

**KEY TO COLENZO'S
STUDENT'S
ALGEBRA**

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Key to Colenso's Student's Algebra by J. Hunter

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J. HUNTER

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K E Y
TO
COLENSO'S STUDENT'S ALGEBRA

BY THE
REV. J. HUNTER, M.A.



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1878

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K E Y.

Ex. 1.

1. $6+10+12+12+6+2+0=48$.
2. $12+5-12+12-5+0=12$.
3. $15-24-24+21+4-0=-8$.
4. $-18+10+12-4+1=1$. 5. $90+100-24+0=166$.
6. $0-15+32-18=-1$. 7. $-90-48+80-120=-178$.
8. $150-192+360-168=150$. 9. $990-228+0-312=450$.
10. $360-240+72-0=192$.

Ex. 2.

1. $6+5+1-1=11$. 2. $3-3+1=1$.
3. $3-5+2=0$. 4. $1+18+75+0=94$.
5. $9+90-10+0=89$. 6. $1-15+75-125=-64$.
7. $1-12+54-108+81=16$. 8. $300-45+9=264$.
9. $1+5-1=5$. 10. $1-1+7-4=3$.

Ex. 3.

1. $2+10+21-8=25$. 2. $12-24+6-9=-15$.
3. $2+10-4+4=12$. 4. $1+6-4+3=6$.
5. $5+6+6+4=21$. 6. $10+9+8-5=22$.
7. $15+12-24+4=7$. 8. $5+6-2+4=13$.
9. $25-18+12-4=15$. 10. $6+30-36+4=4$.

Ex. 4.

1. $0+0+10+36=46$. 2. $6+4+16-2=24$
3. $4+15+16=35$. 4. $6+6-2=10$.

5. $30 \times 8 \times 30 = 7200$. 6. $9 \times 1 \times 3 \times 5 = 135 = 144 - 9$.
 7. $2 \times 4 = 8 = 16 - 13 + 1 + 2 \times 2$.
 8. $4 + 36 + 16 + 64 = 120 = 4 \times 30$.

Ex. 7.

1. $a - x - 2x + a - 2 + 2a + 3 - 2x - 1 + x = 4a - 4x$.
2. $a^3 - 2a^2c + 3ac^2 - a^3c + 2a^3 - 2ac^2 + a^3 - ac^2 - a^2c$
 $= 4a^3 - 4a^2c$.
3. $2x^3 - 2y^3 - z^3 - 3y^2 - 2x^2 + x^2 - 3x^2 + 2y^2 + x^2 = x^2 - 3y^2 - 3z^2$.
4. $x^3 + ax^2 + a^2x - y^3 + by^3 - b^2y + z^3 + cz^2 + c^2z - x^2 + y^2 - z^2$
 $+ ax^2 + by^2 + cz^2 - a^2x + b^2y - c^2z = 2ax^2 + 2by^2 + 2cz^2$.
5. $a^2 - b^2 + c^2 - b^2 + c^2 - a^2 + c^2 - b^2 + a^2 = a^3 - 3b^2 + 3c^2$.
6. $2a^2 - 3ab + b^2 - a^2 + 4ab + b^2 + 2b^2 - a^2 + ab = 2ab + 4b^2$.
7. $x^3 + y^3 - 3x^2y - 3xy^2 - x^2 + 3x^2y + 3xy^2 - y^2 = 0$.
8. $2x - 3y + z - y - 2x + z + 3z - x + 2y - 2x + y - z$
 $= -3x - y + 4z$.
9. $1 - 1 + 1 - 4x + 2x - 3 + 5x - 2 + 5x - 4 = 8x - 8$.
10. $2a - 3b - c + 2d - 2a + 3b - c + 2d + 2a - 3b - c - 2d - 2a$
 $+ 3b - c + 2d = -4c + 4d$.

Ex. 8.

2. $ax + x + ax - x - by + y - by - y = 2(ax - by)$.
3. $(a + c + b - c)x^2 + (3b - 3a + 2a + 2b)xy + (b - c + a - b)y^2$
 $= (a + b)x^2 - (a - 5b)xy + (a - c)y^2$.
4. (i) $(a + b + a - b)x + (b + c - b + c)y = 2(ax + cy)$.
 (ii) $(a + b - a + b)x + (b + c + b - c)y = 2b(x + y)$.
5. (i) $(2a + 2b - 3a + 3b)x + (3b + 3c + 2a - 2c)y$
 $= -(a - 5b)x + (2a + 3b + c)y$.
 (ii) $(-2b - c + a - 2b)x + (a - 2b - b - 2c)y$
 $= (a - 4b - c)x + (a - 3b - 2c)y$.
 (iii) $(-a + 5b + a - 4b - c)x + (2a + 3b + c + a - 3b - 2c)y$
 $= (b - c)x + (3a - c)y$.

