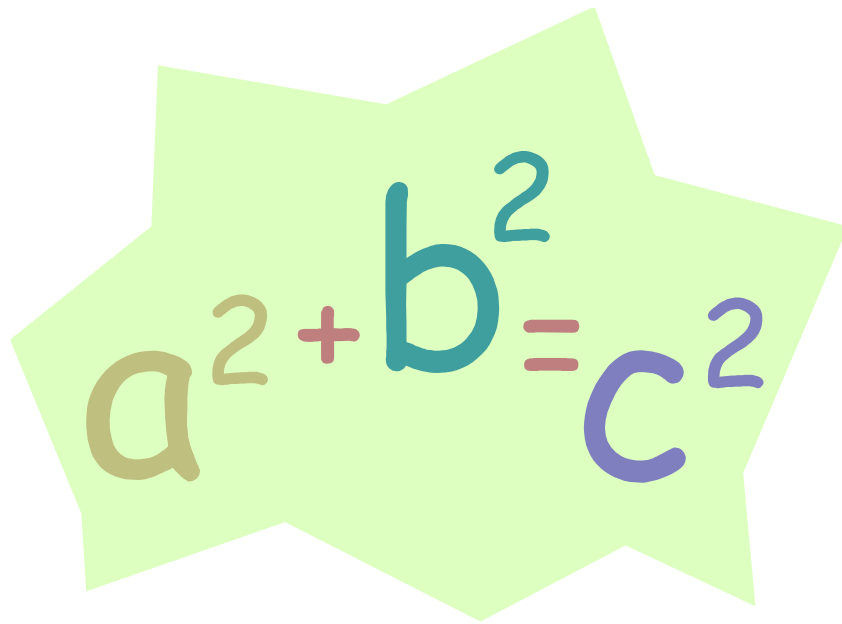


# ELEMENTARY ALGEBRA


$$a^2 + b^2 = c^2$$

## Overview

The Elementary Algebra section of ACCUPLACER contains 12 multiple choice Algebra questions that are similar to material seen in a Pre-Algebra or Algebra I pre-college course. A calculator is provided by the computer on questions where its use would be beneficial. On other questions, solving the problem using scratch paper may be necessary. Expect to see the following concepts covered on this portion of the test:

- Operations with integers and rational numbers, computation with integers and negative rationals, absolute values, and ordering.
- Operations with algebraic expressions that must be solved using simple formulas and expressions, adding and subtracting monomials and polynomials, multiplying and dividing monomials and polynomials, positive rational roots and exponents, simplifying algebraic fractions, and factoring.
- Operations that require solving equations, inequalities, and word problems, solving linear equations and inequalities, using factoring to solve quadratic equations, solving word problems and written phrases using algebraic concepts, and geometric reasoning and graphing.

## Testing Tips

- ✓ Use resources provided such as scratch paper or the calculator to solve the problem. DO NOT attempt to only solve problems in your head.
- ✓ Start the solving process by writing down the formula or mathematic rule associated with solving the particular problem.
- ✓ Put your answer back into the original problem to confirm that your answer is correct.
- ✓ Make an educated guess if you are unsure of the answer.

## Algebra Tips

Test takers should be familiar with the following concepts. For specific practice exercises using these concepts, please utilize the resources listed at the end of this guide.

Understanding a number line

Adding and subtracting negative numbers

Using exponents

Finding a square root

Writing algebraic expressions

Using parentheses in algebraic expressions

Evaluating formulas

Multiplying binomials

Using proportions to solve problems

Combining like terms

Evaluating expressions

Solving linear equations

Solving equations (+, -, ×, ÷)

## Practice Questions

### Order of Operations

1.  $3 \cdot 7^2$

2.  $3 + 2(5) - |-7|$

3.  $\frac{4^2 - 5^2}{(4 - 5)^2}$

*Please note: Multiplication signs may take the form of an x, \*, or •*

### Scientific Notation

Write the following in Scientific Notation. Write in expanded form.

1. 0.00000000000523

2.  $6.02 \times 10^{11}$

Simplify. Write answers in scientific notation.

