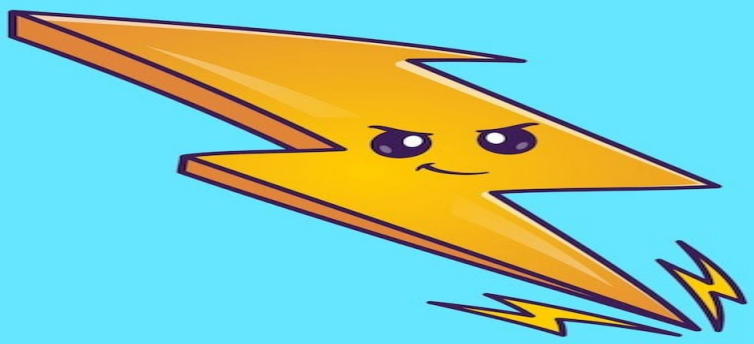

May The Power Be with You!

Carole Greenes

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AUTHOR BIO

Carole Greenes, Ed.D. is Professor Emerita, Mathematics Education at Arizona State University. While at ASU, she served as Associate Vice President for STEM Education, Dean of the School of Educational Innovation and Teacher Preparation, Director of the Practice Research and Innovation in Mathematics Education (PRIME) Center, Director of the Vertically Integrated Projects program that provides research experiences for undergraduate students, and Professor of Mathematics Education in the Ira A. Fulton Schools of Engineering, the College of Liberal Arts and Sciences, and the Mary Lou Fulton Teachers College. Prior to working at ASU, she was Professor of Mathematics Education at Boston University. Currently, she directs the PRIME Group that develops books of challenge problems and games for students, grades K – 12, and authors Carole's Corner for the Center for Mathematics and Teaching, Inc. in California. Carole has authored more than 350 books for students and teachers; 82 articles; six mathematical musicals; and two histories of mathematics in story and song. In 2003, she was inducted into the Massachusetts Mathematics Educators' Hall of Fame. In 2011, she received the NCSM Ross Taylor/Glenn Gilbert National Leadership Award in Mathematics Education. In 2016, she received the Copper Apple Award for Leadership in Mathematics in Arizona, and in 2018 she received the National Council of Teachers of Mathematics Lifetime Achievement Award. Her 2021 - 2025 books/games include: *What's My Angle?*, *Alge-Grid: What's the a?, Pattern Grid-unLocks, Play It Positively or Negatively!*, *Factor Max, Make It Proper, Shape Up, Function Frenzy, What's My Angle?*, and *READY-X?* - all of which were co-authored by high school or college students. She has solo-authored the algebraic reasoning book, *SMARTY; EGAD* focusing on data analyses, and this current book, May *The Power Be with You!,* focusing on exponential relationships,
All 2021 - 2025 books are available at no cost at the Center for Mathematics and Teaching.

May The Power Be with You!

Sets of algebraic equations provide clues to the values of letters in given words. Equations incorporate one or more letters in the given word,
and some letters have exponents. All letter values are whole numbers.

Solutions provide values of the various letters. Method for identifying the values, are labeled Possible Solution Method, since solvers may use the clues in varying order.

Exponent Rules

- **Identity Exponent: Any number to the first power is equal to itself:**
  $A^1 = A$
  Example: $9^1 = 9$
- **Zero Power: Any number raised to the zero power is equal to 1:**
  $A^0 = 1$
  Example: $5^0 = 1$
- **Power of A Power: Raising a power to another power, you multiply the powers.**
  $(A^m)^n = A^{m \times n}$
  Example: $(2^2)^3 = 2^{2x3} = 2^6 = 64$
- **Negative Exponent: To change a negative exponent to a positive one, you flip the number so that the numerator and denominator change places.**
  $A^{-m} = 1/A^m$
  Example: $2^{-3} = 1/2^3 = 1/8$
- **Fraction Exponent: The numerator is the power, and the denominator is the root.**
  Examples: $A^{1/2}$ = Square Root of A. $A^{1/3}$ is the Cube Root of A.
  Example: $9^{1/2} = 3$. Example: $9^{2/3} = 6$. Example: $9^{2/3} = 6$.
- **Power Quotient: To find the quotient of two numbers with the same base, subtract the exponent of the denominator from the exponent of the numerator.**
  $A^m/A^n = A^{m-n}$
  Example: $2^5/2^3 = 2^{(5-3)} = 2^2 = 4$.

Section 1: Power Play

PRO

Use the Clues to figure out the value of each letter in the word PRO.

Clues:

1. **$2P = 4$**
2. **$P + O + R = 13$**
3. **$O = P^2 - 1$.**

Record the value of each letter.

P = _____ R = _____ O = _____

Your Solution method: Show the steps.

ROPE

Use the Clues to figure out the value of each letter in the word ROPE.

Clues:

1. **O = 2P**
2. **R = 7^0**
3. **E = 3^2**
4. **P = 2R**

Record the value of each letter.

R = _____ O = _____ P = _____ E= _____

Your Solution method: Show the steps.

SPAT

Use the Clues to figure out the value of each letter in the word SPAT.

Clues:

1. $O = (S - T)^2$
2. $A - S = 2$
3. $P = (A + S + T)^0$
4. $(A - P)^2 = 100$

Record the value of each letter.

S = _____ P = _____ A = _____ T = _____

Your Solution method: Show the steps.

REST

Use the Clues to figure out the value of each letter in the word REST.

Clues:

1. **$E/R = T$**
2. **$R^2 = 36$**
3. **$E = 3 \times 2^2$**
4. **$T^4 + 2T = S$**

Record the value of each letter.

S = _____ P = _____ A = _____ T= _____

Your Solution method: Show the steps.

SPAR

Use the Clues to figure out the value of each letter in the word SPAR.

Clues:

1. **$S + P = 4A$**
2. **$R^2 + 1 = A$**
3. **$R/S = 2$**
4. **$A^2 = 25$**

Record the value of each letter.

S = _____ P = _____ A = _____ R = _____

Your Solution method: Show the steps.

POWER

Use the Clues to figure out the value of each letter in the word POWER.

Clues:

1. **$W = 2P$**
2. **$P - O = 1$**
3. **$O^3 = R$**
4. **$3^2 - 1 = W$**
5. **$E + R = 6^2$**

Record the value of each letter:

P = _____ O = _____ W = _____ E = _____ R = _____

Your Solution method: Show the steps.

REPEL

Use the Clues to figure out the value of each letter in the word REPEL

Clues:

1. $E^2 = R$
2. $P = 9^2$
3. $L^2 + 17 = P$
4. $R + E == 30$

Record the value of each letter.

R = _____ E = _____ P = _____ E = _____ L = _____

Your Solution method: Show the steps.

DEFEND

Use the Clues to figure out the value of each letter in the word DEFEND.

Clues:

1. **$D = 2^3$**
2. **$D - 3E = E$**
3. **$N - F = 2^2$**
4. **$N + F = 22$**

Record the value of each letter.

D = _____ E = _____ F = _____ E = _____ N = _____ D = _____

Your Solution: Show the steps.

Section 2: Roots Have Power

CUT

Use the Clues to figure out the value of each letter in the word CUT.

Clues:

1. **$U/2 = 2$**
2. **$T^2 = C$**
3. **$C^{1/2} = 3$**

HINT: $C^{1/2}$ is the square root of C.

Record the value of each letter.

C = _____ U = _____ T = _____

Your Solution method: Show the steps.

APT

Use the Clues to figure out the value of each letter in the word CUT.

Clues:

1. **$2P = 14$**
2. **$P + T = 100^{1/2}$**
3. **$A^{1/2} = 5$**

Record the value of each letter.

A = _____ P = _____ T = _____

Your Solution method: Show the steps.

GREW

Use the Clues to figure out the value of each letter in the word GREW.

Clues:

1. $E^{1/2} + R = 8$
2. $E + W = 2G$
3. $G = 100^{1/2}$
4. $G + 1 = W$

Record the value of each letter.

G = _____ R = _____ E = _____ W = _____

Your Solution method: Show the steps.

RULE

Use the Clues to figure out the value of each letter in the word RULE.

Clues:

1. $R^{1/3} + E = 15$ **HINT: $R^{1/3}$ is the cube root of R.**
2. $E \times L = E$
3. $(R + L)^{1/2} = 3$
4. $R/U = 2$

Record the value of each letter.

R = _____ U = _____ L = _____ E = _____

Your Solution method: Show the steps.

SAVE

Use the Clues to figure out the value of each letter in the word SAVE.

Clues:

1. $S^{1/2} = 4$
2. $V^{1/3} = 3$
3. $A^{1/2} + E = 7$
4. $E^3 = S/2$

Record the value of each letter.

S = _____ A = _____ V = _____ E = _____

Your Solution method: Show the steps.

HANDY

Use the Clues to figure out the value of each letter in the word HANDY.

