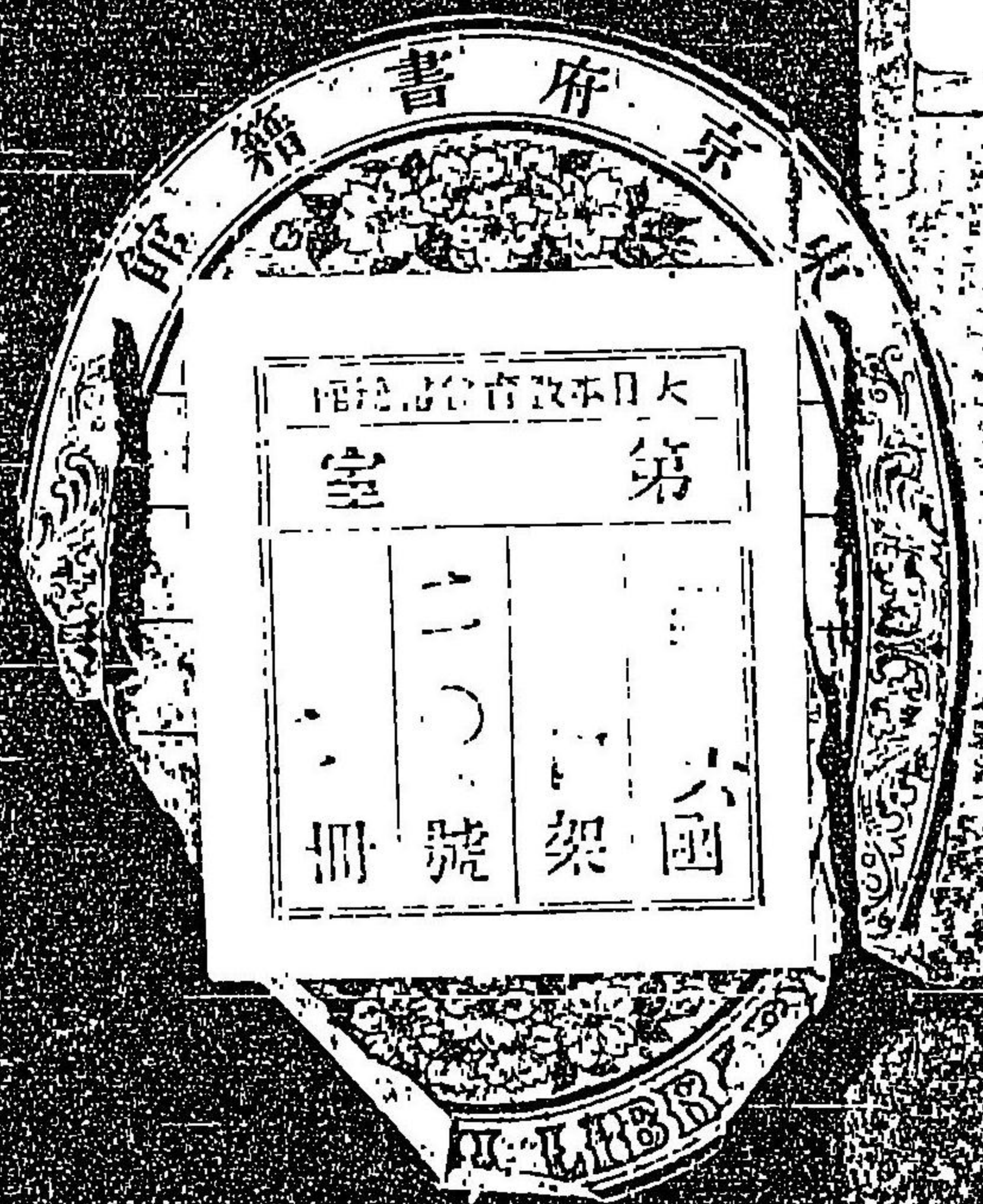


算問題集

上



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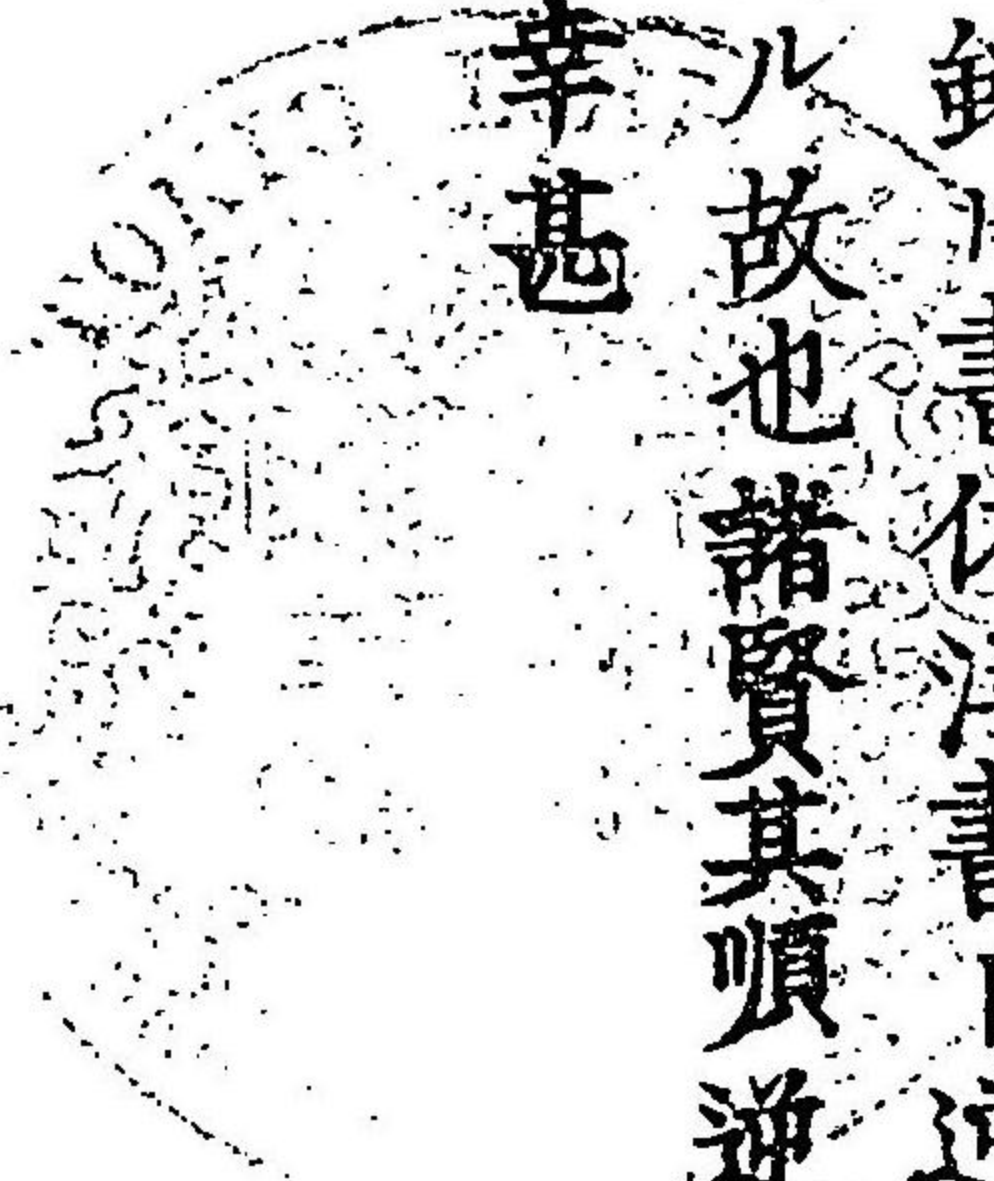
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東洋書局
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此卷者米利堅^{リヂヤ}氏英吉利^{イギリス}トドホント^{トドホント}氏
等ノ諸書ヲ取テ以テ編輯ス然ルニ書中洋文字
ヲ用テ題スト雖^レ書体洋書ト逆セルハ下卷譯
文ヲ以テ題スル故也諸賢其順逆不正ナルヲ答
ムル^{コト}無^クハ幸甚