1.  $(3 \times 10^3)(5 \times 10^6)$

2.  $\frac{6 \times 10^9}{3 \times 10^4}$

### Substitution

Find each value if  $x = 3$ ,  $y = -4$ , and  $z = 2$ .

1.  $xyz - 4z$

2.  $\frac{5x - z}{xy}$

### **Linear equations in one variable**

Solve the following for  $x$ .

1.  $6x - 48 = 6$

2.  $50 - x - (3x + 2) = 0$

### **Formulas**

1. Solve  $PV = nRT$  for  $T$ .

2. Solve  $y = hx + 4x$  for  $x$ .

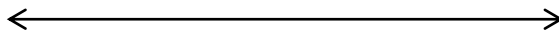
### **Word Problems**

1. One number is 5 more than twice another number. The sum of the numbers is 35. Find the numbers.
2. Sheila bought burgers and fries for her children and some friends. The burgers cost \$2.05 each and the fries are \$.85 each. She bought a total of 14 items, for a total cost of \$19.10. How many of each did she buy?

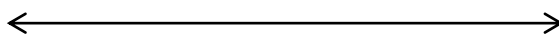
### **Inequalities**

Solve and graph on the number line.

1.  $2x - 7 \geq 3$



2.  $3(x - 4) - (x + 1) < -12$



### **Exponents & Polynomials**

Simplify and write answers with positive exponents.

1.  $(3x^2 - 5x - 6) + (5x^2 + 4x + 4)$

2.  $\frac{24x^4 - 32x^3 + 16x^2}{8x^2}$

3.  $(5a + 6)^2$

### **Factoring**

1.  $x^2 + 5x - 6$

2.  $2x^2 + 4x - 16$

3.  $4x^2 - 36$

4.  $49y^2 + 84y + 36$

### **Quadratic Equations**

1.  $4a^2 + 9a + 2 = 0$

2.  $(3x + 2)^2 = 16$

## Rational Expressions

Perform the following operations and simplify where possible. If given an equation, solve for the variable.

1.  $\frac{4}{2a-2} + \frac{3a}{a^2-a}$

2.  $\frac{16-x^2}{x^2+2x-8} \div \frac{x^2-2x-8}{4-x^2}$

## Graphing

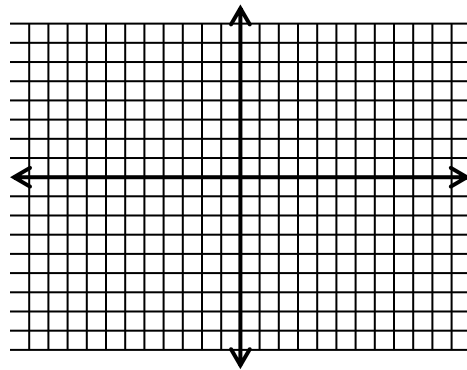
Graph each equation on the coordinate axis.

1.  $3x - 2y = 6$

2.  $x = -3$

3.  $y = 2$

4.  $y = \frac{-2}{3}x + 5$



## Systems of Equations

Solve the following systems of equations.

1.  $\begin{cases} 2x - 3y = -12 \\ x - 2y = -9 \end{cases}$

2.  $\begin{cases} 2x - 3y = -4 \\ y = -2x + 4 \end{cases}$

## Radicals

Simplify the following using the rules of radicals (rationalize denominators). All variables represent positive numbers.

1.  $(\sqrt{8})(\sqrt{10})$

2.  $2\sqrt{18} - 5\sqrt{32} + 7\sqrt{162}$

3.  $\sqrt{\frac{12}{18}} \cdot \sqrt{\frac{15}{40}}$

4.  $(2\sqrt{3} + 5\sqrt{2})(3\sqrt{3} - 4\sqrt{2})$

## Answers

### Order of Operations

- 147
- $3 + 2(5) - |-7| = 3 + 10 - 7 = 13 - 7 = 6$
- 9

**Rule 1:** Simplify all operations inside parentheses.

**Rule 2:** Simplify all exponents, working from left to right.

**Rule 3:** Perform all multiplications and divisions, left to right.

**Rule 4:** Perform all additions and subtractions, left to right.

To help remember the order of operations, use the mnemonic **PEMDAS**, which stands for *Please Excuse My Dear Aunt Sally* (Parentheses, Exponents, Multiplication & Division, Addition & Subtraction).