Clues:

1. $D^2 - Y^2 = 44$
2. $(H + 6)^{1/3} = 3$
3. $A + 3N = D$
4. $H/(A^{1/2}) = 7$
5. $D - Y = 2$

Record the value of each letter.

H = _____ A = _____ N = _____ D = _____ Y = _____

Your Solution method: Show the steps.

RIDDLE

Use the Clues to figure out the value of each letter in the word RIDDLE.

Clues:

1. $D^0 \times D = 8$
2. $R^{1/3} + R = 30$
3. $(L \times D)^{1/2} = 4$
4. $E^{1/2} \times L = D$
5. $R/I = 3$

Record the value of each letter.

R =_____ I = _____ D = _____ D = _____L = _____ E = _____

Your Solution method: Show the steps.

WANDER

Use the Clues to figure out the value of each letter in the word WANDER.

Clues:

1. $W^5 = 1$
2. $N + D = 21$
3. $N^{1/4} = 2$
4. $W^3 \times R = 31$
5. $E^{1/2} = D$
6. $(A^{1/3} + 2)^2 = E$

Record the value of each letter.

W =_____ A = _____ N = _____ D = _____E = _____ R = _____

Your Solution method: Show the steps.

Section 3: Power Products

HAT

Use the Clues to figure out the value of each letter in the word HAT.

Clues:

1. $(A^1)^2 = 9$
2. $(A\text{-}T)^3 = 8$
3. $(H^2)^2 = 16$

Record the value of each letter.

H =_____ A = _____ T = _____

Your Solution method: Show the steps.

DUB

Use the Clues to figure out the value of each letter in the word DUB.

Clues:

1. $(D^{1})^{2} = 8$
2. $(B^{3)2} = 64$
3. $D + U^{2} = 18$
4. $B + D = (D + U) - 1$

Record the value of each letter.

H =_____ A = _____ T = _____

Your Solution method: Show the steps.

BAIT

Use the Clues to figure out the value of each letter in the word BAIT.

Clues:

1. $B^0 + B^3 + B = 11$
2. $I/5 = B$
3. $[(T-A)^2]^5 = 1$
4. $[(A- B)^2]^3 = 64$

Record the value of each letter.

B =_____ A = _____ I = _____T = _____

Your Solution method: Show the steps.

DATE

Use the Clues to figure out the value of each letter in the word DATE.

Clues:

1. $D^2 - A^2 = T^2$
2. $(T^2)^2 = 81$
3. $(E - A)^3 = E^2$
4. $T^0 + E^2 = 65$

Record the value of each letter.

D =_____ A = _____ T = _____ E = _____

Your Solution method: Show the steps.

WANT

Use the Clues to figure out the value of each letter in the word WANT.

Clues:

1. $A + W = N$
2. $(T^4 + N)^2 = 100$
3. $(W - A)^4 = T$
4. $(N + 1)^2 = 10^2$

Record the value of each letter.

W =_____ A = _____ N = _____ T = _____

Your Solution method: Show the steps.

FETCH

Use the Clues to figure out the value of each letter in the word FETCH.

Clues:

1. $(E + C)^2 = F^2$
2. $(T – F)^2 = 25$
3. $(E^2)^2 = 16$
4. $(F/E)^2 = 25$
5. $T = C+ H$

Record the value of each letter.

F =_____ E = _____ T = _____ C = _____ H = _____

Your Solution method: Show the steps.

REMADE

Use the Clues to figure out the value of each letter in the word REMADE.

Clues:

1. $D^2 = 64$
2. $3^3 = A \times E$
3. $M^2 = 49$
4. $(R^2)^2 = 2D$
5. $(M + R)^2 = A^2$

Record the value of each letter.

R =_____ E = _____ M = _____ A = ____ D = _____ E = _____

Your Solution method: Show the steps.

SCHEMED

Use the Clues to figure out the value of each letter in the word SCHEMED.

Clues:

1. $(C - S)^2 = D^2$
2. $(M^2)^2 = \frac{1}{2} S$
3. $S/E = M$
4. $(M + D)^2 - 2 = H$
5. $S = 2^{(2 + 3)}$
6. $C - S = 4$

Record the value of each letter.

R =_____ E = _____ M = _____ A = ____ D = _____ E = _____

Your Solution method: Show the steps.

Section 4: Power Pairs

ELM

Use the Clues to figure out the value of each letter in the word ELM.

Clues:

1. **2 x 1/3 E = M**
2. **M^4/M^2 = E x L**
3. **E^2 = 81**

Record the value of each letter.

E = _____ L = _____ M = _____

Your Solution method: Show the steps.

FIR

Use the Clues to figure out the value of each letter in the word FIR.

Clues:

1. $I^2 = (F + R)^2$
2. $R^5/R^3 = 4$
3. $(F^2)^2 = 81$

Record the value of each letter.

F = _____ I = _____ R = _____

Your Solution method: Show the steps.

PALM

Use the Clues to figure out the value of each letter in the word PALM.

Clues:

1. $A^5/A = M$
2. $P^{1/3} = A$
3. $L^5/L^4 = 1$
4. $(L + A)^3 = 27$

Record the value of each letter.

P = _____ A = _____ L = _____ M = _____

Your Solution method: Show the steps.

TEAK

Use the Clues to figure out the value of each letter in the word TEAK.

Clues:

1. $(E - K)^2 = T$
2. $5K = 25$
3. $A^9/A^7 = 49$
4. $T^{1/2} = K$

Record the value of each letter.

T = _____ E = _____ A = _____ K = _____

Your Solution method: Show the steps.

MAPLE

Use the Clues to figure out the value of each letter in the word MAPLE.

Clues:

1. $P^5/P^3 = 9$
2. $L = ¼ M$
3. $P^3 = A$
4. $(E + M)^2 = 400$
5. $M^6/M^4 = 64$

Record the value of each letter.

M = _____ A = _____ P = _____ L = _____ E = _____

Your Solution method: Show the steps.

CEDAR

Use the Clues to figure out the value of each letter in the word CEDAR.

Clues:

1. $E^{1/2} + 5 = R$
2. $3A = R$
3. $(A - 1)^4 = C$
4. $(D + R + 6)^{1/2} = 6$
5. $R^7/R^5 = 144$

Record the value of each letter.

C = _____ E = _____ D = _____ A = _____ R = _____

Your Solution method: Show the steps.

NUTMEG

Use the Clues to figure out the value of each letter in the word NUTMEG.

Clues:

1. $(T - E)^2 = E$
2. $N^6/N^3 = 5E$
3. $G + E^{1/2} = 6$
4. $(T - 2M)^2 = 100$
5. $(U/7)^4 = G$
6. $G^{1/10} = G$

Record the value of each letter.

N = _____ U = _____ T = _____ M = _____ E = _____ G = _____

Your Solution method: Show the steps.

WALNUT

Use the Clues to figure out the value of each letter in the word WALNUT.

Clues:

1. $A^5/A^2 + 1 = N$
2. $(T + 1)^{1/2} = U$
3. $N^{1/2} + L = W$
4. $U^8/U^6 = 16$
5. $L^4 = N^2$
6. $(A + U)^2 = 36$

Record the value of each letter.

W = _____ A = ____ L = _____ N = _____ U = _____ T = _____

Your Solution method: Show the steps.

Section 5: Fraction Powers

ALE

Use the Clues to figure out the value of each letter in the word ALE.

Clues:

1. $(1/2)^2 \times L = 1$
2. $(1/5)^2 \times E^2 = 1$
3. $E - L = A^2$

Record the value of each letter.

A = _____ L = _____ E = _____

Your Solution method: Show the steps.

TEA

Use the Clues to figure out the value of each letter in the word TEA.

Clues:

1. $A + E = 5^2$
2. $T/(1/2)^3 = 1$
3. $A = 3^2$

Record the value of each letter.

T = _____ E = _____ A = _____

Your Solution method: Show the steps.

COLA

Use the Clues to figure out the value of each letter in the word COLA.

Clues:

1. $C^3 = A$
2. $O^2 = 25$
3. $L/C = \frac{1}{4}L$
4. $(A^{1/2})^{1/3} = 2$

Record the value of each letter.

C = _____ O = _____ L = _____ A = _____

Your Solution method: Show the steps.

MILK

Use the Clues to figure out the value of each letter in the word MILK.

Clues:

1. $L + K = I$
2. $K^2 - 3I = I$
3. $M^{1/3} \times M^{1/3} = 9$
4. $I^{1/2} + M^{1/3} = 8$

Record the value of each letter.

M = _____ I = _____ L = _____ K = _____

Your Solution method: Show the steps.

CIDER

Use the Clues to figure out the value of each letter in the word CIDER.

Clues:

1. $E^{1/2} + D^{1/2} = 11$
2. $I^{1/4} = C$
3. $R + E^{1/2} = 10$
4. $1/2E - 2 = I$
5. $R^3 = 64$

Record the value of each letter.