$x - (10 - x) = 10$
 $x + 10 + (10 - x)$

官許

金澤關口開著述

初
點竄問題集
完

明治五壬申三月出版

卧龍房藏



$$x - (30 + x) = 6$$

$$x = 6 + (30 + x)$$

官許

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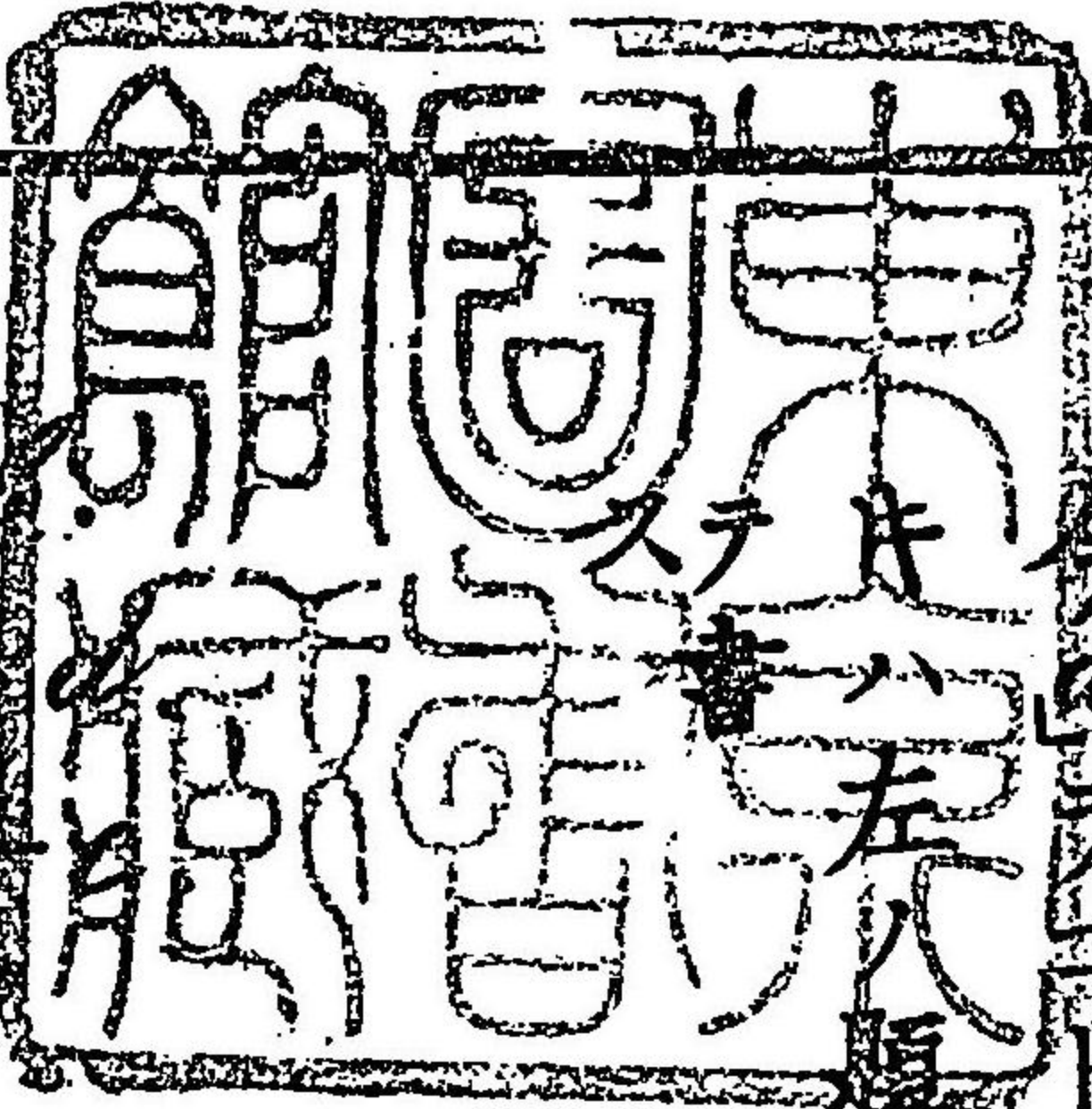


特37

東不
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此卷者米利堅タウス氏英吉利トードホントル氏
等ノ諸書ヲ取テ以テ編輯ス然ルニ書中洋文字
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文ヲ以テ題スル故也諸賢其噴逆不正ナルヲ答
ムルヲ無シハ幸甚





- (1) $ab + cd.$
- (2) $ad + b - d.$
- (3) $bc + ab + a.$
- (4) $(bc + a)b.$
- (5) $(bd - a)(ac - d).$
- (6) $(d + c)(d - c).$
- (7) $\frac{a + 2b}{c} + d.$
- (8) $(a^2 - b)(c + d).$
- (9) $abc + cd + ad.$
- (10) $\frac{a + bc}{7} \times (c + d).$

Find the numerical values of the following expressions, when, $a=1, b=2, c=3, d=4$

- (11) $ad - c + b.$
- (12) $ab + bc - d.$

記号用法
 今四ツ二トシ
 左ハ
 題ヲ
 數ニ換
 へテ
 答ヘン
 丁ヲ
 請フ
 原以
 語下
 ヲ換
 以テ
 スル

1 = 1/5
 24 - 5
 120
 24
 120

when, $a=5, b=2, c=4, d=3.$

$$(26) \quad \frac{6}{a} - \frac{3}{b} + \frac{70}{c-d} - \frac{74}{c+d}.$$

$$(27) \quad \left(\frac{a^2b}{c} \times d\right) \div \left(\frac{ab^2}{c} + d\right).$$

$$(28) \quad \frac{a^2+b^2-d^2}{a+b+d} + \frac{abcd}{2b+c} - \frac{4a^2-7bc+2}{2c+d}.$$

$$(29) \quad \frac{72(a+b^2)}{d^3} - (c-b) + \left(\frac{7}{a^2-b^2} \times \frac{74}{c^2-d^2}\right).$$

$$(30) \quad \{[a+b \times c+d]b+a\} \times c.$$

$$(73) \quad (a+b)c^2-d.$$

$$(74) \quad (a+b)(d-b).$$

$$(75) \quad (ab+ad)c+d.$$

$$(76) \quad (ab+c)(ad-a).$$

$$(77) \quad 3a^2b^2 - 2^2(a+d+7).$$

$$(78) \quad \frac{a+c}{2} \times (a+d).$$

$$(79) \quad \frac{a^2+b^2+c^2}{7} \times \frac{a^3+b^3+c^3-d}{2}.$$

$$(20) \quad \frac{ab^4-c-a^3}{6} \times \frac{4a^2-b+d^3}{33}.$$

when, $a=4, b=3, c=2, d=7.$

$$(21) \quad 5\left(\frac{a \cdot b}{3} - \frac{a-d}{3}\right).$$

$$(22) \quad [(a^2b+7)d] \div (d^2b+d).$$

$$(23) \quad 4\left(abc - \frac{b^3}{9}\right) \times (30c^3 - ab^3d^3).$$

$$(24) \quad \frac{a+b+c}{a-b+d} + \frac{abcd}{ab} + \frac{4a^2+b^2-d^2}{bc+b}.$$

$$(25) \quad \frac{75(a+a+b)}{3c^2} - \frac{a-c}{2} + \frac{3}{abd} \times a^3b^3c^3d^3.$$

Addition.

(3)	(2)	(1)
+ 4a ² bc	- 2a ² bc	+ 7a ² bc
- 2a ² bc	- 3a ² bc	+ a ² bc
+ 7a ² bc	- a ² bc	+ 3a ² bc
<u>- 5a²bc</u>	<u>- 8a²bc</u>	<u>+ 5a²bc</u>

(6)	(5)	(4)
c + bx ² + d	3a - 3bx	- 8a ² bc
4c - 2bx ² - 2d	9a - 5bx	+ 5a ² bc
<u>5c + 3bx²</u>	<u>5a - 4bx</u>	- 2a ² bc
		<u>+ 3a²bc</u>

(8)	(7)
4a + bc + 5d	3x ² y - 3y ² x - 4y + z
2a + 2bc + 3d	3x ² y + 7y ² x - 8y
<u>3a - 3bc</u>	<u>8x²y - 5y²x + 5y</u>

$$(15) \text{ add } x^3 - y^3 + 2xy^2 - 3x^2y, 2x^3 + 2y^3 \\ - 3xy^2 - 5x^2y, 6x^2y + 6xy^2 \\ - x^3 - y^3, \text{ and } 5xy^2 - 2y^3 - 4x^3 \\ + 8x^2y.$$

$$(16) \text{ '' } 2x + 3y - 4z - 10, 8y - 4x \\ + 7z + 8, 11x + 5y - 10z - 2, \\ \text{and } 16 + 10x + 12y + 14z.$$

$$(17) \text{ '' } 3x^3 + 2y^3 + z^3 + 8xyz, 2x^3 \\ + y^3 - 3z^3 - 4xyz, z^3 + 3x^3 \\ - 2y^3 - 2xyz, \text{ and } xyz + x^3 \\ + y^3 + z^3.$$

$$(18) \text{ '' } x^4 + 3x^3y + x^2z - 2xv, 30x^4 \\ - 29x^2z + 18xv - 77x^3y, 16xv \\ + 22x^3y - 75x^4 - 32x^2z, \text{ and} \\ 17x^2z - 72x^4 + 6x^3y - 11xv.$$

$$(19) \text{ '' } ax - by, x - y, ax - x, \text{ and} \\ ax + x.$$

(10)

$$4ab - 4c + 2(a+b) \\ 3ab + 5c + 5(a+b) \\ ab + c + 3(a+b) \\ \hline -2ab + 7c - 4(a+b) \\ \hline -ab - c - 2(a+b)$$

(9)

$$4cx^2 + 5dy^2 - 2z^3 + d \\ 3cx^2 + 2dy^2 - 2z^3 \\ \hline -2cx^2 - 5dy^2 + 5z^3 \\ \hline$$