### Scientific Notation

All numbers in scientific notation have the following form:

*nonzerodigit.restofnumber*  $\times 10^{\text{power}}$ .

1.  $0.00000000000523 = 5.23 \times 10^{-12}$

2. 602,000,00,000

1.  $(3 \times 10^3)(5 \times 10^6) = 3 \cdot 5 \times 10^3 \cdot 10^6 = 15 \times 10^9 = 1.5 \times 10^{10}$

2.  $\frac{6 \times 10^9}{3 \times 10^4} = \frac{6}{3} \times \frac{10^9}{10^4} = 2 \times 10^5$

### Substitution

1.  $xyz - 4z = (3)(-4)(2) - 4(2) = -24 - 8 = -32$

2.  $\frac{5x - z}{xy} = \frac{5(3) - 2}{(3)(-4)} = \frac{13}{-12} = -\frac{13}{12}$

### Linear equations in one variable

1.  $6x - 48 = 6 \Rightarrow 6x - 48 + 48 = 6 + 48 \Rightarrow 6x = 54 \Rightarrow \frac{6x}{6} = \frac{54}{6} \Rightarrow x = 9$

2.  $x = 12$

### Formulas

1.  $PV = nRT \Rightarrow \frac{PV}{nR} = \frac{nRT}{nR} \Rightarrow \frac{PV}{nR} = T$

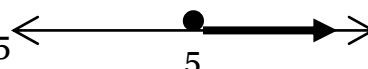
2.  $y = hx + 4x \Rightarrow y = x(h + 4) \Rightarrow \frac{y}{h + 4} = \frac{x(h + 4)}{h + 4} \Rightarrow \frac{y}{h + 4} = x$

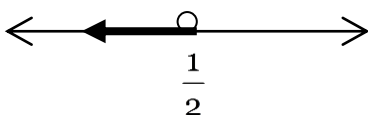
## Word Problems

- $x =$  "another number" and  $2x + 5 =$  "one number." Remember, sum means to add.  $x + 2x + 5 = 35$  therefore  $x = 10$  which is "another number."  $2x + 5 = 25$  which is "one number."
- Let  $x =$  the number of burgers and  $14 - x =$  the number of fries. To get the total amount of money spent, multiply the number of items by the cost of the item.  $2.05x =$  the total dollars spent on burgers and  $.85(14 - x) =$  the total dollars spent on fries. The equation is:  $2.05x + .85(14 - x) = 19.10$ . Solving the equation,  $x = 6$ . Hence, she bought 6 burgers and 8 fries.

## Inequalities

Solve inequalities the same as equations with one exception. When both sides are multiplied or divided by a negative number, remember to switch the direction of the inequality.

1.  $2x - 7 \geq 3 \Rightarrow 2x - 7 + 7 \geq 3 + 7 \Rightarrow 2x \geq 10 \Rightarrow \frac{2x}{2} \geq \frac{10}{2} \Rightarrow x \geq 5$  

2.  $x < \frac{1}{2}$  

## Exponents & Polynomials

- Add like terms:  $(3x^2 - 5x - 6) + (5x^2 + 4x + 4) = 8x^2 - x - 2$
- $\frac{24x^4 - 32x^3 + 16x^2}{8x^2} = \frac{24x^4}{8x^2} - \frac{32x^3}{8x^2} + \frac{16x^2}{8x^2} = 3x^2 - 4x + 2$
- $(5a + 6)^2 = (5a + 6)(5a + 6) = 25a^2 + 30a + 30a + 36 = 25a^2 + 60a + 36$

## Factoring

Steps to factoring, the FOIL method:

- Always factor out the Greatest Common Factor (if possible).
- Factor the first and last term.
- Figure out the middle term.

