

**KEY TO NEW
PRACTICAL ALGEBRA,
FOR TEACHERS**

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Key to New practical algebra, for teachers by James B. Thomson

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JAMES B. THOMSON

**KEY TO NEW
PRACTICAL ALGEBRA,
FOR TEACHERS**

NOTE.

ALL agree that the best kind of help for pupils in Arithmetic and Algebra, is *Self-help*; that it is better for the learner not to know the answer to a problem, until he has tried his own ability to solve it. In a word, that it is better for him to solve a single example independently, than a score by the help of a teacher or a Key.

And yet it must be admitted that a majority of teachers desire a KEY. This demand comes not only from young and inexperienced teachers, but from those whose character and scholarship are above suspicion. They desire it, not because of their inability to solve the problems, nor because they shrink from labor. Their object is to save time, which they may devote to other branches of study.

A well constructed Key will often disclose in a single minute the error in a pupil's work, which might consume half an hour of the teacher's time, if he were obliged to wade through a long operation.

The plan of the work before us is to indicate in full the operations to be performed, and give the results; omitting the minor details. It also contains many valuable suggestions as to the different methods by which certain problems may be solved. It is hoped teachers will find it adapted to their wants.

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KEY.

EXERCISES IN NOTATION.

Pages 12, 13.

2. $4c + d + m - 5x = ab.$

3. $5cd + \frac{a}{b} = xy.$

4. $\frac{3b}{5c} + 4m = c + 6d - 7ax.$

5. $a - b + xy = 6mn.$

6. $x - y + 4a + b - m = cd + 15m.$

2. The quotient of twice the product of a and b divided by x , plus a minus b , equals the quotient of a plus b divided by c , plus the product of a , x , and y minus four times the product of c and d .

3. The quotient of three times b plus c divided by 8, plus 3 times x , equals 3 times the product of c and d divided by a , plus the product of x , y , and z minus the quotient of c divided by d .

4. The quotient of 3 times a divided by 5, minus the product of a and x plus the product of b and c , equals the quotient of 4 times a minus b divided by x , plus the quotient of c times d divided by 4, minus 3 times x .

5. The product of a , b , and c minus x , divided by 3 times d , increased or diminished by 3 times x plus 5 times y , equals the product of c , d , and h plus x divided by twice a , minus the product of x and y .

6. The quotient of 4 times a into x into y divided by 5 times a , plus the quotient of a minus b divided by x , equals the quotient of x plus y divided by a , minus the quotient of twice a plus d divided by 3 times c .

ALGEBRAIC OPERATIONS.

Page 15.

- | | | | |
|----|----------------|------------------------------|---------------|
| 3. | Let | $x =$ price of the apple, | |
| | Then will | $3x =$ " " " orange. | |
| | And | $4x =$ 8 cents. | |
| | Dividing by 4, | $x =$ 2 cents, apple; } | } <i>Ans.</i> |
| | And | $3x =$ 6 cents, orange. } | |
| 4. | Let | $x =$ value of the hay, | |
| | Then will | $4x =$ " " " cow. | |
| | And | $5x =$ \$40. | |
| | Dividing by 5, | $x =$ \$8, hay; } | } <i>Ans.</i> |
| | And | $4x =$ \$32, cow. } | |
| 5. | Let | $x =$ one of the numbers, | |
| | Then will | $3x =$ other number. | |
| | And | $4x =$ 36. | |
| | Dividing by 4, | $x =$ 9; } | } <i>Ans.</i> |
| | And | $3x =$ 27. } | |
| 6. | Let | $x =$ C's number of peaches, | |
| | Then | $2x =$ B's " " " | |
| | And | $4x =$ A's " " " | |
| | Adding, | $7x =$ 28. | |
| | Dividing by 7, | $x =$ 4, C's number; } | } <i>Ans.</i> |
| | And | $2x =$ 8, B's " " | |
| | " | $4x =$ 16, A's " " | |
| 7. | Let | $x =$ son's age, | |
| | Then will | $3x =$ father's age. | |
| | And | $4x =$ 48. | |
| | Dividing by 4, | $x =$ 12 years, son's age; } | } <i>Ans.</i> |
| | And | $3x =$ 36 " father's age. } | |

Page 16.

8. Let $x =$ B's share of gain,
 Then will $4x =$ A's " "
 And $5x =$ \$100.
 Dividing by 5, $x =$ \$20, B's share of gain; } *Ans.*
 And $4x =$ \$80, A's " "
9. Let $x =$ 1st number,
 Then will $2x =$ 2d "
 And $3x =$ 3d "
 Adding, $6x =$ 90.
 Dividing by 6, $x =$ 15, 1st; } *Ans.*
 And $2x =$ 30, 2d; }
 " $3x =$ 45, 3d. }
10. Let $x =$ value of the calf,
 Then will $8x =$ " " " cow.
 And $9x =$ \$63.
 Dividing by 9, $x =$ \$7, price of calf; } *Ans.*
 And $8x =$ \$56, " " cow. }
11. Let $x =$ value of bridle,
 Then will $2x =$ " " saddle,
 And $21x =$ " " horse.
 Adding $24x =$ \$126.
 Divid. by 24, $x =$ \$5.25, worth of bridle; } *Ans.*
 And $2x =$ \$10.50, " " saddle; }
 " $21x =$ \$110.25, " " horse. }
12. Let $x =$ daughter's portion,
 Then $2x =$ son's "
 And $9x =$ wife's "
 " $12x =$ \$36000.
 Therefore, $x =$ \$3000, daughter's portion; } *Ans.*
 And $2x =$ \$6000, son's " }
 " $9x =$ \$27000, wife's " }

13. Let $x = 1\text{st number}$,
 Then $3x = 2\text{d}$ "
 And $4x + 5 = 3\text{d}$ "
 " $8x + 5 = 1877$.
 Subt. 5 from each, $8x = 1872$.
 Therefore, $x = 234$, 1st number; }
 And $3x = 702$, 2d " } *Ans.*
 " $4x + 5 = 941$, 3d "

POWERS AND ROOTS.