(72)

$$a + b + c \\ a + b - c \\ a - b + c \\ \hline -a + b + c$$

(77)

$$12x^2y + 2(a+b)z^2 \\ -77x^2y - (a+b)z^2 \\ 4x^2y + 4(a+b)z^2 \\ -3x^2y + 2(a+b)z^2 \\ \hline x^2y + (a+b)z^2$$

(74)

$$2a^2 - 77ab + 3b^2 \\ 5a^2 + 72ab - 5b^2 \\ 72a^2 + 6ab - 9b^2 \\ \hline 3a^2 + 6ab + 3b^2$$

(73)

$$2ax + 3by \\ 3ax + 2by \\ 7ax + by \\ \hline 3ax + 7by$$

(26) add $-b+3c-d-175e+6f-5g,$
 $3b-2c-3d-e+27f, 5c$
 $-8d+3f-7g, -7b-6c+$
 $17d+9e-5f+17g, -3b$
 $-5d-2e+6f-9g+h.$

(27) " $7a^2b-3abc-8b^2c-9c^3$
 $+cd^2, 8abc-5a^2b+3c^3-$
 $4b^2c+cd^2, 4a^2b-8c^3-3d^3$
 $+9b^2c.$

(28) " $5a^2bc+6bx-4af, -3a^2bc$
 $-6bx+14af, -af+9bx+$
 $2a^2bc, 6af-8bx+6a^2bc.$

(29) " $a^2n^2+3a^3m+b, -6a^2n^2-b$
 $-6a^3m, 9b-9a^3m-3a^2n^2,$
 $7mn-5b-2a^3m+3a^2n^2,$
 $12a^3m+5a^2n^2+2b-3mn,$
 $a^2n^2+mn-a^3m.$

(20) add $ax+2bx+4by-3ay, 2ax$
 $+bx+2ay-by, \text{ and } 4ax$
 $+3by.$

(27) " $px+qy+rx-c, 2px-2qy$
 $+2c, 3qy-px+4c, \text{ and}$
 $7px-8qy-rx-3c.$

(22) " $ax^2+a^2x-2ax, x-ax+$
 $2x^2, ax^2-2x+x^2 \text{ and } -2ax$
 $-2a^2x-2ax^2.$

(23) " $a^2x-ax^2-x^2, ax-x^2-a^2,$
 $-2a^2-2a^2x-2ax^2, \text{ and}$
 $-3a^2x+3a^2+3ax^2.$

(24) " $a-x+4y-3z+w, x-w$
 $-y-3a-2x, \text{ and } x+y$
 $+z.$

(25) " $ax^2y+bx^2y^2+cx^3, ax^2y^2$
 $+cx^3, \text{ and } 2ax^2y+4bdx.$

Subtraction.

消法

(3)	(2)	(1)
$8a^2bc$	$13a^2b$	$5a^2bc$
<u>$4a^2bc$</u>	<u>$9a^2b$</u>	<u>$2a^2bc$</u>

(6)	(5)	(4)
$10b^2d$	$7ac$	$12ab$
<u>$-3b^2d$</u>	<u>$-4ac$</u>	<u>$6ab$</u>

(9)	(8)	(7)
$6a^2 - 8b$	$-3a^4b^n$	$-8a^2bc$
<u>$3a^2 - 5b$</u>	<u>$-5a^4b^n$</u>	<u>$+3a^2bc$</u>

(77)

$$\begin{array}{r} 4xy^2 + 4z \\ -3xy^2 + 7z - 6x^3 \end{array}$$

(70)

$$\begin{array}{r} 3x^2 - 4x^2y + 8 \\ 5x^2 - 6x^2y - 3 \end{array}$$

(30) add $4a^3b^2c - 76a^4x - 9ax^3d, 6a^3b^2c$
 $- 6ax^3d + 17a^4x, 76ax^3d - a^4x$
 $- 9a^3b^2c, 25a^4x + 4a^3b^2c +$
 $4ax^3d.$

$$(23) 2x^3 - 3xy + 2y^2x - (x^3 + y^3 - y^2x).$$

$$(24) 3x - \{x - 3a - (2y - a)\}.$$

$$(25) a^2 - (b^2 - c^2) - \{b^2 - (c^2 - a^2)\} + c^2 \\ - (b^2 - a^2).$$

$$(26) x + y + z - (x - y) - (y - z) - (-y).$$

$$(27) 2(a - b) - c + d - \{a - b - 2(c - d)\}.$$

$$(28) a + 2b - 6a - \{3b - (6a - 6b)\}.$$

$$(29) 7a - \{3a - [4a - (5a - 2a)]\}.$$

$$(30) 2x - [3y - \{4x - (5y - 6x)\}].$$

(12) From $2a + b - c$, subtract $a - b$.

$$(13) \text{ ,, } 3ac - 2b, \text{ ,, } ac - b - d.$$

$$(14) \text{ ,, } 5ab - 6, \text{ ,, } -2ab + 6$$

$$(15) \text{ ,, } 4y^2 - 3y + 4, \text{ ,, } 2y^2 + 2y + 4$$

$$(16) 219a^3 - 117a^2b + 218ab^2 + 145b^3, \\ - (26a^3 + 4a^2b + 61ab^2 - 10b^3)$$

$$(17) a - x + 2y - 3z + w,$$

$$- (2x + 3a - y + z - w)$$

$$(18) 5x^3 + x^2y - 6xy^2 + y^3, \\ - (3x^3 + 4x^2y - 7xy^2 + y^3 - xy^3)$$

$$(19) y^4 - 4xy^3 + 7x^2y^2 - x^3y + 3x^4, \\ - (2x^4 + 3x^3y + x^2y^2 + xy^3)$$

$$(20) 2px^2 + 7y^2 - 8qxy, \\ - (px^2 - 4qxy + 2ry^2)$$

$$(21) 2x^3 - 3x^2y + 2xy^2 - (x^3 - xy^2 + y^3).$$

$$(22) 7x^2 - xyx + 18z, \\ - (-3x^2 - 2xyx - p - q^3).$$

$$(73) (a^2 + b^2 + c^2 - ab - ac - bc) \\ (a + b + c).$$

$$(74) (a^4 + a^3b + a^2b^2 + ab^3 + b^4)(a - b).$$

$$(75) (2a + bc - 2b^2)(2a - bc + 2b^2).$$

$$(76) \text{ Multiply } 4ab - 2ac, \text{ by} \\ ba - b + 3ac.$$

$$(77) \text{ " } a + bx, \text{ by } a + cx.$$

$$(78) (x - 7)(x + 7)(x + 4).$$

$$(79) (x - 5)(x - 6)(x - 7)(x + 8).$$

$$(80) (a^3 + 3a^2b + 3ab^2 + b^3) \\ (a^3 - 3a^2b + 3ab^2 - b^3).$$

$$(81) (x^2 - a^2)(x^2 - xa + a^2)(x^2 + xa + a^2).$$

$$(82) (x^n - 2ax^{n-1}y + y^2) \times 3xy^n.$$

$$(83) (a^n + 2a^m b^n + ab^n)(a^n - b^n).$$

$$(84) (x^n + y^n)(x^n + y^n).$$

$$(85) (x^m - y^m)(x^m + y^m)(x^n - y^n).$$

$$(86) (x^2 - x + 7)(x^2 + x + 7)(x^4 - x^2 + 7).$$

Multiplication.

乘法

$$(1) \text{ Multiply } a + b, \text{ by } ab.$$

$$(2) \text{ " } x + y, \text{ " } yx.$$

$$(3) \text{ " } 2ab + 3b^2, \text{ by } acb.$$

$$(4) \text{ " } 7a^2c + 5c^2b, \text{ " } bcd.$$

$$(5) \text{ " } 6x^3y + x^2y^2, \text{ " } yx.$$

$$(6) \text{ " } x^2 - xy + y^2, \text{ " } x + y.$$

$$(7) \text{ " } x^2 - xy + y^2, \text{ " } x^2 + xy + y^2.$$

$$(8) \text{ " } 3x^2 - 2xy + 5, \\ \text{ by } x^2 + 2xy - 6.$$

$$(9) \text{ " } x^6 - x^5y + x^4y^2 - x^3y^3 + x^2y^4 \\ - xy^5 + y^6, \text{ by } x + y.$$

$$(10) \text{ " } x^4 - 2x^3y + 4x^2y^2 - 8xy^3 \\ + 7y^4, \text{ by } x + 2y.$$

$$(11) \text{ " } 27a^2 - 13ab + 5b^2, \\ \text{ by } 7a^2 + b^2.$$

$$(12) (a + x)(b + x)(c + x).$$

18

Division.