C = _____ I = _____ D = _____ E = _____ R= _____

Your Solution method: Show the steps.

JUICE

Use the Clues to figure out the value of each letter in the word JUICE.

Clues:

1. $(I^{1/3})^2 = C$
2. $U^2 = 2^2 \times 3^2$
3. $[(1/2)^2]\ J + E = C$
4. $(1/3)^2 \times C = E$
5. $(E^5 + U\ )^2 = 7^2$

Record the value of each letter.

J = _____ U = _____ I = _____ C = _____ E = _____

Your Solution method: Show the steps.

WATER

Use the Clues to figure out the value of each letter in the word WATER.

Clues:

1. $R - A = 2W$
2. $T^2 \times (T + 1) = E$
3. $(R^{1/2})^{1/2} = W$
4. $W^4 = 81$
5. $(1/3\ E)^2 = 16$

Record the value of each letter.

W = _____ A = _____ T = _____ E = _____ R = _____

Your Solution method: Show the steps.

LEMONADE

Use the Clues to figure out the value of each letter in the word LEMONADE.

Clues:

1. $O^2 + 4 = A$
2. $N^3 = E$
3. $D^{1/6} = N - 1$
4. $A^{1/3} = 5$
5. $A - M = 25$
6. $4(N + 2)^2 = M$
7. $L^{1/4} = N$

Record the value of each letter.

L = _____E = _____M = ____ O = ____ N = ____ A = ____ D = ____ E = ____

Your Solution method: Show the steps.

Section 6: Negative Powers

SHOE

Use the Clues to figure out the value of each letter in the word SHOE.

Clues:

1. $H^{-2} = S/O$
2. $E^3 + S = O$
3. $S^6 = S$
4. $(O + S)^2 = 10^2$

Record the value of each letter.

S = _____H = _____ O = ____ E = ____

Your Solution method: Show the steps.

HEELS

Use the Clues to figure out the value of each letter in the word HEELS.

Clues:

1. **$E/2L = H$**
2. **$L^{-2} \times S = H$**
3. **$(H + E)^2 = 81$**
4. **$L^0 = H$**

Record the value of each letter.

H = _____E = _____ E = ____ L = ____ S = ____

Your Solution method: Show the steps.

BOOTS

Use the Clues to figure out the value of each letter in the word BOOTS.

Clues:

1. $B^{-2} = 1/4$
2. $B^2 = O$
3. $T^2 = S$
4. $(O + T)^2 = 49$

Record the value of each letter.

B= _____O = _____ O = ____ T = ____ S = ____

Your Solution method: Show the steps.

SANDAL

Use the Clues to figure out the value of each letter in the word SANDAL.

Clues:

1. $S^{-2} = 1/(A + N + L)$
2. $N = (A + A)^3$
3. $A = A^0 \times A^0$
4. $49^{1/2} = D$
5. $1/3N \times N = L$

Record the value of each letter.

S = _____A = _____ N = ____ D = ____ A = ____ L = ____

Your Solution method: Show the steps.

BALLET

Use the Clues to figure out the value of each letter in the word BALLET.

Clues:

1. $L^2 - A^2 = 11T$
2. $B^4 = T^2$
3. $A^3/25T = 100$
4. $T^{-3} = 1/64$
5. $(E - T)^2 = B^2$

Record the value of each letter.

B= _____A = _____ L = ____ L = ____ E = ____ T = ____

Your Solution method: Show the steps.

FLATS

Use the Clues to figure out the value of each letter in the word FLATS.

Clues:

1. $(L + T)^2 = 81$
2. $L^{-2} \times L^2 = T$
3. $A^{-3} \times L = 1$
4. $F^2 = 25$
5. $(S + T)^2 = (L + A)^2$

Record the value of each letter.

B= _____A = _____ L = ____ L = ____ E = ____ T = ____

Your Solution method: Show the steps.

SKATES

Use the Clues to figure out the value of each letter in the word FLATS.

Clues:

1. **$K \times E = T$**
2. **$S^6/S^4 = 64$**
3. **$A/K^{1/2} = S$**
4. **$E^{-3} \times S = 1$**
5. **$(T - S)^2 = 100$**

Record the value of each letter.

S = _____K = _____ A = ____ T = ____ E = ____ S = ____

Your Solution method: Show the steps.

LOAFER

Use the Clues to figure out the value of each letter in the word FLATS.

Clues:

1. $(R - O)^5 = 1$
2. $10^2 - R^2 = 19$
3. $E^{-5} \times (L \times O) = 1$
4. $F^3 = 3R$
5. $E^{-3} \times O = 1$
6. $L^{-2} \times (2A + L) = 1$

Record the value of each letter.

L= _____O = _____ A = ____ F = ____ E = ____ R = ____

Your Solution method: Show the steps.

Section 1: Power Play

Solutions

PRO

Use the Clues to figure out the value of each letter in the word PRO.

Clues:

1. **2P = 4**
2. **P + O + R = 13**
3. **O = P^2 – 1.**

Possible Solution method:

Clue 1: 2P = 4. Then, P = 2.

Clue 3: O = P^2 – 1. Replace P with 2.
Then, O = 4 – 1, and O = 3.

Clue 2: P + O + R = 13.
Replace P with 2, and O with 3.
Then, 2 + 3 + R = 13, and R = 8.

P = 2 R = 8 O = 3

ROPE

Use the Clues to figure out the value of each letter in the word PRO.

Clues:

1. **O = 2P**
2. **R = 7^0**
3. **E = 3^2**
4. **P = 2R**

Possible Solution method:

Clue 3: E = 3^2. Then, E = 9.

Clue 2: R = 7^0 Any number to the zero power is equal to 1. Then, R = 1.

Clue 4: P = 2R Replace R with 1. Then, P = 2 x 1, and P = 2.

Clue 1: O = 2P Replace P with 2. Then, O = 2 x 2, and O = 4.

R = 1 O = 4 P = 2 E = 9

SPAT

Use the Clues to figure out the value of each letter in the word SPAT.

Clues:

1. **O = (S – T)2**
2. **A – S = 2**
3. **P = (A + S + T)0**
4. **(A – P)2 = 100**

Possible Solution method:

Clue 3: $P = (A + S + T)^0$. Then, (A + S + T) to the zero power is 1. Then, P = 1.

Clue 4: $(A – P)^2 = 100$. Replace P with 1. Then, $(A – 1)^2 = 100$.
Then, the square root of both sides of the equation is: A – 1 = 10. Then, A = 11.

Clue 2: A – S = 2. Replace A with 11. Then, 11 – S = 2, and S = 9.

Clue 1: $(S – T)^2 = 9$. Then, the square root of both sides of the equation is S - T = 3. Replace S with 9. Then, 9 – T = 3, and T = 6.

S = 9 P = 1 A = 11 T = 6

REST

Use the Clues to figure out the value of each letter in the word REST.

Clues:

1. **$E/R = T$**
2. **$R^2 = 36$**
3. **$E = 3 \times 2^2$**
4. **$T^4 + 2T = S$**

Possible Solution method:

Clue 3: $E = 3 \times 2^2$. Then, $E = 3 \times 4$, and $E = 12$.

Clue 2: $R^2 = 36$. The square root of 36 is 6. Then, $R = 6$.

Clue 1: $E/R = T$. Replace E with 12 and R with 6. Then, $12/6 = 2$. Then, $T = 2$.

Clue 4: $T^4 + 2T = S$. Replace T with 2. Then, $2^4 + 2 \times 2 = S$. Then, $16 + 4 = 20$, and $S = 20$.

$R = 6$ $E = 12$ $S = 20$ $T = 2$

SPAR

Use the Clues to figure out the value of each letter in the word SPAR.

Clues:

1. **$S + P = 4A$**
2. **$R^2 + 1 = A$**
3. **$R/S = 2$**
4. **$A^2 = 25$**

Possible Solution method:

Clue 4: $A^2 = 25$. Then, $A = 5$.

Clue 2: $R^2 + 1 = A$. Replace A with 5. Then, $R^2 + 1 = 5$. Then, $R^2 = 4$, and $R = 2$.

Clue 3: $R/S = 2$. Replace R with 2. Then, $2/S = 2$ and $S = 1$.

Clue 1: $S + P = 4A$. Replace S with 1 and A with 5. Then, $1 + P = 20$, and $P = 19$.

$S = 1 \quad P = 19 \quad A = 5 \quad R = 2$

POWER

Use the Clues to figure out the value of each letter in the word POWER.

Clues:

1. **$W = 2P$**
2. **$P - O = 1$**
3. **$O^3 = R$**
4. **$3^2 - 1 = W$**
5. **$E + R = 6^2$**

Possible Solution method:

Clue 4: $3^2 - 1 = W$. Then, $9 - 1 = W$, and $W = 8$.

Clue 1: $W = 2P$. Replace W with 8. Then, $8 = 2P$, and $P = 4$.