- $x^2 + 5x - 6 \rightarrow (x + 6)(x - 1)$ , to check, multiply back using FOIL method

$$2. 2x^2 + 4x - 16 \longrightarrow 2(x^2 + 2x - 8) \longrightarrow 2(x-2)(x+4)$$

$$3. 4x^2 - 36 \longrightarrow 4(x^2 - 9) \longrightarrow 4(x+3)(x-3)$$

$$4. (7y+6)^2$$

### Quadratic Equations

Steps:

1. Get zero on one side of the equals
2. Factor
3. Set each factor to zero
4. Solve for your variable

If you cannot factor the equation and the quadratic is in the form

$ax^2 + bx + c = 0$ , then use the quadratic formula.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$1. 4a^2 + 9a + 2 = 0 \Rightarrow (4a+1)(a+2) = 0 \Rightarrow 4a+1=0 \text{ or } a+2=0 \Rightarrow a = -\frac{1}{4} \text{ or } a = -2$$

2. The solution is given below:

$$(3x+2)^2 = 16 \Rightarrow 9x^2 + 12x + 4 = 16 \Rightarrow 9x^2 + 12x + 4 - 16 = 16 - 16 \Rightarrow 9x^2 + 12x - 12 = 0 \\ \Rightarrow 3(3x+4x-4) = 0 \Rightarrow 3(3x-2)(x+2) = 0 \Rightarrow x = \frac{2}{3} \text{ or } x = -2$$

## Rational Expressions

1. First, find a common denominator (factor denominators to see what you need), add, and then reduce (if possible) at the very end.

$$\begin{aligned}\frac{4}{2a-2} + \frac{3a}{a^2-a} &= \frac{4}{2(a-1)} + \frac{3a}{a(a-1)} = \frac{4}{2(a-1)} \cdot \frac{a}{a} + \frac{3a}{a(a-1)} \cdot \frac{2}{2} = \frac{4a}{2a(a-1)} + \frac{6a}{2a(a-1)} = \frac{10a}{2a(a-1)} \\ &= \frac{5}{a-1}\end{aligned}$$

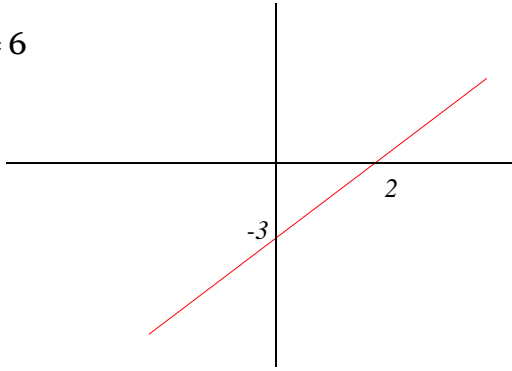
2. Division is the same process with one extra step (invert & multiply):  $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$

One other hint:  $(1-x) = -(x-1)$

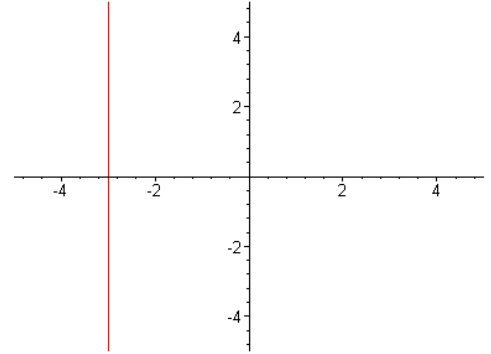
$$\begin{aligned}\frac{16-x^2}{x^2+2x-8} \div \frac{x^2-2x-8}{4-x^2} &= \frac{(4-x)(4+x)}{(x-2)(x+4)} \div \frac{(x-4)(x+2)}{(2-x)(2+x)} = \frac{(4-x)(4+x)}{(x-2)(x+4)} \cdot \frac{(2-x)(2+x)}{(x-4)(x+2)} \\ &= \frac{-(x-4)(4+x)}{(x-2)(x+4)} \cdot \frac{-(x-2)(2+x)}{(x-4)(x+2)} = \frac{\cancel{-(x-4)}(4+x)}{(x-2)(x+4)} \cdot \frac{\cancel{-(x-2)}(2+x)}{\cancel{(x-4)}(x+2)} = 1\end{aligned}$$