- (1) Divide $6ab - 8ax + 4a^2y$, by $2a$.
- (2) " $70a^2x - 75x^2$, " $5x$.
- (3) " $5xy + 20x^2y - 45axy$, " $5xy$.
- (4) " $-9a^2bc - 72ab^2c$, " $-3abc$.
- (5) " $6a^2x^2y - 9axy^2$, " $-3xy$.
- (6) " $a^2 - b^2$, by $a + b$.
- (7) " $4x^2 - y^2$, " $2x - y$.
- (8) " $a^2 - 2ax + x^2$, " $a - x$.
- (9) " $a^2 + ab - ac - bc$, by $a - c$.
- (10) " $xy - y^2 - xz + yz$, " $y - x$.
- (11) " $a^2 + 4ax + 4x^2$, " $a + 2x$.
- (12) " $a^3 - 3a^2x + 3ax^2 - x^3$,
by $a - x$.
- (13) " $a^3 + 5a^2x + 5ax^2 + x^3$,
by $a + x$.
- (14) " $a^4 - b^4$, by $a^2 + a^2b + ab^2 + b^2$.

- (27) $(x^4 - ax^3 + bx^2 - cx + d)$
 $(x^4 + ax^3 - bx^2 + cx - d)$.
- (28) $(x^3 + 4x^2 + 5x - 24)(x^2 - 4x + 7)$.
- (29) $(x^3 - 4x^2 + 77x - 24)(x^2 + 4x + 5)$.
- (30) $(a^4 - 2a^3 + 3a^2 - 2a + 7)$
 $(a^4 + 2a^3 + 3a^2 + 2a + 7)$.

$$(26) a^5 + a^3b^2 + 2a^2b^3 - b^5 \div a^2 - ab + b^2$$

$$(27) x^3 + ax^2 + bx + c, \div x - r.$$

$$(28) 7 + 2x, \div 7 - 3x.$$

$$(29) 7 + 2x, \div 7 - x - x^2$$

$$(30) 7, \div 7 + x.$$

$$(75) (a^4 - 4a^3y + 6a^2y^2 - 4ay^3 + y^4) \\ \div (a^2 - 2ay + y^2).$$

$$(76) 72x^4 - 792 \div 3x - 6.$$

$$(77) x^6 - 3x^4y^2 + 3x^2y^4 - y^6, \\ \div x^3 - 3x^2y + 3xy^2 - y^3$$

$$(78) x^{4n} + x^{2my} + y^{4n} \div x^{2n} + x^{my} + y^{2n}$$

$$(79) a^2 - b^2 + 2bc - c^2 \div a - b + c$$

$$(20) x^4 - 6x^2y^2 - 76xy^3 - 75y^4, \\ \div x^2 + 2xy + 3y^2$$

$$(21) ax^3 - a^2x^2 - bx^2 + b^2 \div ax - b.$$

$$(22) mp^2x^3 + mq^2x^2 - np^2x^2 - mr^2x - nq^2x \\ + nr, \div mx - n.$$

$$(23) a^3x^2 - a^3x + a^2x^2 + 2a^2x - 2a^2 + 2ax \\ + ax^2 - ax^3 - x^3 \div a^2x + 2a - x^2$$

$$(24) -2a^{-8}x^5 + 77a^{-4}x^6 - 5x^7 - 24a^4x^8, \\ \div 2a^{-3}x^3 - 3a^4x^4$$

$$(25) a^3 - 3a^2x + x^3 \div a + x.$$

- (17) Factor $4x^4 - 4x^2y + y^2$.
- (18) " $36x^2 - 24xy + 4y^2$.
- (19) " $4x^2y^2 - 4xyz + z^2$.
- (20) " $a^2 - b^2$.
- (21) " $4x^2 - 9y^2$.
- (22) " $a^2c^2 - b^2d^2$.
- (23) " $9a^2x^2 - 76a^2y^2$.
- (24) " $25a^4b^4x^4 - 4z^2$.
- (25) " $49x^4 - 16y^2$.
- (26) " $x^2 + 73x + 42$.
- (27) " $x^2 + 2x - 75$.
- (28) " $x^2 - 75x + 56$.
- (29) " $x^2 - x - 72$.
- (30) " $8a^3 - b^3$.
- (31) " $a^3 + 64m^3$.
- (32) " $16a^4 + 36a^2b^2 + 81b^4$.
- (33) " $a^4b^4 - 87c^4$.

找法

Factoring.

- (1) Factor $7a^2bc^3 - 28abc$.
- (2) " $4x^4y^2 - 2x^2y^2$.
- (3) " $6x^2y^2 + 72xy^3$.
- (4) " $2a^2b + abc - abd$.
- (5) " $7x^3y^2 - 7x^2y^3 + 7x^2y^2z$.
- (6) " $75a^2cd + 20ac^2d - 75acd^2$.
- (7) " $a^2 + 2ab + b^2$.
- (8) " $4x^2 + 12xy + 9y^2$.
- (9) " $x^2 + 72x + 36$.
- (10) " $4x^4 + 4x^2y + y^2$.
- (11) " $4a^2b^2 + 12abc + 9c^2$.
- (12) " $16a^4y^4 + 8a^2y^4z^2 + y^4z^4$.
- (13) " $a^2 - 2ab + b^2$.
- (14) " $a^2x^2 - 2acx + c^2$.
- (15) " $4x^2 - 4xy + y^2$.
- (16) " $9a^2b^2 - 24a^2bc + 16a^2c^2$.

○ 最大等數

Greatest Common Divisor.

Find the greatest common divisors of the following;

(1) of $42abx$, $70acx$.

(2) " $56acd^2x^2y$, $24afx^2y$.

(3) " $2x^3 - 4x^2y + 2xy^2$, $2x^3 - 2xy^2$.

(4) " $3ax^2 + 3x^3$, $2ay + 2xy$.

(5) " $4a^2c - 4acx$, $3a^2y - 3agx$.

(6) " $x^3 - y^3$, $x^2 - y^2$.

(7) " $4c^2 - 72cx + 9x^2$, $4c^2 - 9x^2$.

(8) " $4ax^3 - 4axy^2$, $72a^2x^2 - 72a^2y^2$.

(9) " $2a^3x + 4a^2bx + 2ab^2x$,

$4a^2x^3 + 8abx^3 + 4b^2x^3$.

(10) " $2x^2 + 5xy + 3y^2$, $3x^2 + xy - 2y^2$.

(11) " $x^3 - 5x^2 + 7x - 3$, $x^2 + x - 12$.

(12) " $3a^2x^3 - 3a^2y^3$, $6ax^2 - 6ay^2$.

(13) " $a^2 - 4$, $a^2 + 4a + 4$.

(34) Factor $9x^4y^2 + 24x^3y^3 + 16x^2y^4$.

(35) " $4x^2 - 12xy + 9y^2$.

(36) " $a^2b^2c^2 - c^2d^2$.

(37) " $x^2 + 9x + 18$.

(38) " $2a^2x^2 - 2b^2x^2$.

(39) " $a^2 - b^2 + 2bc - c^2$.

(40) " $a^4 - 9a^2b^2 - 6abc^2 - c^4$.

(41) " $6x^2 + xy - 12y^2$.

(42) " $a^2 + 2ab + b^2 - c^2$.

(43) " $6a^2 - 3ab + 5ac + 2bc - 6c^2$.

(44) " $x^5 + 32y^5$.

(45) " $64x^6 - 729y^6$.

$$(28) \text{ of } 3a^2 - 3b^2, 3a^2 + 6ab + 3b^2, \\ 3axy + 3bxy.$$

$$(29) \text{ ,, } x^2 - 9, x^2 - 3x - 18, \\ x^2 + 77x + 24.$$

$$(30) \text{ ,, } x^2 - 3x - 28, x^2 - 77x + 28, \\ x^2 - 75x + 56.$$

$$(37) \text{ ,, } x^4 - 5x^2 + 6, x^4 - 7x^2 + 72, \\ x^4 + 2x^2 - 75.$$

$$(32) \text{ ,, } x^3 + 5x^2 + 7x + 3, x^3 + 3x^2 - x - 3, \\ x^3 + x^2 - 5x + 3.$$

$$(33) \text{ ,, } x^2 + x + 7, x^3 + 2x^2 + 2x + 7, \\ x^3 - 7.$$

$$(34) \text{ ,, } x^4 - x^2 + 2x - 7, x^3 - 2x^2 + 2x - 7, \\ x^3 + 7.$$

$$(35) \text{ ,, } x^2 + xy - y^2 - yx, x^2 + xy - yx - x^2, \\ xy + y^2 - x^2 - y^2.$$

$$(74) \text{ of } a^3 - ab^2, a^2 + 2ab + b^2$$

$$(75) \text{ ,, } x^5 - x^3b^2, x^4 - b^4$$

$$(76) \text{ ,, } x^2 + 2x - 3, x^2 + 5x + 6.$$

$$(77) \text{ ,, } 3x^2y + 3xy^2, 3x^2 + 6xy + 3y^2$$

$$(78) \text{ ,, } x^4 + ax^3 - a^3x - a^4, x^4 + x^2a^2 + a^4.$$

$$(79) \text{ ,, } 20x^4 + x^2 - 7, 25x^4 + 5x^3 - x - 7.$$

$$(20) \text{ ,, } a^4 - 2a^2b^2 + b^4, a^3 - 3a^2b + 3ab^2 - b^3.$$

$$(27) \text{ ,, } 2a^2x^2, 4x^2y^2, 8x^3y.$$

$$(22) \text{ ,, } x^2 + 5x + 4, x^2 + 2x - 8, \\ x^2 + 7x + 72.$$

$$(23) \text{ ,, } 3a^{2n}x^{n-7}, 6a^{2n}x^{n+7}, 27a^{2n-7}x^{2n}.$$

$$(24) \text{ ,, } x^2a - x^2b, 2ya^2 - 2yb^2, a^2 - ab.$$

$$(25) \text{ ,, } 7a^2 + 7ab, 4ab + 4b^2, \\ 2ac + 2bc.$$

$$(26) \text{ ,, } 3x^2 - 6x, 2x^3 - 4x^2, x^2y - 2xy.$$

$$(27) \text{ ,, } 3x^2 + 6xy, 2xy + 4y^2, \\ 4xz + 8zy.$$

(75) of x^2+5x+6 , x^2+2x-8 ,
 $x^2+7x+12$.