Clue 2: $P - O = 1$. Replace P with 4. Then, $4 - O = 1$, and $O = 3$.

Clue 3: $O^3 = R$. Replace O with 3. Then, $3^3 = 27$, and $R = 27$.

Clue 5: $E + R = 6^2$. Replace R with 27. Then, $E + 27 = 36$, and $E = 9$.

$P = 4$ $O = 3$ $W = 8$ $E = 9$ $R = 27$

REPEL

Use the Clues to figure out the value of each letter in the word REPEL

Clues:

1. **$E^2 = R$**
1. **$P = 9^2$**
2. **$L^2 + 17 = P$**
3. **R + E == 30**

Possible Solution method:

Clue 2: $P = 9^2$. Then, P = 81.

Clue 3: $L^2 + 17 = P$. Replace P with 81. Then, $L^2 + 17 = 81$. Then, $L^2 = 81 – 17$. Then, $L^2 = 64$, and L = 8.

Clue 4: R + E = 30.
Clue 1: $E^2 = R$.
In Clue 4, Replace R with E^2.
Then, $E^2 + E = 30$. Then, E = 5 and R = 25.
Check: 25 + 5 = 30

R = 25 E = 5 P = 81 E = 5 L = 8

DEFEND

Use the Clues to figure out the value of each letter in the word DEFEND.

Clues:

1. **$D = 2^3$**
2. **$D - 3E = E$**
3. **$N - F = 2^2$**
4. **$N + F = 22$**

Possible Solution method:

Clue 1: $D = 2^3$. Then, $D = 8$.

Clue 2: $D - 3E = E$. Add $3E$ to both sides of the equation.
Then, $D = 4E$. Replace D with 8. Then, $8 = 4E$, and $E = 2$.

Clue 3: $N - F = 2^2$. Then, $N - F = 4$.

Clue 4: $N + F = 22$

Add equations in Clues 3 and 4.
$N - F = 4$ + $N + F = 22$. Then, $2N = 26$, and $N = 13$.
Replace N with 13 in either Clue 3 or 4, and solve for F. Clue 4: $13 + F = 22$, and $F = 9$.

D = 8 E = 2 F = 9 E = 2 N = 13 D = 8

Section 2: Roots Have Power

Solutions

CUT

Use the Clues to figure out the value of each letter in the word CUT.

Clues:

1. **$U/2 = 2$**
2. **$T^2 = C$**
3. **$C^{1/2} = 3$**

Possible Solution method:

Clue 1: $U/2 = 2$. Then, $U = 4$.

Clue 3: $C^{1/2} = 3$
$C^{1/2}$ means the square root of C. Then, $C = 9$.

Clue 2: $T^2 = C$
Replace C with 9. Then, $T^2 = 9$, and $T = 3$.

$C = 9$ $U = 4$ $T = 3$

APT

Use the Clues to figure out the value of each letter in the word APT.

Clues:

1. **$2P = 14$**
2. **$P + T = 100^{1/2}$**
3. **$A^{1/2} = 5$**

Possible Solution method:

Clue 1: $2P = 14$. Then, $P = 7$.

Clue 2: $P + T = 100^{1/2}$

$100^{1/2}$ means the square root of 100.

Replace P with 7. Then, $7 + T = 10$, and $T = 3$.

Clue 3: $A^{1/2} = 5$. The square root of A is 5. That means that $A = 25$.

A = 25 P= 7 T = 3

GREW

Use the Clues to figure out the value of each letter in the word GREW.

Clues:

1. **$E^{1/2} + R = 8$**
2. **$E + W = 2G$**
3. **$G = 100^{1/2}$**
4. **$G + 1 = W$**

Possible Solution method:

Clue 3: $G = 100^{1/2}$. The square root of 100 is 10. Then, G = 10.

Clue 4: G + 1 = W. Replace G with 10. Then, 10 + 1 = W, and W = 11.

Clue 2: E + W = 2G. Replace W with 11 and G with 10.
Then, E + 11 = 2 x 10. Then, E + 11 = 20, and E = 9.

Clue 1: $E^{1/2} + R = 8$. Replace E with 9. Then, $E^{1/2} = 3$.
Then, 3 + R = 8, and R = 5.

G = 10 R = 5 E =9 W = 11

RULE

Use the Clues to figure out the value of each letter in the word RULE.

Clues:

1. $R^{1/3} + E = 15$
2. $E \times L = E$
3. $(R + L)^{1/2} = 3$
4. $R/U = 2$

Possible Solution method:

Clue 2: E x L = E. Then, L = 1.

Clue 3: $(R + L)^{1/2} = 3$. Replace L with 1. Then, $(R + 1)^{1/2} = 3$
Then, the square root of R + 1 is 3, and R + 1 = 9. Then, R = 8.

Clue 4: R/U = 2. Replace R with 8. Then, 8/U = 2, and U = 4.

Clue 1: $R^{1/3} + E = 15$. Replace R with 8. The cube root of 8 is 2.
Then, 2 + E = 15, and E = 13.

R = 8 U = 4 L = 1 E = 13

SAVE

Use the Clues to figure out the value of each letter in the word SAVE.

Clues:

1. $S^{1/2} = 4$
2. $V^{1/3} = 3$
3. $A^{1/2} + E = 7$
4. $E^3 = S/2$

Possible Solution method:

Clue 1: $S^{1/2} = 4$. The square root of S is 4. Then, S = 16,

Clue 2: $V^{1/3} = 3$. The cube root of V is 3. Then, V = 27.

Clue 4: $E^3 = S/2$. Replace S with 16. Then, $E^3 = 8$, and E = 2.

Clue 3: $A^{1/2} + E = 7$. Replace E with 2. Then, $A^{1/2} + 2 = 7$.
Then, $A^{1/2} = 5$, and A = 25.

S = 16 A = 25 V = 27 E = 2

HANDY

Use the Clues to figure out the value of each letter in the word HANDY.

Clues:

1. $D^2 - Y^2 = 44$
2. $(H + 6)^{1/3} = 3$
3. $A + 3N = D$
4. $H/(A^{1/2}) = 7$
5. $D - Y = 2$

Possible Solution method:

Clue 2: $(H + 6)^{1/3} = 3$. The cube root of (H + 6) is 3.
Then, H + 6 =27, and H = 21.

Clue 4: $H/(A^{1/2}) = 7$. Replace H with 21. Then, $21/ A^{1/2} = 7$.
Then, $A^{1/2}$ must equal 3. Then, A = 9.

Clue 1: $D^2 - Y^2 = 44$.
Clue 5: D – Y = 2. Then, D = Y + 2.
Clue 1: To get a difference of 44 between the squares of D and Y
when D is 2 greater than Y. Then, D = 12 and Y = 10.

Clue 3: A + 3N = D. Replace A with 9 and D with 12. Then, 9 + 3N = 12.
Then, 3N = 3, and N = 1.

H = 21 A = 9 N = 1 D = 12 Y = 10

RIDDLE

Use the Clues to figure out the value of each letter in the word RIDDLE.

Clues:

1. $D^0 \times D = 8$
2. $R^{1/3} + R = 30$
3. $(L \times D)^{1/2} = 4$
4. $E^{1/2} \times L = D$
5. $R/I = 3$

Possible Solution method:

Clue 1: $D^0 \times D = 8$. Replace D^0 with 1. Then, $1 \times D = 8$, and $D = 8$.

Clue 3: $(L \times D)^{1/2} = 4$. The square root of (L X D) is 4. Then, L X D = 16.
Replace D with 8. Then, $L \times 8 = 16$, and $L = 2$.

Clue 4: $E^{1/2} \times L = D$. Replace L with 2, and D with 8.
Then, $E^{1/2} \times 2 = 8$. Then, $E^{1/2} = 4$, and $E = 16$.

Clue 2: $R^{1/3} + R = 30$. The cube root of R plus R = 30.
Then, R = 27. The cube root of 27 is 3. Check: 27 + 3 = 30.

Clue 5: R/I = 3. Replace R with 27. Then, 27/I = 3, and I = 9.

R = 27 I = 9 D = 8 D =8 L = 2 E = 16

WANDER

Use the Clues to figure out the value of each letter in the word WANDER.

Clues:

1. $W^5 = 1$
2. $N + D = 21$
3. $N^{1/4} = 2$
4. $W^3 \times R = 31$
5. $E^{1/2} = D$
6. $(A^{1/3} + 2)^2 = E$

Possible Solution Method:

Clue 1: $W^5 = 1$. Then, W = 1.

Clue 4: $W^3 \times R = 31$. Replace W with 1. Then, $1 \times R = 31$, and R = 31.

Clue 3: $N^{1/4} = 2$. The fourth root of N is 2. Then, N = 16.

Clue 2: N + D = 21. Replace N with 16. Then, 16 + D = 21, and D = 5.

Clue 5: $E^{1/2} = D$. Replace D with 5. Then, $E^{1/2} = 5$, and E = 25.