## Graphing

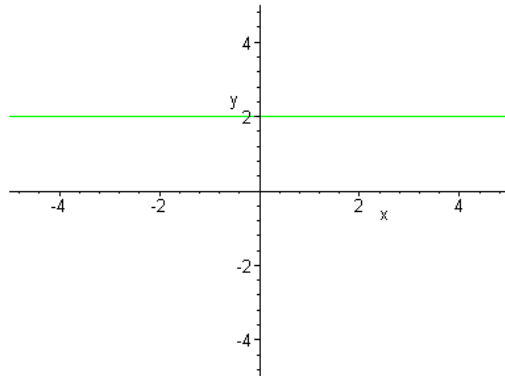
1.  $3x - 2y = 6$



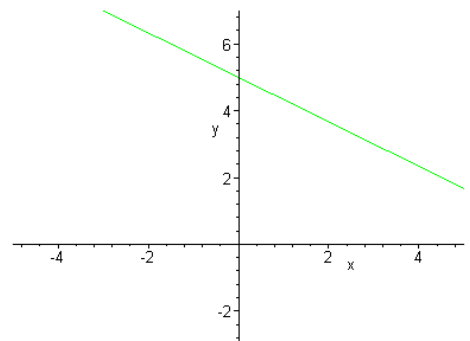
2.  $x = -3$



3.  $y = 2$



4.  $y = \frac{-2}{3}x + 5$



## Systems of Equations

The following are 2 dimensional linear equations. Each equation represents a line that can be graphed on the coordinate plane. The ultimate solution to a system of equations is for the lines to intersect in one point such as question #1 and #2.

1. The answer is  $x = 3$  and  $y = 6$ . The work is below.

$$2x - 3y = -12$$

$$2x - 3y = -12$$

$$x - 2y = -9 \quad \text{Multiply by } -2 \rightarrow \underline{-2x + 4y = 18}$$

$$y = 6 \quad \text{Now, substitute into the first equation}$$

$$2x - 3(6) = -12 \quad \Rightarrow \quad x = 3$$

2.  $x = 1, y = 2$

## Radicals

Think of the index (index  $\sqrt{\quad}$ ) as a door person. If it is two, then two identical factors inside become one outside. Also, remember these properties:

$$\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$$

$$1. (\sqrt{8})(\sqrt{10}) = \sqrt{8 \cdot 10} = \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5} = 2 \cdot 2\sqrt{5} = 4\sqrt{5}$$

$$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$$

$$2. \sqrt{\frac{12}{18}} \cdot \sqrt{\frac{15}{40}} = \sqrt{\frac{2}{3}} \cdot \sqrt{\frac{3}{8}} = \sqrt{\frac{2 \cdot 3}{3 \cdot 8}} = \sqrt{\frac{6}{24}} = \frac{\sqrt{6}}{\sqrt{24}} = \frac{\sqrt{6}}{2\sqrt{6}} = \frac{1}{2}$$

Continue to reduce to yield the answer

3. Worked out below.

$$2\sqrt{18} - 5\sqrt{32} + 7\sqrt{162} =$$

$$2\sqrt{9 \cdot 2} - 5\sqrt{16 \cdot 2} + 7\sqrt{81 \cdot 2}$$

$$2 \cdot 3\sqrt{2} - 5 \cdot 4\sqrt{2} + 7 \cdot 9\sqrt{2}$$

$$6\sqrt{2} - 20\sqrt{2} + 63\sqrt{2}$$

They all have  $\sqrt{2}$  as a factor

$$49\sqrt{2}$$

4. Worked out below.

$$(2\sqrt{3} + 5\sqrt{2})(3\sqrt{3} - 4\sqrt{2}) = 6\sqrt{9} - 8\sqrt{6} + 15\sqrt{6} - 20\sqrt{4} = 18 - 8\sqrt{6} + 15\sqrt{6} - 40 = -22 + 7\sqrt{6}$$

\*\*Use the FOIL method and multiply