(76) " $x-7$, x^2-7 , x^2+4x-5 .

(77) " $10x(x+y)$, $8y(x-y)$, $5(x^2-y^2)$.

(78) " $78x^4(x-y)$, $25x^3(x-y)^2$, $72x^5(x-y)^3$.

(79) " x^3-7 , x^2+x-2 .

(20) " $6x^2-x-7$, $2x^2+3x-2$.

(27) " $a-x$, a^2-x^2 , a^3-x^3 .

(22) " $3x^2-7x+6$, $2x^2-7x+3$,
 $6x^2-7x+2$.

(23) " $3x^2-5x+2$, $4x^3-4x^2-x+1$
 $6x^2-x-2$.

(24) " $2x-7$, $4x^2-7$, $4x^2+7$.

(25) " x^2-4a^2 , $(x+2a)^3$, $(x-2a)^3$.

最小公倍数

Least Common Multiple.

Find the least common multiples
of the following:

(1) of $6ab^2$, $78a^2b$.

(2) " $6a^2xy$, $8ax^2$, $12x^2y^2$.

(3) " a^2-b^2 , $a^2-2ab+b^2$.

(4) " $75x^2y^2$, $6x^3y$.

(5) " $3x^2yz$, $6xy^3$, $9xyz$.

(6) " $3ab^2$, $6ac^3$, $4c^3d$, b^2c^2 .

(7) " $ax-bx$, $ay-by$, x^2y^2 .

(8) " $a-b$, a^2-b^2 , $a^2-2ab+b^2$.

(9) " $8x^2(x-y)$, $75x^5(x-y)^2$, $72x^3(x^2-y^2)$.

(70) " $2a^2(a+x)$, $4ax(a-x)$.

(17) " a^3-x^3 , a^2-x^2 .

(72) " $2x-7$, $4x^2-7$.

(73) " $x^2+7x+12$, $x^2+8x+15$.

(74) " x^2-y^2 , x^3+y^3 , $x^2-2xy+y^2$.

Reduce the following fractions to a mixed quantity:

(2) $\frac{x^2+x-4}{x+2}$ (7) $\frac{a^2+x^2}{a+x}$
 (4) $\frac{x^2+a^2+3-2ax}{x-a}$ (3) $\frac{a^3+x^3}{a^2+2ax+x^2}$
 (5) $\frac{30-17x-44x^2+32x^3}{75+77x-4x^2}$
 (7) $\frac{x^2+3x-25}{x-4}$ (6) $\frac{4x-x^2+3-y}{4-x}$
 (8) $\frac{2y^4+7y^2+35}{y^3-3y^2+7y-21}$

Reduce the following mixed quantity to a fractional form:

(2) $a + \frac{ax}{a-x}$ (7) $a + \frac{b}{c}$
 (4) $a + \frac{ac+d}{c+d}$ (3) $1 + \frac{c}{x-y}$
 (6) $1 + \frac{a^2+b^2-c^2}{2ab}$ (5) $x+y + \frac{x^2+y^2}{x-y}$
 (7) $ab+cd + \frac{abc-c^2d-2cd^2}{c+2d}$

7
4
3

Transformation of Fractions.

Reduce the following fractions to their lowest terms:

(2) $\frac{74ax}{27ay}$ (7) $\frac{12acd}{16abc}$
 (4) $\frac{76abx^2}{24a^2b^2x}$ (3) $\frac{45x^3y^3z}{36abx^2y^2z}$
 (6) $\frac{2(x^2-y^2)}{x^2-2xy+y^2}$ (5) $\frac{3a^2-3b^2}{4a-4b}$
 (8) $\frac{x^2-a^2}{x^2+2ax+a^2}$ (7) $\frac{5(a^2-x^2)}{70(a-x)}$
 (10) $\frac{3x^2-6x}{2xy-4y}$ (9) $\frac{3ax^2-3a^2x}{2x^2y-2axy}$
 (12) $\frac{x^2+x-2}{2x^3-3x+1}$ (11) $\frac{x^2+2ax+a^2}{3(x^2-a^2)}$
 (13) $\frac{x^2-9}{x^2-x-12}$
 (14) $\frac{x^2-2ax+a^2}{7x^2y-70axy+3a^2y}$
 (15) $\frac{-7x^2-75xy+3y^2}{6x^3-6x^2y+2xy^2-2y^3}$

$$(14) \frac{4}{c-x}, \frac{5}{x^2}, \frac{6}{x^3}.$$

$$(15) 4, \frac{5}{a^2-x^2}, \frac{6}{a^2+x^2}, \frac{7}{y}.$$

(16) 3

Reduce the following fractions to a least common denominator:

$$(2) \frac{b}{ac}, \frac{c}{ab}, \frac{a}{bc} \quad (7) \frac{a}{b}, \frac{c}{d}, \frac{d}{x}.$$

$$(4) \frac{xy}{x+y}, \frac{axy}{(x+y)^2} \quad (3) \frac{a}{x-y}, \frac{a}{x+y}.$$

$$(5) \frac{x+a}{b}, \frac{a}{b}, \frac{a-x}{a}.$$

$$(6) \frac{a}{a^2-x^2}, \frac{b}{a-x}, \frac{c}{a+x}.$$

$$(7) \frac{m}{4a(a+x)}, \frac{n}{4(a^2-x^2)}.$$

$$(8) \frac{3x}{4}, \frac{4}{b}, \frac{12x^2}{75}.$$

$$(9) \frac{2b}{75}, \frac{3c}{5}, \frac{4d}{25}.$$

$$(10) a, \frac{3b^2}{4}, \frac{5c^3}{6}.$$

$$(11) \frac{x}{1-x}, \frac{x^2}{(1-x)^2}, \frac{x^3}{(1-x)^3}.$$

$$(12) 3bx, \frac{a}{a+x}, \frac{b}{a^2-x^2}, \frac{c}{x}.$$

$$(13) \frac{cx}{a-x}, \frac{dx^2}{a+x}, \frac{x^3}{a+x}.$$

分數減法

Subtraction of Fractions.

- (1) $\frac{a+2x}{a-2x} - \frac{a-2x}{a+2x}$.
- (2) $4a + \frac{2a}{c} - (2a - \frac{a-3b}{c})$.
- (3) $\frac{5x+3y}{4} - \frac{x-2y}{5}$.
- (4) $\frac{a}{a-x} - \frac{x}{a+x}$.
- (5) $\frac{x+y}{x-y} - \frac{x-y}{x+y}$.
- (6) $a + \frac{a-x}{a(a+x)} - \frac{a+x}{a(a-x)}$.
- (7) $3x + \frac{11x-10}{15} - (2x + \frac{3x-5}{7})$.
- (8) $\frac{1}{y-z} - \frac{1}{y^2-z^2}$.
- (9) $\frac{a}{a-x} + \frac{3a}{a+x} - \frac{2ax}{a^2-x^2}$.
- (10) $\frac{3a-4b}{7} - \frac{2a-b-c}{3} + \frac{15a-4c}{12}$

$$\frac{a-4b}{21}$$

分數加法

Addition of Fractions.

