KEY TO COLENSO'S STUDENT'S ALGEBRA

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

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COLENSO'S STUDENT'S ALGEBRA

BY THE

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1878

KEY.

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. $30+106-24+0=106$.
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. $30\times8\times30=7200$. 6. $9\times1\times3\times5=135=144-9$.
7. $2\times4=8=16-13+1+2\times2$.
8. $4+36+16+64=120=4\times30$.

Ex. 7.

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

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) $(-a+5b+a-4b-c)x+(2a+3b+c+a-3b-2c)y$
$=(b-c)x+(3a-c)y$.

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.

$$\begin{array}{r} x^2-ax+b \\ x-c \\ \hline x^3-ax^2+bx \\ \quad -cx^2+acx-bc \\ \hline x^3-(a+c)x^2+(ac+b)x-bc \end{array} \qquad \begin{array}{r} x^2-ax+b \\ x^2+ax-c \\ \hline x^4-ax^3+bx^2 \\ \quad +ax^3-a^2x^2+abx \\ \quad\quad -cx^2+acx-bc \\ \hline x^4-(a^2-b+c)x^2+a(b+c)x-b \end{array}$$

16.
$$\begin{array}{r} 1-ax+bx^2-cx^3 \\ 1+x-x^2 \\ \hline 1-ax+bx^2-cx^3 \\ \quad +x-ax^2+bx^3-cx^4 \\ \quad\quad -x^2+ax^3-bx^4+cx^5 \\ \hline 1-(a-1)x-(a-b+1)x^2+(a+b-c)x^3-(b+c)x^4+cx^5. \end{array}$$

18. $ax-by$
$ax+cy$
a^2x^2-abxy
$+acxy-bcy^2$
$a^2x^2-a(b-c)xy-bcy^2$
$ax-dy$
$a^3x^3-a^2(b-c)x^2y-abcxy^2$
$-a^2dx^2y+a(bd-cd)xy^2+bcdy^3$
$a^3x^3-a^2(b-c+d)x^2y-a(bc-bd+cd)xy^2+bcdy^3$

19. $2x-m$
$x+2m$
$2x^2-mx$
$+4mx-2m^2$
$2x^2+3mx-2m^2$
$2x^2-3mx$
$4x^4+6mx^3-4m^2x^2$
$-6mx^3-9mnx^2+6m^2nx$
$-4n^2x^2-6mn^2x+4m^2n^2$
$4x^4+6(m-n)x^3-(4m^2+9mn+4n^2)x^2+6mn(m-n)x$
$+4m^2n^2$

$2x+n$
$x-2n$
$2x^2+nx$
$-4nx-2n^2$
$2x^2-3nx-2n^2$

20. x^2+ax-b^2
x^2+bx-a^2
$x^4+ax^3-b^2x^2$
$+bx^3+abx^2-b^2x$
$-a^2x^2-a^2x+a^2b^2$
$x^4+(a+b)x^3-(a^2-ab+b^2)x^2-(a^3+b^3)x+a^2b^2$
$x-(a+b)$
$x^5+(a+b)x^4-(a^2-ab+b^2)x^3-(a^3+b^3)x^2+a^2b^2x$
$-(a+b)x^4-(a^2+2ab+b^2)x^3+(a^3+b^3)x^2$
$x^5-\{2a^2+2b^2+ab\}x^3$
$+(a^4+a^3b+ab^3+b^4)x-a^2b^2(a+b)$
$+(a^4+a^3b+a^2b^2+ab^3+b^4)x-a^2b^2(a+b)$