Clue 6: $(A^{1/3} + 2)^2 = E$. Replace E with 25. Then, $(A^{1/3} + 2)^2 = 25$.
The square root of both sides of the equal symbol is: $(A^{1/3} + 2) = 5$.
Then, $A^{1/3} + 2 = 5$. Then, $A^{1/3} = 3$. The cube root of A is 3. Then, A = 27.

W = 1 A = 27 N = 16 D = 5 E = 25 R = 31

Section 3: Power Products Solutions

HAT

Use the Clues to figure out the value of each letter in the word HAT.

Clues:

1. $(A^1)^2 = 9$
2. $(A - T)^3 = 8$
3. $(H^2)^2 = 16$

Possible Solution method:

Clue 1: $(A^1)^2 = 9$. Then, $A^{(1 \times 2)} = 9$. Then, $A^2 = 9$, and A = 3.

Clue 2: $(A-T)^3 = 8$. Replace A with 3. Then, $(3 - T)^3 = 8$ and T = 1.

Clue 3: $(H^2)^2 = 16$. Then, $H^{(2 \times 2)} = 16$. Then, $H^4 = 16$, and H = 2.

H = 2 A = 3 T = 1

DUB

Use the Clues to figure out the value of each letter in the word DUB.

Clues:

1. $(D^1)^2 = 81$
2. $(B^{3)2} = 64$
3. $D + U^2 = 18$

Possible Solution method:

Clue 1: $(D^1)^2 = 81$. Then, $D^{(1 \times 2)} = 81$. Then, $D^2 = 81$, and $D = 9$.

Clue 2: $(B^3)^2 = 64$. Then, $B^{(3 \times 2)} = 64$ Then, $B^6 = 64$, and $B = 2$.

Clue 3: $D + U^2 = 18$. Replace D with 9. Then, $9 + U^2 = 18$.
Then, $U^2 = 9$, and $U = 3$.

D = 9 U = 3 B = 2

BAIT

Use the Clues to figure out the value of each letter in the word BAIT.

Clues:

1. $B^0 + B^3 + B = 11$
2. $I/5 = B$
3. $[(T-A)^2]^5 = 1$
4. $[(A- B)^2]^3 = 64$

Possible Solution method:

Clue 1: $B^0 + B^3 + B = 11$. Then, $B^0 = 1$. Then, $B^3 + B = 10$
Test values for B. Then, $2^3 + 2 = 10$, and B = 2.

Clue 4: $[(A- B)^2]^3 = 64$. Replace B with 2. Then, $[(A- 2)^2]^3 = 64$.
The cube root of 64 is 4. Then, $(A - 2)^2 = 4$, and A = 4.

Clue 2: I/5 = B. Replace B with 2. Then, I/5 = 2, and I = 10.

Clue 3: $[(T-A)^2]^5 = 1$. Replace A with 4. Then, $[(T-4)^2]^5 = 1$.
Then, T = 5.

B = 2 A = 4 I = 10 T = 5

DATE

Use the Clues to figure out the value of each letter in the word DATE.

Clues:

1. $D^2 - A^2 = T^2$
2. $(T^2)^2 = 81$
3. $(E - A)^3 = E^2$
4. $T^0 + E^2 = 65$

Possible Solution method:

Clue 2: $(T^2)^2 = 81$. Then, $(T^2)^2 = T^4$ and $T^4 = 81$. Then, $T = 3$.

Clue 4: $T^0 + E^2 = 65$. Replace T with 3. Then, $3^0 = 1$. Then, $1 + E^2 = 65$. Then, $E^2 = 64$, and $E = 8$.

Clue 3: $(E - A)^3 = E^2$. Replace E with 8. Then, $(8 - A)^3 = 64$. Then, $A = 4$.
Check: 4 x 4 x 4 = 64.

Clue 1: $D^2 - A^2 = T^2$ Replace A with 4 and T with 3.
Then, $D^2 - 4^2 = 3^2$. Then, $D^2 - 16 = 9$. Then, $D^2 = 25$, and $D = 5$.

D = 5 A = 4 T = 3 E = 8

WANT

Use the Clues to figure out the value of each letter in the word DATE.

Clues:

1. **$A + W = N$**
2. **$(T^4 + N)^2 = 100$**
3. **$(W - A)^4 = T$**
4. **$(N + 1)^2 = 10^2$**

Possible Solution Method:

Clue 4: $(N + 1)^2 = 100$. Then, $N + 1 = 10$, and $N = 9$.

Clue 2: $(T^4 + N)^2 = 100$. Replace N with 9. Then, $(T^4 + 9)^2 = 100$
The square root of 100 is 10. Then, $T^4 + 9 = 10$, and $T = 1$.

Clue 1: $A + W = N$. Replace N with 9. Then, $A + W = 9$

Clue 3: $(W - A)^4 = T$. Replace T with 1. Then, $(W - A)^4 = 1$
That means that W and A must differ by 1.
From Clue 1, $A + W = 9$, and W is greater than A by 1.
Then, $W = 5$ and $A = 4$.

$W = 5$ $A = 4$ $N = 9$ $T = 1$

FETCH

Use the Clues to figure out the value of each letter in the word FETCH.

Clues:

1. $(E + C)^2 = F^2$
2. $(T – F)^2 = 25$
3. $(E^2)^2 = 16$
4. $(F/E)^2 = 25$
5. $T = C + H$

Possible Solution Method:

Clue 3: $(E^2)^2 = 16$. Then, $E^2 = 4$, and $E = 2$.

Clue 4: $(F/E)^2 = 25$. Replace E with 2. Then, $(F/2)^2 = 25$
The square root of $(F/2)^2$ is $F/2$. The square root of 25 is 5.
Then, $F/2 = 5$, and $F = 10$.

Clue 1: $(E + C)^2 = F^2$. Take the square root of each side of the equation.
Then, $E + C = F$. Replace E with 2 and F with 10.
Then, $2 + C = 10$, and $C = 8$.

Clue 2: $(T – F)^2 = 25$. Take the square root of each side of the equation.
Then, $T – F = 5$. Replace F with 10. Then, $T – 10 = 5$, and $T = 15$.

Clue 5: $T = C + H$ Replace T with 15 and C with 8. Then, $15 = 8 + H$, and $H = 7$.

F = 10 E = 2 T = 15 C = 8 H = 7

REMADE

Use the Clues to figure out the value of each letter in the word REMADE.

Clues:

1. $D^2 = 64$
2. $3^3 = A \times E$
3. $M^2 = 49$
4. $(R^2)^2 = 2D$
5. $(M + R)^2 = A^2$

Possible Solution Method:

Clue 1: $D^2 = 64$. Take the square root of each side of the equation. Then, D = 8.

Clue 3: $M^2 = 49$. Take the square root of each side of the equation. Then, M = 7.

Clue 4: $(R^2)^2 = 2D$. Replace D with 8. Then, $(R^2)^2 = 16$. Then, $R^2 = 4$, and R = 2.

Clue 5: $(M + R)^2 = A^2$. Replace M with 7 and R with 2. Then, $(7 + 2)^2 = A^2$. Then, $9^2 = A^2$. Then $81 = A^2$ and A = 9.

Clue 2: $3^3 = A \times E$. Replace A with 9. Then, 27 = 9 x E, and E = 3.

R = 2 E = 3 M = 7 A = 9 D = 8 E = 3

SCHEMED

Use the Clues to figure out the value of each letter in the word SCHEMED.

Clues:

1. $(C - S)^2 = D^2$
2. $(M^2)^2 = ½ S$
3. $S/E = M$
4. $(M + D)^2 - 2 = H$
5. $S = 2^{(2 + 3)}$
6. $C - S = 4$

Possible Solution Method:

Clue 5: $S = 2^{(2 + 3)}$. Then, $S = 2^5$, and $S = 32$.

Clue 6: $C - S = 4$. Replace S with 32. Then, $C - 32 = 4$, and $C = 36$.

Clue 1: $(C - S)^2 = D^2$. Replace C with 36 and S with 32. Then, $(36 - 32)^2 = D^2$.
Then, $4^2 = D^2$, and $D = 4$.

Clue 2: $(M^2)^2 = ½ S$. Replace S with 32. Then, $(M^2)^2 = 16$.
The square root of $(M^2)^2$ is M^2. The square root of 16 is 4.
Then, $M^2 = 4$, and $M = 2$.

Clue 3: $S/E = M$. Replace S with 32 and M with 2. Then, $32/E = 2$, and $E = 16$.

Clue 4: $(M + D)^2 - 2 = H$. Replace M with 2 and D with 4.
Then, $(2 + 4)^2 - 2 = H$. Then, $6^2 - 2 = H$. Then, $H = 36 - 2$, and $H = 34$.

S = 32 C = 36 H = 34 E = 16 M = 2 E = 16 D = 4

Section 4: Power Pairs

Solutions

ELM

Use the Clues to figure out the value of each letter in the word ELM.