- (1) $a + \frac{1}{a} + \frac{1}{2b} + \frac{3x}{4a^2}$.
- (2) $\frac{2}{a^2b^3} + \frac{3}{a^3b^2} + \frac{4}{a^3b^3}$.
- (3) $\frac{2a}{3x^2} + \frac{a+2x}{4x} + \frac{a}{6x}$.
- (4) $\frac{a}{a+b} + \frac{b}{a-b}$.
- (5) $\frac{2x}{7-x^2} + \frac{1}{x+7}$.
- (6) $\frac{2}{(x-7)^3} + \frac{3}{(x-7)^2} + \frac{4}{x-7}$.
- (7) $\frac{a}{(7+a)(a+x)} + \frac{x}{(7-x)(a+x)}$.
- (8) $\frac{1}{4(7+a)} + \frac{1}{4(7-a)} + \frac{1}{2(7-a^2)}$.
- (9) $\frac{3x-4y}{7} + \frac{-2x+y+7}{3} + \frac{15x-4}{12}$.
- (10) $\frac{a^2-bc}{(a+b)(a+c)} + \frac{b^2-ac}{(b+c)(a+b)} + \frac{c^2-ab}{(a+c)(b+c)}$

$$(71) 3 + \frac{x}{4}, x + \frac{4}{x}$$

$$(72) \frac{(a+b)^2}{2x}, \frac{4x^2}{a+b}$$

$$(73) \frac{3x^2+7}{2}, \frac{2y}{3}$$

$$(74) \frac{(x-7)^2}{y^3}, \frac{(x+7)y^2}{x-7}$$

$$(75) m + \frac{7}{m} - 7, m + \frac{7}{m} + 7$$

$$(76) x - \frac{y^2}{x}, \frac{x}{y} + \frac{y}{x}$$

$$(77) \frac{x(a-x)}{a^2+2ax+x^2}, \frac{a(a+x)}{a^2-2ax+x^2}$$

$$(78) \frac{a^2-x^2}{a+b}, \frac{a^2-b^2}{x(a+x)}, a + \frac{ax}{a-x}$$

$$(79) x + \frac{2xy}{x-y}, x - \frac{2xy}{x+y}$$

$$(20) \frac{a^3-x^3}{a^3+x^3}, \frac{a^2-x^2}{a^2+x^2}, \frac{a-x}{a+x}, \frac{a^2-ax+x^2}{a^2+ax+x^2}$$

$$(21) x^2+x+7, \frac{7}{x^2} - \frac{7}{x} + 7$$

$$(22) x+7+\frac{7}{x}, x-7+\frac{7}{x}$$

$$(23) \frac{2a-b}{4a}, \frac{6a-2b}{b^2-2ab}$$

分數乘法

Multiplication of Fractions.

Find the products of the following fractions.

$$(1) \frac{7x}{5y}, \frac{3a}{4c}$$

$$(2) \frac{2x}{x-y}, \frac{x^2-y^2}{3}$$

$$(3) 2\left(\frac{x+y}{x-y}\right), \frac{x^2-y^2}{x^2+2xy+y^2}$$

$$(4) \frac{3x^2y}{4a}, \frac{2a^2b}{c}$$

$$(5) \frac{7abf}{3cd}, \frac{4x^2y^2}{3ab^2}$$

$$(6) \frac{7x-6}{3}, \frac{2x}{5}$$

$$(7) \frac{2}{x-y}, \frac{x^2-y^2}{a}$$

$$(8) \frac{ab}{4-x}, \frac{3x^2}{a^2}$$

$$(9) \frac{x^2-4}{3}, \frac{4x}{x+2}$$

$$(10) a + \frac{b}{x}, b + \frac{a}{x}$$

分數除法

Division of Fractions.

- (1) Divide $\frac{3a^2}{a^2-b^2}$ by $\frac{a}{a+b}$.
- (2) " $\frac{3x}{2x-2}$, " $\frac{2x}{x-1}$.
- (3) " $\frac{(x+y)^2}{x-y}$, " $\frac{x+y}{(x-y)^2}$.
- (4) " $x + \frac{x}{x-1}$, " $x - \frac{x}{x-1}$.
- (5) " $\frac{x^3-3x^2a+3xa^2-a^3}{x+a}$ by $\frac{x-a}{x+a}$.
- (6) " $\frac{x^4-y^4}{a^3+b^3}$, by $\frac{x-y}{a^2-ab+b^2}$.
- (7) " $x^2+2+\frac{7}{x^2}$, " $\frac{x}{a} + \frac{7}{ax}$.
- (8) " $\frac{2ax+x^2}{c^3-x^3}$, " $\frac{x}{c-x}$.
- (9) " $x+y+\frac{x^2}{y}$, " $x+y+\frac{y^2}{x}$.
- (10) " $\frac{x^2-9}{x^2+4x+4}$, " $\frac{x+3}{x+2}$.
- (11) " 7, by $\frac{7}{a} + \frac{7}{b} + \frac{7}{c}$.

(24) $\frac{a}{a+b} + \frac{b}{a-b}, \frac{a}{a+c} - \frac{b}{b+c}$.

(25) $\frac{7-x^2}{7+y}, \frac{7-y^2}{x+x^2}, 7 + \frac{x}{7-x}$.

(26) $\frac{a^4-b^4}{a^2-2ab+b^2}, \frac{a-b}{a^2+ab}$.

(27) $\frac{x+y}{2y}, \frac{x+y}{x-y} - \frac{x-y}{x+y} - \frac{4y^2}{x^2-y^2}$.

(28) $\frac{a^3-b^3}{a^3+b^3}, \frac{a+b}{a-b}, \left(\frac{a^2-ab+b^2}{a^2+ab+b^2}\right)^2$.

(29) $\frac{x^2}{a^2} - \frac{x}{a} + 7, \frac{x^2}{a^2} + \frac{x}{a} + 7$.

(30) $\frac{4(a^2-ab)}{b(a+b)^2}, \frac{a^2-b^2}{bab}$.

$$(7) \frac{3}{2y-3} - \frac{2y+15}{4y^2+9} - \frac{2}{2y+3}$$

$$(8) \frac{x}{1-x} - \frac{x^2}{(1-x)^2} + \frac{x^3}{(1-x)^3}$$

$$(9) \left(\frac{x+2y}{x+y} + \frac{x}{y} \right) \div \left(\frac{x+2y}{y} - \frac{x}{x+y} \right)$$

$$(10) \frac{x^2-9x+20}{x^2-6x} \times \frac{x^2-73x+42}{x^2-5x}$$

$$(11) \frac{x^{3n}}{x^{n-7}} - \frac{x^{2n}}{x^{n+7}} + \frac{1}{x^{n+7}} - \frac{1}{x^{n-7}}$$

$$(12) \frac{a^2-ax}{bc+bx} \times \frac{4(a+x)}{3(c-x)}$$

$$(13) \frac{a}{b} - \frac{a^2-b^2}{b^2x} + \frac{a(a^2-b^2)x^2}{b^2(b+ax)}$$

$$(14) \frac{a^4-2a^2x^2+x^4}{a^3x+ax^3} \div \left(\frac{a+x}{a} \times \frac{a-x}{x} \right)$$

$$(15) \left(a + \frac{2ax-7}{b} \right) \div \frac{x-a}{ax+7}$$

$$(12) \text{ Divide } a^4 - \frac{7}{a^4}, \text{ by } a - \frac{7}{a}.$$

$$(13) \text{ " } \frac{x^2}{y^3} + \frac{7}{x}, \text{ by } \frac{x}{y^2} + \frac{7}{x} - \frac{7}{y}.$$

$$(14) \text{ " } \frac{a}{a+b} + \frac{b}{a-b}, \text{ by } \frac{a}{a-b} - \frac{b}{a+b}.$$

$$(15) \text{ " } \frac{x+2y}{x+y} + \frac{x}{y}, \text{ by } \frac{x+2y}{y} - \frac{x}{x+y}.$$

Miscellaneous examples.

Simplify the following expressions.

$$(1) \frac{a^2+ab+b^2}{2} + \frac{a^2-ab+b^2}{2}$$

$$(2) \frac{7}{a-7} - \frac{2a}{a^2+7} + \frac{7}{a+7}$$

$$(3) \frac{y-7}{2} + \frac{y-2}{3} + \frac{y+7}{6}$$

$$(4) \frac{2x}{x^2-y^2} + \frac{7}{x+y} - \frac{7}{x-y}$$

$$(5) \frac{x-y}{y} + \frac{2x}{x-y} - \frac{x^3+x^2y}{x^2y-y^3}$$

$$(6) \left(x + \frac{y-x}{7+xy} \right) \div \left(1 - x \frac{y-x}{7+xy} \right)$$

$$(12) \frac{b}{ax} - a^2 = b^2 - \frac{a}{bx}$$

$$(13) \frac{3x-4}{2} = \frac{x}{2} + \frac{x}{4} - \frac{7}{2}$$

$$(14) \frac{x}{8} - 7 + \frac{x}{12} - \frac{x+5}{4} = -\frac{11}{4}$$

$$(15) \frac{x+a}{b} - \frac{x}{a} = 7$$

$$(16) \frac{x-7}{2} + \frac{x-2}{3} - \frac{x-3}{4} = 6$$

$$(17) \frac{x}{3} - \frac{x}{4} - \frac{7}{2} = \frac{x}{5} - \frac{x}{6}$$

$$(18) \frac{3x-7}{7} + \frac{6-x}{4} - \frac{2x-4}{12} = \frac{54-x}{28}$$

$$(19) \frac{5x-7}{3} - \frac{3x-2}{7} = \frac{x-5}{4}$$

$$(20) \frac{x}{8} - \frac{2(x-7)}{5} = \frac{3x-4}{15} + \frac{x}{12}$$

$$(21) \frac{x-a}{3} - \frac{2x-3b}{5} - \frac{a-x}{2} = 10a + 11b$$

$$(22) \frac{6x+a}{4x+b} = \frac{3x-b}{2x-a}$$

$$(23) \frac{ax-b}{4} + \frac{a}{3} = \frac{bx}{2} - \frac{bx-a}{3}$$

$$(24) \frac{a+c}{a+x} + \frac{a-c}{a-x} = \frac{2b^2}{a^2-x^2}$$

*Equations of the First Degree
with one unknown
quantity.*

$$(1) \frac{x}{4} + \frac{2x}{3} = \frac{5}{6}$$

$$(2) \frac{2x}{5} - \frac{2x}{3} = \frac{5}{2}$$

$$(3) \frac{x}{7} + \frac{3x}{2} + \frac{x}{4} = 5$$

$$(4) \frac{73x}{72} + \frac{4}{3} = 6x, -\frac{79x}{4}$$

$$(5) \frac{x-4}{3} + \frac{x-2}{6} = \frac{5}{3}$$

$$(6) -\frac{x-4}{3} - \frac{x-2}{6} = \frac{5}{3}$$

$$(7) \frac{x-3}{72} + \frac{3x-4}{27} = 8$$

$$(8) \frac{x}{3-x} + 4 = \frac{3}{5}$$

$$(9) 73x + 76 = 7x + 20$$

$$(10) 7x - 27 = -72x + 7$$

$$(11) 5x - \frac{6x+3}{17} = \frac{7x+75}{2} - 3$$

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$$(38) \frac{3x-7}{5} + \frac{25-4x}{9} = \frac{5x-74}{3}$$

