9$
8.  $-2x^2 + 2x + 3$  9. 2 10.  $4x^2 + 8x$  11.  $4x - 7y$  12.  $4x + y$  13.  $x^3 - x^2 - 5x + 2$
14.  $3b$  15.  $9y^2 - 30xy + 25x^2$  16.  $2x^2 + 4$  17.  $8x$  18.  $4x^3y^2 + 8xy^3 + 12xy^2$
19.  $3a + 16$  20.  $4x - 15$  21.  $2xy - 12x - 6y$  22.  $-2y^2 - 6y$  23.  $2m^2 + 3m$  24.  $a^3$
25.  $6x^3y^5$  26.  $8a^3b^6$  27.  $9x^8$  28.  $x$  29.  $\frac{9x^2}{16y^2}$  30.  $5\sqrt{2}$  31. 48 32.  $9\sqrt{5}$
33.  $-3\sqrt{3}$  34.  $\frac{32\sqrt{k}}{3}$  35.  $(2x - 1)(x + 3)$  36.  $(x + 4)(x - 3)$  37.  $(x + 2y)(x - 2y)$
38.  $(1 + 4y)(1 - 4y)$  39. yes 40.  $(2x + 3)(x - 7)$  41.  $x(x + 1)(x - 5)$
42.  $(a^2 + b^2)(a + b)(a - b)$  43.  $\frac{2(x + 2)}{x(x + 4)}$  44.  $\frac{5}{6x}$  45.  $\frac{3}{2r}$  46.  $\frac{1}{1 + a}$  47.  $\frac{5a}{4}$

48.  $\frac{5x+7}{(x+2)(x+1)}$  49.  $\frac{2+x}{2}$  50.  $\frac{5x}{x+3}$  51.  $\frac{4b+5a}{ab}$  52.  $\frac{1}{y(y-1)}$  53.  $\frac{4x-5}{6}$
54.  $\frac{x+y}{3}$  55.  $\frac{16x^5}{75y^5}$  56.  $y=9$  57.  $y=\frac{19}{4}$  58.  $x=-\frac{4}{3}$  59.  $p>6$  60.  $\frac{3-b}{a}$
61.  $x=\frac{7}{5}$  62.  $x=2$  63.  $x=\frac{bc}{a-b}$  64.  $y=\frac{7}{9}$  65.  $x=-\frac{7}{2}$  66.  $x=\frac{b}{a+1}$
67.  $p=\frac{17}{3}$  68.  $c=a-bx$  69.  $x=\frac{21}{4}$  70.  $x=\frac{b}{a+c}$  71. 5 72.  $x<-32$
73.  $m\geq 0$  74.  $x=4, y=3$  75.  $x=\frac{18}{7}, y=\frac{13}{7}$  76.  $x=1, y=-1$
77.  $x=\frac{3}{4}, y=-\frac{1}{2}$  78.  $x=-\frac{1}{2}, y=\frac{3}{2}$  79.  $x=\frac{1}{4}, y=\frac{3}{4}$  80.  $t=\pm\sqrt{\frac{2s}{a}}$
81.  $x=\pm\sqrt{\frac{b}{7}}$  82.  $x=-2$  83.  $x=-\frac{1}{2}, 2$  84.  $x=\frac{1}{2}, -\frac{3}{2}$  85.  $x=1$  86.  $80-x$
87.  $A=2L(W+2)$  88.  $(15A+10B)$  cents 89.  $(25x+15y)$  cents 90.  $2x-3$
91.  $\frac{60}{x}$  feet 92.  $\frac{x}{7}$  93.  $(22d+0.12m)$  dollars 94.  $x+(2x-3)$
95.  $0.08(d-500)$  dollars 96.  $\frac{21x}{8}$  97. 6 tapes 98. 16, 32 99. \$550
100. 16 dimes, 24 quarters 101. Length= 60 feet, Width= 25 feet 105. (5, 0)