Clues:

1. **2 x 1/3 E = M**
2. **M^4/M^2 = E X L**
3. **E^2 = 81**

Possible Solution Method:

Clue 3: E^2 = 81. Take the square root on both sides of the equation. Then, E = 9.

Clue 1: 2 x 1/3 E = M. Replace E with 9. Then, 2 x 1/3(9) = M. Then, 2 x 3 = M, and M = 6.

Clue 2: M^4/M^2 = E X L. Replace M with 6 and E with 9. Then, $6^4/6^2$ = 9 X L. Then, $6^4/6^2 = 6^2$, and 6^2 = 36. Then, 36 = 9 x L, and L = 4.

E = 9 L = 4 M = 6

FIR

Use the Clues to figure out the value of each letter in the word FIR.

Clues:

1. $I^2 = (F + R)^2$
2. $R^5/R^3 = 4$
3. $(F^2)^2 = 81$

Possible Solution Method:

Clue 2: $R^5/R^3 = 4$. Then, $R^5/R^3 = R^{(5-3)}$ or R^2.
Then, $R^2 = 4$, and R = 2.

Clue 3: $(F^2)^2 = 81$. Then, $(F^2)^2 = F^{(2+2)}$ or F^4.
Then, $F^4 = 81$, and F = 3.
Check: 3 x 3 x 3 x 3 = 81.

Clue 1: $I^2 = (F + R)^2$. Replace F with 3 and R with 2.
Then, $I^2 = (3 + 2)^2$ Then, $I^2 = 52$. Then, I = 5.

F = 3 I = 5 R = 2

PALM

Use the Clues to figure out the value of each letter in the word PALM.

Clues:

1. $A^5/A = M$
2. $P^{1/3} = A$
3. $L^5/L^4 = 1$
4. $(L + A)^3 = 27$

Possible Solution Method:

Clue 3: $L^5/L^4 = 1$. Then, $L^{(5-4)} = 1$. Then, $L^1 = 1$, and L = 1.

Clue 4: $(L + A)^3 = 27$. Replace L with 1. Then, $(1 + A)^3 = 27$.
Take the cube root of both sides of the equation.
Then, 1 + A = 3, and A = 2.

Clue 1: $A^5/A = M$. Replace A with 2. Then, $2^5/2 = M$.
Then, 32/2 = 16, and M = 16.

Clue 2: $P^{1/3} = A$. Replace A with 2. Then, $P^{1/3} = 2$.
Then, the cube root of P is 2, and P = 8.

P = 8 A = 2 L = 1 M = 16

TEAK

Use the Clues to figure out the value of each letter in the word TEAK.

Clues:

1. $(E - K)^2 = T$
2. $5K = 25$
3. $A^9/A^7 = 49$
4. $T^{1/2} = K$

Possible Solution Method:

Clue 2: $5K = 25$. Then, $K = 5$.

Clue 4: $T^{1/2} = K$. Replace K with 5. The exponent ½ means the square root of T. The square root of T is 5, and T = 25.

Clue 3: $A^9/A^7 = 49$. Then, $A^2 = 49$, and A = 7.

Clue 1: $(E - K)^2 = T$. Replace K with 5 and T with 25. Then, $(E - 5)^2 = 25$. Take the square root of both sides of the equation. Then, $E - 5 = 5$, and E = 10.

T = 25 E = 10 A = 7 K = 5

MAPLE

Use the Clues to figure out the value of each letter in the word MAPLE.

Clues:

1. **$P^5/P^3 = 9$**
2. **L= ¼ M**
3. **$P^3 = A$**
4. **$(E + M)^2 = 400$**
5. **$M^6/M4 = 64$**

Possible Solution Method:

Clue 1: $P^5/P^3 = 9$. Then, $P^2 = 9$, and P = 3.

Clue 3: $P^3 = A$. Replace P with 3. Then, $3^3 = A$, and A = 27.

Clue 5: $M^6/M4 = 64$. Then, $M^2 = 64$, and M = 8.

Clue 2: L= ¼ M. Replace M with 8. Then, L = ¼ 8, and L = 2.

Clue 4: $(E + M)^2 = 400$. Take the square root of both sides of the equation. Then, E + M = 20. Replace M with 8. Then, E + 8 = 20, and E = 12.

M = 8 A = 27 P = 3 L = 2 E = 12

CEDAR

Use the Clues to figure out the value of each letter in the word CEDAR.

Clues:

1. $E^{1/2} + 5 = R$
2. $3A = R$
3. $(A - 1)^4 = C$
4. $(D + R + 6)^{1/2} = 6$
5. $R^7/R^5 = 144$

Possible Solution Method:

Clue 5: $R^7/R^5 = 144$. Then, $R^2 = 144$, and $R = 12$.

Clue 2: $3A = R$. Replace R with 12. Then, $3A = 12$, and $A = 4$.

Clue 3: $(A - 1)^4 = C$. Replace A with 4. Then, $(4 - 1)^4 = C$ Then, $3^4 = C$.
Then, $C = 81$.

Clue 1: $E^{1/2} + 5 = R$. Replace R with 12. Then, $E^{1/2} + 5 = 12$.
Then, $E^{1/2} = 7$, and $E = 49$.

Clue 4: $(D + R + 6)^{1/2} = 6$. Replace R with 12. Then, $(D + 12 + 6)^{1/2} = 6$
Then, $(D + 18)^{1/2} = 6$. Square both sides of the equation.
Then, $D + 18 = 36$, and $D = 18$.

C = 81 E = 49 D = 18 A = 4 R = 12

NUTMEG

Use the Clues to figure out the value of each letter in the word NUTMEG.

Clues:

1. $(T - E)^2 = E$
2. $N^6/N^3 = 5E$
3. $G + E^{1/2} = 6$
4. $(T - 2M)^2 = 100$
5. $(U/7)^4 = G$
6. $G^{1/10} = G$

Possible Solution Method:

Clue 6: $G^{1/10} = G$. Then, G = 1.

Clue 5: $(U/7)^4 = G$. Replace G with 1. Then, $(U/7)^4 = 1$
Then, U/7 must equal 1, and U = 7.
Check: 7/7 = 1

Clue 3: $G + E^{1/2} = 6$. Replace G with 1. Then, $1 + E^{1/2} = 6$.
Then, $E^{1/2} = 5$, and E = 25.

Clue 2: $N^6/N^3 = 5E$. Replace E with 25. Then, $N^6/N^3 = 125$.
Then, $N^{(6-3)} = 125$. Then, $N^3 = 125$, and N = 5.

Clue 1: $(T - E)^2 = E$. Replace E with 25. Then, $(T - 25)^2 = 25$
Take the square root of both sides of the equation.
Then, T – 25 = 5, and T = 30.

Clue 4: $(T - 2M)^2 = 100$. Take the square root of both sides of the equation.
Then, T – 2M = 10. Replace T with 30. Then, 30 – 2M = 10, and M = 10.

N = 5 U = 7 T = 30 M = 10 E = 25 G = 1

WALNUT

Use the Clues to figure out the value of each letter in the word WALNUT.

Clues:

1. $A^5/A^2 + 1 = N$
2. $(T + 1)^{1/2} = U$
3. $N^{1/2} + L = W$
4. $U^8/U^6 = 16$
5. $L^4 = N^2$
6. $(A + U)^2 = 36$

Possible Solution Method:

Clue 4: $U^8/U^6 = 16$. Then, $U^2 = 16$, and $U = 4$.

Clue 2: $(T + 1)^{1/2} = U$. Replace U with 4. Then, $(T + 1)^{1/2} = 4$
Take the square root of both sides of the equation. Then, $T + 1 = 2$, and $T = 1$.

Clue 6: $(A + U)^2 = 36$. Replace U with 4. Then, $(A + 4)^2 = 36$
Take the square root of both sides of the equation.
Then, $A + 4 = 6$, and $A = 2$.

Clue 1: $A^5/A^2 + 1 = N$. Then, $A^3 + 1 = N$. Replace A with 2.
Then, $2^3 + 1 = N$, and $N = 9$.

Clue 5: $L^4 = N^2$. Replace N with 9. Then, $L^4 = 9^2$. Then. $L^4 = 81$, and $L = 3$.

Clue 3: $N^{1/2} + L = W$. Replace N with 9 and L with 3.
Then, $9^{1/2} + 3 = W$ Then, $3 + 3 = W$, and $W = 6$.

W = 6 A = 2 L = 3 N = 9 U = 4 T = 1

Section 5: Fraction Powers

Solutions

ALE

Use the Clues to figure out the value of each letter in the word ALE.

Clues:

1. **$(1/2)^2$ X L = 1**
2. **$(1/5)^2$ X E^2 = 1**
3. **E – L = A^2**

Possible Solution Method:

Clue 2: $(1/5)^2$ X E^2 = 1. Then, 1/5 x 1/5 = 1/25 Then, 1/25 x E^2 = 1.
Then, E = 5.
Check: 1/25 x 25 = 25/25 = 1

Clue 1: $(1/2)^2$ X L = 1. Then, ½ x ½ = ¼. Then, ¼ x L = 1, and L = 4.