$$(39) 79x + \frac{7}{2}(7x-2) = 4x + \frac{35}{2} \cdot 0$$

$$(40) x = 3x - \frac{7}{2}(4-x) + \frac{7}{3}$$

$$(41) \frac{2x+5}{73} + \frac{40-x}{8} = \frac{70x-427}{79}$$

$$(42) \frac{5x-7}{2} - \frac{2x+7}{3} = 3x-74 \cdot 0$$

$$(43) \frac{x}{7} - \frac{x-5}{77} + 5 = x - \left(\frac{2x}{77} + 7\right) \cdot 0$$

$$(44) \frac{x-7}{2} + \frac{x-2}{3} = \frac{x+3}{4} + \frac{x+4}{6} + 7$$

$$(45) \frac{x-7}{x-2} - \frac{x-2}{x-3} = \frac{x-5}{x-6} - \frac{x-6}{x-7} \cdot 0$$

$$(46) (x-5)(x-2) - (x-5)(2x-5) + (x+7)(x-2) = 0$$

$$(47) 3-x-2(x-7)(x+2) = (x-3)(5-2x)$$

$$(48) x-3-(3-x)(x+7) = (x-3)(7+x)+3-x$$

$$(25) \frac{6x+73}{75} - \frac{3x+5}{5} = \frac{2x}{5}$$

$$(26) \frac{x-3}{2} + \frac{x}{3} = 20 - \frac{x-79}{2}$$

$$(27) 70\left(x + \frac{7}{2}\right) - 6x\left(\frac{7}{x} - \frac{7}{3}\right) = 23 \cdot 0$$

$$(28) \frac{x}{72} - \frac{8-x}{8} - \frac{5+x}{4} + \frac{77}{4} = 0$$

$$(29) 3x-4 - \frac{4}{5} \times \frac{7x-9}{3} = \frac{4}{5} \left(6 + \frac{x-7}{3}\right) \cdot 0$$

$$(30) \frac{4x}{5-x} - \frac{20-4x}{x} = \frac{75}{x} \cdot 0$$

$$(31) \frac{7x+5}{23} + \frac{9x-7}{70} - \frac{x-9}{5} + \frac{2x-3}{75} = 23 \frac{1}{3}$$

$$(32) \frac{ax}{b} + \frac{cx}{d} + g = q \cdot x + \frac{ex}{d} + h \cdot 0$$

$$(33) \frac{70x+77}{78} - \frac{72x+2}{77x-8} = \frac{5x-4}{9}$$

$$(34) \frac{7}{7}\left(x - \frac{7}{2}\right) - \frac{7}{5}\left(\frac{2}{3} - x\right) = \frac{43}{30} \cdot 0$$

$$(35) \frac{2x+7}{29} - \frac{40x-3x}{72} = 9 - \frac{477-6x}{2}$$

$$(36) \frac{2x-7}{3} - \frac{3x-2}{4} = \frac{5x-4}{6} - \frac{7x+6}{72}$$

$$(37) \frac{2x-9}{27} + \frac{x}{18} - \frac{x-3}{4} = 8 \frac{7}{3} - x \cdot 0$$

Equations of the First Degree
with two unknown
quantities.

$$(1) \frac{x}{3} + \frac{y}{5} = 5, \quad 2x + \frac{y}{3} = 77.$$

$$(2) 3x + 4y = 78, \quad 2x - y = 7.$$

$$(3) 7x - 3y = 72, \quad 2x + 2y = 72.$$

$$(4) 5x + 3y = 26, \quad 5x - y = 78.$$

$$(5) 4x + 3y = 76, \quad 3x + 4y = 77.$$

$$(6) 6x + y = 72, \quad x + 6y = 37.$$

$$(7) 4x + 5y = 77, \quad 3y - 2x = 8.$$

$$(8) x - 3y = 6, \quad 2x + 9y = 77.$$

$$(9) 2x - \frac{3}{4}y = 9, \quad x + y = 27.$$

$$(10) \frac{x}{2} - y = 7, \quad x - \frac{y}{2} = 8$$

$$(11) \frac{x+y}{10} + \frac{x-y}{2} = 0, \quad \frac{x+y}{5} + \frac{x-y}{2} = 7.$$

$$(12) \frac{2x-y}{4} - \frac{3}{2} = \frac{3y}{4} - x - 2,$$

$$\frac{x+y}{3} = 2\frac{2}{3}.$$

$$(49) \frac{x+70}{3} - \frac{3}{5}(3x-4) + \frac{(3x-2)(2x-3)}{6} = 0$$

$$= x^2 - \frac{8}{75}.$$

$$(50) (x+\frac{5}{2})(x-\frac{3}{2}) - (x+5)(x-3) + \frac{3}{4} = 0.$$

$$(25) \frac{2x+y}{9} + \frac{7x+6y+77}{78} = \frac{68-4x}{6},$$

$$\frac{27}{20} \left(\frac{x}{7} + \frac{y}{4} + \frac{7}{3} \right) = 4x - \frac{y}{8} - 24.$$

$$(26) \frac{x}{a} + \frac{y}{b} = 7, \quad \frac{x}{3a} + \frac{y}{6b} = \frac{2}{3}.$$

$$(27) \frac{7}{5}(2x+7y) - 7 = \frac{2}{3}(2x-6y+7),$$
$$x = 4y.$$

$$(28) x + \frac{7}{2}(3x-y-7) = \frac{7}{4} + \frac{3}{4}(y-7),$$

$$\frac{7}{5}(4x+3y) = \frac{7y}{10} + 2.$$

$$(29) ax+by=c, \quad mx-ny=d$$

$$(30) \frac{3x-5y}{2} + 3 = \frac{2x+y}{5},$$

$$8 - \frac{x-2y}{4} = \frac{x}{2} + \frac{y}{3}.$$

$$(73) \frac{x}{2} + \frac{y}{3} = 12, \quad \frac{x}{3} + \frac{y}{2} = 13.$$

$$(74) \frac{x+y}{2} - \frac{x-y}{3} = 8,$$

$$\frac{x+y}{3} + \frac{x-y}{4} = 77.$$

$$(75) 2x+3y=43, \quad 70x-y=7.$$

$$(76) 5x-7y=33, \quad 77x+72y=700.$$

$$(77) \frac{x}{2} + \frac{y}{3} = 7, \quad \frac{x}{3} + \frac{y}{4} = 7.$$

$$(78) 76x+77y=500, \quad 77x-3y=770.$$

$$(79) \frac{77x-5y}{22} = \frac{3x+y}{32}, \quad 8x-5y=7.$$

$$(20) 4x+8y=2.4, \quad 70.2x-6y=3.48.$$

$$(27) 73x+77y=4a, \quad 72x-6y=a.$$

$$(22) \frac{m}{x} + \frac{n}{y} = 7, \quad \frac{n}{x} + \frac{m}{y} = 7,$$

$$(23) 3.4x - .02y = .01,$$

$$2x + .4y = 7.2.$$

$$(24) \frac{x}{a} + \frac{y}{b} = 7 - \frac{x}{c}, \quad \frac{x}{b} + \frac{y}{a} = 7 + \frac{y}{c}.$$

$$(8) \frac{6y-4x}{3z-7} = 7, \quad \frac{5z-x}{2y-3z} = 7,$$

$$\frac{y-2z}{3y-2x} = 7.$$

$$(9) \frac{3}{x} - \frac{4}{5y} + \frac{7}{z} = \frac{38}{5}, \quad \frac{7}{3x} + \frac{7}{2y} + \frac{2}{z} = \frac{67}{6},$$

$$\frac{4}{5x} - \frac{7}{2y} + \frac{4}{z} = \frac{767}{70}.$$

$$(10) \frac{2}{x} - \frac{5}{3y} + \frac{7}{z} = \frac{85}{27}, \quad \frac{7}{4x} + \frac{7}{y} + \frac{2}{z} = \frac{443}{72},$$

$$\frac{5}{6x} - \frac{7}{y} + \frac{4}{z} = \frac{433}{36}.$$

$$(11) x-2y+3z=6, \quad 2x+3y-4z=20,$$

$$3x-2y+5z=26.$$

$$(12) 4x-3y+2z=40,$$

$$5x+9y-7z=47,$$

$$9x+8y-3z=97.$$

$$(13) 3x+2y+z=23,$$

$$5x+2y+4z=46,$$

$$70x+5y+4z=75.$$

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 Equations of the First Degree with
 more than two unknown
 quantities.