Page 17.

1-12. Oral.

13. $a^2 + b^2$.

14. $(a + b)^2$.

15. $a + b - c^2$.

16. $\sqrt{a} + \sqrt{x}$.

17. $\sqrt[3]{x} - y^5$.

18. $\sqrt[3]{a} + b^2$.

ALGEBRAIC EXPRESSIONS.

Page 19.

4. $(a + b)cd - \frac{x}{c} = 5 \times 20 - \frac{6}{4} = 98\frac{1}{2}$.
 5. $(x - a) + ax + \frac{c}{a} = 4 + 12 + 2 = 18$.
 6. $x \div 2 + (d - c) + bc - x = 3 + 1 + 12 - 6 = 10$.
 7. $dx + (c - a)(a - b) + x = 30 - 2 + 6 = 34$.
 8. $d + x(c - a) + a - x + c = 5 + 12 + 2 - 6 + 4 = 17$.

FORCE OF THE SIGNS.

Page 21.

1. 60.

2. 40.

3. $ac + 8b$.

4. $5b - 2d$.

5. 35.

6. 24.

7. $3x + 2y + ab$.

8. $6b - 7cx + 3a$.

9. $bx + cxy$.

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10. $\frac{15xy}{2z} + a$.

11. $\frac{b - a}{xy} + 2z$.

12. $3x + xy + 2z \times 3y = 3x + xy + 6yz$, *Ans.*

13. $(x - y) \times \frac{a - b}{d} = \frac{ax - ay - bx + by}{d}$, *Ans.*

$a = 3$, $b = 4$, $c = 2$, $x = 6$, $y = 8$, and $z = 10$.

14. $a + \frac{ax}{c} + yz = 3 + \frac{18}{2} + 80 = 92$, *Ans.*

15. $\frac{2b}{x - b} + aby + 2z = \frac{8}{2} + 96 + 20 = 120$, *Ans.*

ADDITION.

Case I, Page 24.

- 3. $21ab$.
- 4. $17xy$.
- 5. $15a^2$.
- 6. $-23bcd$.
- 7. $-16x^2y^2$.

8. $45ab^2$.

- 9. $-39abx^2y^2$.
- 10. $29b^2dm^3$.
- 12. $bc = 4$.
- 13. $xy = 5$.

Case II, Page 25.

- 16. $8x$.
- 17. abc .
- 18. $-12b$.
- 19. $-12y$.
- 20. $-2m$.

21. $6ab + 14ab + 15ab + 16ab = 51ab$;
 $-7ab - 12ab = -19ab$;
 $51ab - 19ab = 32ab$.

Since $32ab = 32$, $\therefore ab = 1$, *Ans.*

22. $bcd - 3bcd + 4bcd + 4bcd - 5bcd = 75$.
 Uniting, $9bcd - 8bcd = bcd = 75$, *Ans.*

EXAMPLES.

Page 26.

1. $24a + 2b - 3d$.
 2. $16mn - xy + bc$.
 3. $3bc$
 $-7bc + xy - mn$
 $11bc$

 $9bc$

 $16bc + xy - mn$, *Ans.*

4. $5ab - 3mn$
 $-ab$
 $3ab + 2z$
 $-4ab$
 ab

 $4ab - 3mn + 2z$, *Ans.*

$$\begin{array}{r}
 5. \quad 3xy \\
 - \quad xy + ab \\
 - \quad 7xy \qquad + b \\
 \quad \quad 8xy \\
 - \quad xy \\
 \hline
 \quad 13xy \\
 \hline
 15xy + ab + b, \quad \text{Ans.}
 \end{array}$$

7. $21(a + b)$.

8. $19c(x - y)$.

9. $7a\sqrt{xy}$.

10. $6\sqrt{a}$.

11. $10\sqrt{x - y}$.

Page 27.

13. $a(7 - 6b + 3d - 3m)$.

14. $(ab + 3 - 2c - 5m)y$.

15. $m(9 + ab - 7c + 3d)$.

16. $x(13a - 3b + c - 3d + m)$.

17. $(a + b - c)xy$.

PROBLEMS.

Page 28.

2. Let $x =$ cost of ball,
 Then $2x - 2 =$ " " kite.
 And $3x - 2 = 46$ cents.
 Adding 2 to each side, $3x = 48$ "
 $\therefore x = 16$ " ball; }
 And $2x - 2 = 30$ " kite, } *Ans.*

NOTE.—As the learner is not supposed to be acquainted with transposition, he should in the operation set down the number required to be added to each side of the equation, as seen in the solution of the first example.

3. Let $x =$ number of peaches,
 Then $2x - 3 =$ " " pears.
 And $3x - 3 = 75$.
 Adding 3 to each side, $3x = 78$.
 $\therefore x = 26$ peaches; }
 And $2x - 3 = 49$ pears, } *Ans.*
4. Let $x =$ the less number;
 Then $5x - 5 =$ the greater number.
 And $6x - 5 = 85$.
 Adding 5 to each side, $6x = 90$.
 $\therefore x = 15$, the less No; }
 And $5x - 5 = 70$, the greater No. } *Ans.*