Clue 3: E – L = A^2. Replace E with 5 and L with 4. Then, 5 – 4 = A^2.
Then, A = 1.

A = 1 L = 4 E = 5

TEA

Use the Clues to figure out the value of each letter in the word TEA.

Clues:

1. **$A + E = 5^2$**
2. **$T/(1/2)^3 = 1$**
3. **$A = 3^2$**

Possible Solution Method:

Clue 3: $A = 3^{2.}$ Then, A = 9.

Clue 1: $A + E = 5^2$. Replace A with 9. Then, 9 + E = 25, and E = 16.

Clue 2: $T/(1/2)^3 = 1$. Then, $(1/2)^3 = 1/8$. Then, $T^{1/8} = 1$, and T = 8

T = 8 E = 16 A = 9

COLA

Use the Clues to figure out the value of each letter in the word COLA.

Clues:

1. $C^3 = A$
2. $O^2 = 25$
3. $L/C = 3^2$
4. $(A^{1/2})^{1/3} = 2$

Possible Solution Method:

Clue 2: $O^2 = 25$. Then, O = 5.

Clue 4: $(A^{1/2})^{1/3} = 2$. Then, $(A^{1/2})^{1/3} = A^{1/6}$.
Then, $A^{1/6} = 2$, and A =64.
Check:2x2x2x2x2x2 = 64

Clue 1: $C^3 = A$. Replace A with 64.
Then, $C^3 = 64$, and C = 4.

Clue 3: $L/C = 3^2$. Replace C with 4.
Then, L/4 = 9, and L = 36.

C = 4 O = 5 L = 36 A = 64

MILK

Use the Clues to figure out the value of each letter in the word MILK.

Clues:

1. $L + K = I$
2. $K^2 - 3I = I$
3. $M^{1/3} \times M^{1/3} = 9$
4. $I^{1/2} + M^{1/3} = 8$

Possible Solution Method:

Clue 3: $M^{1/3} \times M^{1/3} = 9$.
The base is the same (both M), so add the exponents.
Then, $M^{2/3} = 9$, and $M = 27$.

Clue 4: $I^{1/2} + M^{1/3} = 8$. Replace M with 27. Then, $27^{1/3} = 3$.
Then, $I^{1/2} + 3 = 8$. Then, $I^{1/2} = 5$, and $I = 25$.

Clue 2: $K^2 - 3I = I$. Replace I with 25. Then, $K^2 - (3 \times 25) = 25$
Then, $K^2 - 75 = 25$. Then, , $K^2 = 100$, and $K = 10$.

Clue 1: $L + K = I$. Replace K with 10 and I with 25.
Then, $L + 10 = 25$, and $L = 15$.

M = 27 I = 25 L = 15 K = 10

CIDER

Use the Clues to figure out the value of each letter in the word CIDER.

Clues:

1. $E^{1/2} + D^{1/2} = 11$
2. $I^{1/4} = C$
3. $R + E^{1/2} = 10$
4. $1/2E - 2 = I$
5. $R^3 = 64$

Possible Solution Method:

Clue 5: $R^3 = 64$. Then, R = 4.

Clue 3: $R + E^{1/2} = 10$. Replace R with 4. Then, $4 + E^{1/2} = 10$.
Then. $E^{1/2} = 6$, and E = 36.

Clue 4: $1/2E - 2 = I$. Replace E with 36. Then, 18 – 2 = I, and I = 16.

Clue 1: $E^{1/2} + D^{1/2} = 11$. Replace E with 36. Then, $36^{1/2} = 6$.
Then, $6 + D^{1/2} = 11$. Then, $D^{1/2} = 5$, and D = 25.

Clue 2: $I^{1/4} = C$. Replace I with 16. Then, $16^{1/4} = 2$. Then, C = 2.

C = 2 I = 16 D = 25 E = 36 R= 4

JUICE

Use the Clues to figure out the value of each letter in the word JUICE.

Clues:

1. $(I^{1/3})^2 = C$
2. $U^2 = 2^2 \times 3^2$
3. $[(1/2)^2]\ J + E = C$
4. $(1/3)^2 \times C = E$
5. $(E^5 + U)^2 = 7^2$

Possible Solution Method:

Clue 2: $U^2 = 2^2 \times 3^2$. Then, $U^2 = 4 \times 9$. Then, $U^2 = 36$, and $U = 6$.

Clue 5: $(E^5 + U)^2 = 7^2$. Replace U with 6. Then, $(E^5 + 6)^2 = 49$.
Take the square root of both sides of the equation.
Then, $E^5 + 6 = 7$, and $E = 1$.

Clue 4: $(1/3)^2 \times C = E$. Replace E with 1. Then $1/9\ C = 1$, and $C = 9$.

Clue 1: $(I^{1/3})^2 = C$. Replace C with 9. Then, $(I^{1/3})^2 = 9$.
Take the square root of both sides of the equation.
Then, $I^{1/3} = 3$, and $I = 27$.

Clue 3: $[(1/2)^2]\ J + E = C$. Replace E with 1 and C with 9.
Then, $[(1/2)^2]\ J + 1 = 9$. Then, $\frac{1}{4}\ J = 8$, and $J = 32$.

J = 32 U = 6 I = 27 C = 9 E = 1

WATER

Use the Clues to figure out the value of each letter in the word WATER.

Clues:

1. **$R - A = 2W$**
2. **$T^2 \times (T + 1) = E$**
3. **$(R^{1/2})^{1/2} = W$**
4. **$W^4 = 81$**
5. **$(1/3\ E)^2 = 16$**

Possible Solution Method:

Clue 4: $W^4 = 81$. Then, $W = 3$.

Clue 3: $(R^{1/2})^{1/2} = W$. Replace W with 3. Then, $(R^{1/2})^{1/2} = 3$.
Then, $R^{1/4} = 3$. Then, 3 is the fourth root of R, and R = 3x3x3x3.
Then, R = 81.

Clue 1. $R - A = 2W$. Replace R with 81 and W with 3.
Then, $81 - A = 6$, and $A = 75$.

Clue 5: $(1/3\ E)^2 = 16$. Take the square root of both sides of the equation.
Then, $1/3E = 4$, and $E = 12$.

Clue 2: $T^2 \times (T + 1) = E$. Replace E with 12. Then, $T^2 \times (T + 1) = 12$.
Then, $T^3 + T^2 = 12$, and $T = 2$.
Check: $8 + 4 = 12$.

W = 3 A = 75 T = 2 E = 12 R = 81

LEMONADE

Use the Clues to figure out the value of each letter in the word LEMONADE.

Clues:

1. $O^2 + 4 = A$
2. $N^3 = E$
3. $D^{1/6} = N - 1$
4. $A^{1/3} = 5$
5. $A - M = 25$
6. $4(N + 2)^2 = M$
7. $L^{1/4} = N$

Possible Solution Method:

Clue 4: $A^{1/3} = 5$. Then, A = 5 x 5 x 5, and A = 125.

Clue 5: A - M = 25. Replace A with 125. Then, 125 – M = 26, and M = 100.

Clue 1: $O^2 + 4 = A$. Replace A with 125. Then, $O^2 + 4 = 125$.
Then, $O^2 = 121$, and O = 11.

Clue 6: $4(N + 2)^2 = M$. Replace M with 100. Then, $4(N + 2)^2 = 100$.
Then, divide both sides of the equation by 4. Then, $(N + 2)^2 = 25$.
Take the square root of both sides of the equation.
Then, N + 2 = 5, and N = 3.

Clue 2: $N^3 = E$. Replace N with 3. Then, E = 27.

Clue 7: $L^{1/4} = N$. Replace N with 3. Then, $L^{1/4} = 3$, and L = 3x3x3x3.
Then, L = 81.

Clue 3: $D^{1/6} = N – 1$. Replace N with 3. Then, $D^{1/6} = 3 – 1$.
Then, $D^{1/6} = 2$, and D = 2x2x2x2x2x2. Then, D = 64.

L = 81 E = 27 M = 100 O = 11

N = 3 A = 125 D = 64 E = 27

Section 6: Negative Powers

Solutions

SHOE

Use the Clues to figure out the value of each letter in the word SHOE.

Clues:

1. $H^{-2} = S/O$
2. $E^3 + S = O$
3. $S^6 = S$
4. $(O + S)^2 = 10^2$

Possible Solution Method:

Clue 3: $S^6 = S$. Then, S = 1.

Clue 4: $(O + S)^2 = 10^2$.
Take the square root of both sides of the equation.
Then, O + S = 10. Replace S with 1. Then, O + 1 = 10, and O = 9.