Key.—Multiplication.

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6. (i) $(2a+2b+3a-3b)x+(3b+3c-2a+2c)y$
 $= (5a-b)x-(2a-3b-5c)y.$
 (ii) $(-2b-c-a+2b)x+(a-2b+b+2c)y$
 $= -(a+c)x+(a-b+2c)y.$
 (iii) $(5a-b-a-c)x-(2a-3b-5c-a+b-2c)y$
 $= (4a-b-c)x-(a-2b-7c)y.$
7. (i) $(2a+2b+2b+c)x+(3b+3c-a+2b)y$
 $= (2a+4b+c)x-(a-5b-3c)y.$
 (ii) $(-3a+3b-a+2b)x+(2a-2c+b+2c)y$
 $= -(4a-5b)x+(2a+b)y.$
 (iii) $(2a+4b+c-4a+5b)x-(a-5b-3c-2a-b)y$
 $= -(2a-9b-c)x+(a+6b+3c)y.$
8. (i) $(2a+2b-a+2b)x+(3b+3c+b+2c)y$
 $= (a+4b)x+(4b+5c)y.$
 (ii) $(-3a+3b+2b+c)x+(2a-2c-a+2b)y$
 $= -(3a-5b-c)x+(a+2b-2c)y.$
 (iii) $(a+4b-3a+5b+c)x+(4b+5c+a+2b-2c)y$
 $= -(2a-9b-c)x+(a+6b+3c)y.$

Ex. 10.

15.

$\frac{x^2-ax+b}{x-c}$	$\frac{x^2-ax+b}{x^2+ax-c}$
$\frac{x^3-ax^2+bx}{-cx^2+acx-bc}$	$\frac{x^4-ax^3+bx^2}{+ax^3-a^2x^2+abx}$
$\frac{x^3-(a+c)x^2+(ac+b)x-bc}{x^3-(a^2-b+c)x^2+a(b+c)x-b}$	

16. $1-ax+bx^2-cx^3$

$$\frac{1+x-x^3}{1-ax+bx^2-cx^3}$$

$$1-ax+bx^2-cx^3$$

$$+x-ax^2+bx^3-cx^4$$

$$-x^3+ax^3-bx^4+cx^5$$

$$1-(a-1)x-(a-b+1)x^2+(a+b-c)x^3-(b+c)x^4+cx^5.$$

18. $ax - by$

$ax + cy$

$a^2x^2 - abcy$

$+ acxy - bcy^2$

$a^2x^2 - a(b-c)xy - bcy^2$

$ax - dy$

$a^2x^3 - a^2(b-c)x^2y - abcdxy^2$

$- a^2dx^2y + a(bd - cd)xy^2 + bcdy^3$

$a^2x^3 - a^2(b-c+d)x^2y - a(bc - bd + cd)xy^2 + bcdy^3$

19. $2x - m$

$x + 2m$

$2x^2 - mx$

$+ 4mx - 2m^2$

$2x^2 + 3mx - 2m^2$

$2x^2 - 3mx - 2m^2$

$4x^4 + 6mx^3 - 4m^2x^2$

$- 6mx^3 - 9mnx^2 + 6m^2nx$

$- 4n^2x^2 - 6mn^2x + 4m^2n^2$

$4x^4 + 6(m-n)x^3 - (4m^2 + 9mn + 4n^2)x^2 + 6mn(m-n)x$

$+ 4m^2n^2$

20. $x^2 + ax - b^2$

$x^2 + bx - a^2$

$x^4 + ax^3 - b^2x^2$

$+ bx^3 + abx^2 - b^2x$

$- a^2x^2 - a^2x + a^2b^2$

$x^4 + (a+b)x^3 - (a^2 - ab + b^2)x^2 - (a^2 + b^2)x + a^2b^2$

$x - (a+b)$

$x^5 + (a+b)x^4 - (a^2 - ab + b^2)x^3 - (a^2 + b^2)x^2 + a^2b^2x$

$- (a+b)x^4 - (a^2 + 2ab + b^2)x^3 + (a^2 + b^2)x^2$

$x^5 - \{2a^2 + 2b^2 + ab\}x^3$

$+ (a^4 + a^3b + ab^3 + b^4)x - a^2b^2(a+b)$

$+ (a^4 + a^3b + a^2b^2 + ab^3 + b^4)x - a^2b^2(a+b)$