

**Algebra:** Algebra is the use of symbols to represent numbers, together with rules for manipulating these symbols.

Ex: Instead of writing the rule for division by a fraction in terms of numbers as  $\frac{7/13}{5/6} = \frac{7}{13} \cdot \frac{6}{5}$ , we can write  $\frac{a/b}{c/d} = \frac{a}{b} \cdot \frac{d}{c}$ . The rule in terms of symbols is interpreted as true for any numbers (except division by 0), while the rule in terms of numbers may be true only for those particular numbers.

**Distributive Law:** One rule of algebra which is used very often is called the **distributive law**

$$a(b+c) = ab+ac. \text{ This rule can be worked either forward or backward: } ab+ac = a(b+c).$$

Use of this rule in both directions should become automatic. It may not be the correct thing to do at any particular step but it should become automatic to think of either expanding a product or of factoring a sum.

$$\text{Special Cases: } (a \pm b)^2 = a^2 \pm 2ab + b^2 \quad (a+b)(a-b) = a^2 - b^2 \text{ (MEMORIZE!!)}$$

Ex: What is  $67 \times 73$  ?

$$\text{Soln: } 67 \times 73 = (70-3)(70+3) = 70^2 - 3^2 = 4900 - 9 = 4891.$$

Ex: Rationalize  $\frac{1}{1+\sqrt{2}}$ .

$$\text{Soln: } \frac{1}{1+\sqrt{2}} = \frac{\sqrt{2}-1}{\sqrt{2}-1} \cdot \frac{1}{\sqrt{2}+1} = \frac{\sqrt{2}-1}{(\sqrt{2})^2-1^2} = \frac{\sqrt{2}-1}{2-1} = \sqrt{2}-1.$$

**Rules Of Exponents:**  $\boxed{a^n = a \cdot a \cdot a \dots \cdot a}$  ( $n$  factors  $a$ ).

$a$  is called the **base** while  $n$  is called the **exponent** and the result is called the **power**.

Rules for manipulating exponents are:  $a^0 = 1$ .  $a^1 = a$ .  $\boxed{a^{-n} = \frac{1}{a^n}}$ .  $(a \cdot b)^n = a^n \cdot b^n$ .

$$\boxed{a^n \cdot a^m = a^{n+m}}. \quad (a^n)^m = a^{n \cdot m}. \quad a^{1/2} = \sqrt{a}. \quad a^{1/3} = \sqrt[3]{a}. \quad a^{1/n} = \sqrt[n]{a}. \quad a^{m/n} = (a^{1/n})^m.$$

Special values:  $2^5 = 32$ .  $3^5 = 243$ .  $2^{10} = 1024$ .  $(-1)^n = \pm 1$  as  $n$  is even or odd.

$0^0$  is not defined.

Exponents can have any values, not just integers or fractions.

Learn to use your calculator to find any power of any number.

## Algebra 1 Homework Problems

(NO CALCULATORS)

- Express 47% of 138 as a decimal correct to three significant digits.
- To what whole number is  $101^2$  equivalent?
- To what whole number is  $57^2$  equivalent?

**RATIONALIZE THE DENOMINATOR AND REDUCE TO SIMPLEST FORM**

d)  $\frac{5}{2\sqrt{3}+2}$

e)  $\sqrt{\frac{2}{3}}$

f)  $\frac{3}{\sqrt[3]{6}}$

g)  $3x\left(\sqrt[4]{\frac{y}{2x}}\right)$

h)  $\sqrt{\frac{a-b}{a+b}}$

i)  $\frac{4xy^2}{\sqrt[3]{2xy^2}}$

j)  $\sqrt[5]{\frac{3}{2}}$

k)  $\frac{1+\sqrt{3}}{1-\sqrt{3}}$

l)  $\frac{\sqrt{x-1}-\sqrt{x+1}}{\sqrt{x-1}+\sqrt{x+1}}$

**FIND THE PRODUCTS**

m)  $(x-4)(x+7)$

n)  $(2x-3)(4x+1)$

o)  $(2t^2+s)(3t^2+4s)$

p)  $(z-x)(x^2+xz+z^2)$

q)  $(x+3y)(x^2-3xy+9y^2)$

r)  $(u+2)(u-2)(u^2+4)(u^4+16)$

**EVALUATE**

s)  $\left(\frac{3}{4}\right)^{-3}$

t)  $(0.02)^{-2}$

u)  $\left(\frac{64}{27}\right)^{2/3}$

v)  $(-37^3)^{1/3}$

w)  $-(-1)^{-17/23}$

x)  $17^{13}/17^{14}$

y)  $4^3 \bullet 17^0$

z)  $12^{3.1}(3^{4.3})(12^{-1.6}) \bullet 3^{1.4}/3^{4.2}$

aa)  $9^{2.6} \bullet 9^{-1.8}/9^{-0.2}$

ab) Evaluate:  $(9999)(8)$  .ac) Evaluate:  $99999 \times 99999$  .

ad) Spikes 2.25 cm long are cut from metal rods 4 m long. How many complete spikes can be formed from one rod?

ae) A stack of 100 new one-dollar bills is 1 cm high. What is the height in meters of a stack containing 1 million one-dollar bills?

af) If there are 240 boys in a school with a total enrollment of 720 students, what percent of the students are girls?

ag) A pole is painted in red, white, and blue sections. If  $\frac{1}{3}$  of the pole is white, and  $\frac{1}{4}$  is red, what fraction of the pole is blue?