Clue 1: $H^{-2} = S/O$. Replace S with 1 and O with 9.
Then, $H^{-2} = 1/9$. H^{-2} is another name for $1/H^2$.
Then, $1/H^2 = 1/9$, and H = 3.

Clue 2: $E^3 + S = O$. Replace S with 1 and O with 9.
Then, $E^3 + 1 = 9$. Then, $E^3 = 8$, and E = 2.

S = 1 H = 3 O = 9 E = 2

HEELS

Use the Clues to figure out the value of each letter in the word HEELS.

Clues:

1. **$E/2L = H$**
2. **$L^{-2} \times S = H$**
3. **$(H + E)^2 = 81$**
4. **$L^0 = H$**

Possible Solution Method:

Clue 4: $L^0 = H$. Then, $L^0 = 1$. Then, $H = 1$.

Clue 3: $(H + E)^2 = 81$ Replace H with 1. Then, $(1 + E)^2 = 81$.
Then, take the square root of both sides of the equation.
Then, $1 + E = 9$, and $E = 8$.

Clue 1: $E/2L = H$. Replace E with 8 and H with 1.
Then, $8/2L = 1$, and $L = 4$.

Clue 2: $L^{-2} \times S = H$. Replace L with 4, and H with 1.
Then, $4^{-2} \times S = 1$. Then, $1/16 \times S = 1$, and $S = 16$.

H = 1 E = 8 E = 8 L = 4 S = 16

BOOTS

Use the Clues to figure out the value of each letter in the word BOOTS.

Clues:

1. $B^{-2} = 1/4$
2. $B^2 = O$
3. $T^2 = S$
4. $(O + T)^2 = 49$

Possible Solution Method:

Clue 1: $B^{-2} = 1/4$. Then, $B^{-2} = 1/ B^2$. Then, $1/ B^2 = 1/4$, and B = 2.

Clue 2: $B^2 = O$. Replace B with 2. Then, $2^2 = O$, and O = 4.

Clue 4: $(O + T)^2 = 49$. Take the square root of both sides of the equation. Then, O + T = 7. Replace O with 4. Then, 4 + T = 7, and T = 3.

Clue 3: $T^2 = S$. Replace T with 3. Then, $3^2 = S$, and S = 9.

B = 2 O = 4 O = 4 T = 3 S = 9

SANDAL

Use the Clues to figure out the value of each letter in the word SANDAL.

Clues:

1. $S^{-2} = 1/(A + N + L)$
2. $N = (A + A)^3$
3. $A = A^0 \times A^0$
4. $49^{1/2} = D$
5. $1/3N \times N = L$

Possible Solution Method:

Clue 4: $49^{1/2} = D$. Then, 7 = D.

Clue 3: $A = A^0 \times A^0$. Then, A = 1 x 1, and A = 1.

Clue 2: $N = (A + A)^3$. Replace A with 1. Then, $N = (1 + 1)^3$.
Then, $N = 2^3$ and N = 8.

Clue 5: $1/3N \times N = L$. Replace N with 8. Then, 1/3(8) x 8 = L.
Then, 2 x 8 = L, and L = 16.

Clue 1: $S^{-2} = 1/(A + N + L)$. Replace A with 1, N with 8, and L with 16.
Then, $1/S^2 = 1/ (1 + 8 + 16)$. Then, $1/S^2 = 1/ 25$. Then, S = 5.

S = 5 A = 1 N = 8 D = 7 A = 1 L = 16

BALLET

Use the Clues to figure out the value of each letter in the word BALLET.

Clues:

1. $L^2 - A^2 = 11T$
2. $B^4 = T^2$
3. $A^3/25T = 100$
4. $T^{-3} = 1/64$
5. $(E - T)^2 = B^2$

Possible Solution Method:

Clue 4: $T^{-3} = 1/64$. Then, $1/T^3 = 1/64$, and T = 4.

Clue 2: $B^4 = T^2$. Replace T with 4. Then, $B^4 = 16$, and B = 2.

Clue 5: $(E - T)^2 = B^2$. Replace T with 4 and B with 2.
Then, $(E - 4)^2 = 4$. Take the square root of both sides of the equation.
Then, E – 4 = 2, and E = 6.

Clue 3: $A^3/25T = 100$. Replace T with 4. Then, $A^3/100 = 10$.
Then, $A^3 = 100$ x 10. Then, $A^3 = 1000$, and A = 10.

Clue 1: $L^2 - A^2 = 11T$. Replace A with 10, and T with 4.
Then, $L^2 - 10^2 = 44$. Then, $L^2 - 100 = 44$. Then, $L^2 = 144$, and L = 12.

B = 2 A = 10 L = 12 L = 12 E = 6 T = 4

FLATS

Use the Clues to figure out the value of each letter in the word FLATS.

Clues:

1. $(L + T)^2 = 81$
2. $L^{-2} \times L^2 = T$
3. $A^{-3} \times L = 1$
4. $F^2 = 25$
5. $(S + T)^2 = (L + A)^2$

Possible Solution Method:

Clue 4: $F^2 = 25$. Then, F = 5.

Clue 2: $L^{-2} \times L^2 = T$. Then, $1/L^2 \times L^2 = T$. Then, $L^2/L^2 = T$, and T = 1.

Clue 1: $(L + T)^2 = 81$. Replace T with 1. Then, $(L + 1)^2 = 81$.
Take the square root of both sides of the equation.
Then, L + 1 = 9, and L = 8.

Clue 3: $A^{-3} \times L = 1$. Replace L with 8. Then, $A^{-3} \times 8 = 1$.
Then, $1/A^3 \times 8 = 1$. Then, $8/A^3 = 1$, and A = 2.

Clue 5: $(S + T)^2 = (L + A)^2$. Replace T with 1, L with 8, and A with 2.
$(S + 1)^2 = (8 + 2)^2$. Take the square root of both sides of the equation.
Then, S +1 = 10. Then, S = 9.

F = 5 L = 8 A = 2 T = 1 S = 9

SKATES

Use the Clues to figure out the value of each letter in the word FLATS.

Clues:

1. **$K \times E = T$**
2. **$S^6/S^4 = 64$**
3. **$A/K^{1/2} = S$**
4. **$E^{-3} \times S = 1$**
5. **$(T - S)^2 = 100$**

Possible Solution Method:

Clue 2: $S^6/S^4 = 64$. Then, $S^2 = 64$, and $S = 8$.

Clue 5: $(T - S)^2 = 100$. Take the square root of both sides of the equation. Then, $T – S = 10$. Replace S with 8. Then, $T - 8 = 10$, and $T = 18$.

Clue 4: $E^{-3} \times S = 1$. Replace S with 8. Then, $1/E^3 \times 8 = 1$. Then, $8/E^3 = 1$, and $E = 2$.

Clue 1: $K \times E = T$. Replace E with 2, and T with 18. Then, $K \times 2 = 18$, and $K = 9$.

Clue 3: $A/K^{1/2} = S$. Replace K with 9 and S with 8. Then $A/3 = 8$, and $A = 24$.

S = 8 K = 9 A = 24 T = 18 E = 2 S = 8

LOAFER

Use the Clues to figure out the value of each letter in the word FLATS.

Clues:

1. $(R - O)^5 = 1$
2. $10^2 - R^2 = 19$
3. $E^{-5} \times (L \times O) = 1$
4. $F^3 = 3R$
5. $E^{-3} \times O = 1$
6. $L^{-2} \times (2A + L) = 1$

Possible Solution Method:

Clue 2: $10^2 - R^2 = 19$. Then, $100 - R^2 = 19$. Then, $R^2 = 81$, and $R = 9$.

Clue 4: $F^3 = 3R$. Replace R with 9. Then, $F^3 = 27$, and $F = 3$.

Clue 1: $(R - O)^5 = 1$. Replace R with 9. Then, $(9 - O)^5 = 1$.
Then, O must be 1 less than R. Then, O = 8.

Clue 5: $E^{-3} \times O = 1$. Replace O with 8. Then, $1/ E^3 \times 8 = 1$, and E = 2.

Clue 3: $E^{-5} \times (L \times O) = 1$. Replace E with 2, and O with 8.
Then, $1/2^5 \times (L \times 8) = 1$. Then, $1/32 \times 8L = 1$. Then, $8/32\ L = 1$
Then, ¼ L = 1, and L = 4.

Clue 6: $L^{-2} \times (2A + L) = 1$. Replace L with 4. Then, $(4)^{-2} \times (2A + 4) = 1$.
Then, $1/4^2 \times (2A + 4) = 1$. Then, $1/16 \times 2A + 1/16 \times 4 = 1$.
Then, $2/16(A) + 4/16 = 1$. Then, $1/8A + 1/4 = 1$. Then, $1/8A = 3/4$
Then, $8(1/8A) = 8 \times 3/4$. Then, $8/8A = 24/4$. Then, A = 6.

L= 4 O = 8 A = 6 F = 3 E = 2 R = 9