$$(1) 3x-4y+5z=14, \quad 3y+2z=70,$$

$$72x-8y-z=30.$$

$$(2) x+y+z=6, \quad 5x+2y-3z=0,$$

$$2x+y-z=7.$$

$$(3) 3x+2y-z=7, \quad x+y-z=7,$$

$$x+2y+3z=75.$$

$$(4) 2x-2y+3z=76, \quad 3x+5y-2z=6,$$

$$4x+3y-4z=-7.$$

$$(5) \frac{x}{3} + \frac{y}{4} + \frac{z}{5} = 47, \quad \frac{x}{4} + \frac{y}{5} + \frac{z}{6} = 38,$$

$$\frac{x}{2} + \frac{y}{3} + \frac{z}{4} = 62.$$

$$(6) \frac{x+y}{z} = 5, \quad \frac{y-z}{x} = 7, \quad \frac{x-z}{y} = \frac{7}{3}.$$

$$(7) x + \frac{7}{2}(y+z) = 702, \quad y + \frac{7}{3}(x+z) = 78,$$

$$z + \frac{7}{4}(x+y) = 67.$$

$$\begin{aligned}
 (20) \quad & 3x - 4y + 3z + 3v - 6u = 77, \\
 & 3x - 5y + 2z - 4u = 77, \\
 & 7y - 3z + 3u - 2v = 2, \\
 & 5z + 4u + 2v - 2x = 3, \\
 & 6u - 3v + 4x - 2y = 6.
 \end{aligned}$$

$$\begin{aligned}
 (14) \quad & 5x - 6y + 4z = 75, \\
 & 7x + 4y - 3z = 79, \\
 & 2x + y + 6z = 46.
 \end{aligned}$$

$$\begin{aligned}
 (15) \quad & \frac{2}{x} + \frac{7}{y} = \frac{3}{z}, \quad \frac{3}{z} - \frac{2}{y} = 2, \\
 & \frac{7}{x} + \frac{7}{z} = \frac{4}{3}.
 \end{aligned}$$

$$(16) \quad \frac{3y-7}{4} = \frac{6x}{5} - \frac{x}{2} + 7\frac{4}{5},$$

$$\frac{5x}{4} + \frac{4z}{3} = y + \frac{5}{6},$$

$$\frac{3x+7}{7} - \frac{x}{14} + \frac{7}{6} = \frac{2z}{27} + \frac{y}{3}.$$

$$\begin{aligned}
 (17) \quad & 7x - 3y = 7, \quad 4z - 7y = 7, \\
 & 77z - 7u = 7, \quad 79x - 3u = 7.
 \end{aligned}$$

$$\begin{aligned}
 (18) \quad & 3u - 2y = 2, \quad 2x + 3y = 39, \\
 & 5x - 7z = 77, \quad 4y + 3z = 47.
 \end{aligned}$$

$$\begin{aligned}
 (19) \quad & 4u - 2x = 30, \quad 4y + 2z = 74, \\
 & 2x - 3y + 2z = 73, \\
 & 5y + 3u = 32.
 \end{aligned}$$

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Evolution.

Extract the square roots of the following examples.

- (1) $a^4 - 2a^3 + 3a^2 - 2a + 7.$
- (2) $9x^2 - 30ax + 25a^2 + 5a^3 + \frac{a^4}{4} - 3a^2x.$
- (3) $4x^4 + 8ax^3 + 4a^2x^2 + 76b^2x^2 + 76ab^2x + 76b^4.$
- (4) $\frac{a^2}{b^2} + \frac{b^2}{a^2} + 2\left(\frac{a}{b} + \frac{b}{a}\right) + 3.$
- (5) $\frac{x^2}{4} + \frac{yz}{9} + \frac{x^2}{76} + \frac{xy}{3} - \frac{xz}{4} - \frac{yz}{6}$
- (6) $\frac{x^2}{9} + \frac{4yz}{25} + \frac{x^2}{76} + \frac{4xy}{75} - \frac{xz}{6} - \frac{yz}{5}.$
- (7) $x^4 + 2px^3 + (p^2 - 2q)x^2 - 2pqx + q^2.$
- (8) $(x + x^{-7})^2 - 4(x - x^{-7}).$
- (9) $4x^4 + 72x^3 + 5x^2 - 6x + 7.$
- (10) $4x^4 - 4x^3 + 5x^2 - 2x + 7.$
- (11) $4x^4 - 72ax^3 + 25a^2x^2 - 24a^3x + 76a^4.$
- (12) $25x^4 - 30ax^3 + 49a^2x^2 - 24a^3x + 76a^4.$

Involution.

- (2) $(-2axy^2)^3.$
- (4) $(a^{-2})^2.$
- (6) $(2x^2y^3)^{-2}.$
- (8) $(ax^2y^3z^{-2})^{-3}.$
- (10) $(c+d)^4.$
- (12) $(a+b)^6.$
- (14) $(c-d)^4.$
- (16) $(c-d)^6.$
- (17) $(7+2x+3x^2)^2.$
- (18) $(a+b-c)^3.$
- (19) $(7+2x+x^2)^3.$
- (20) $(7-3x+3x^2-x^3)^2.$
- (7) $(2a^2yx^3)^3.$
- (3) $(-3a^2bc^3x)^4.$
- (5) $(x^{-3}y)^{-2}.$
- (7) $(2x^{-2}y^{-3})^{-2}.$
- (9) $(a+b)^3.$
- (11) $(a+b)^5.$
- (13) $(a-b)^3.$
- (15) $(a-b)^5.$

$$(23) 64a^6 - 288a^5 + 7080a^3 - 7458a - 729$$

$$(24) 7 - 6x + 27x^2 - 44x^3 + 63x^4 - 54x^5 + 27x^6$$

$$(25) a^3 + 3a^2b - 3a^2c + 3b^2a + 3c^2a + b^3 - 6abc - 3b^2c + 3c^2b - c^3$$

$$(26) 8x^3 + 36x^2y - 24x^2z + 54y^2x + 27y^3 - 72xyz + 24z^2x - 54y^2z + 36yz^2 - 8z^3$$

$$(27) 8x^6 - 36x^5 + 66x^4 - 63x^3 + 33x^2 - 9x + 7$$

$$(28) 8x^6 + 48x^5c + 60x^4c^2 - 80x^3c^3 - 90x^2c^4 + 708xc^5 - 27c^6$$

$$(29) 8x^6 - 36x^5c + 702x^4c^2 - 777x^3c^3 + 204x^2c^4 - 744xc^5 + 64c^6$$

$$(30) x^3 - \frac{7}{x^3} - 3x^2 - \frac{3}{x^2} + 5$$

$$(73) x^6 - 6x^5a + 75x^4a^2 - 20a^3x^3 + 75a^4x^2 - 6a^5x + a^6$$

$$(74) (a-b)^4 - 2(a^2+b^2)(a-b)^2 + 2(a^4+b^4)$$

$$(75) 4\{(a^2-b^2)cd + ab(c^2-d^2)\}^2 + \{(a^2-b^2)(c^2-d^2) - 4abcd\}^2$$

$$(76) a^4 + b^4 + c^4 + d^4 - 2a^2(b^2+d^2) - 2b^2(c^2-d^2) + 2c^2(a^2-d^2)$$

$$(77) 9a^{2m} + 6a^{3m+1} + 25c^{2m-4} + a^{4m+2} - 30a^m c^{m-2} - 70a^{2m+1} c^{m-2}$$

$$(78) 49x^4 + 9 - \frac{74x^3}{5} - \frac{6x}{5} + \frac{7057x^2}{25}$$

$$(79) 7 + x$$

$$(20) \frac{x^2}{y^2} \left(\frac{x^2}{4y^2} + 7 \right) + \frac{4y^2}{x^2} \left(\frac{y^2}{x^2} + 7 \right) + 3$$

Extract the cube roots of the following examples. $\sqrt[3]{}$ $\equiv \sqrt[3]{}$

$$(21) 8x^3 - 72x^2 + 6x - 7$$

$$(22) x^6 - 6x^5 + 75x^4 - 20x^3 + 75x^2 - 6x + 7$$

指数及根式理論

Theory of Indices.

- (1) Simplify $(x^{\frac{2}{3}} \times x^{\frac{4}{7}})^{\frac{14}{3}}$.
- (2) " $a^{\frac{7}{2}} \times a^{-\frac{7}{3}} \times a^{-\frac{7}{4}} \times a^{-\frac{7}{5}}$.
- (3) " $\left(\frac{ay}{x}\right)^{\frac{7}{2}} \times \left(\frac{bx}{y^2}\right)^{\frac{7}{3}} \times \left(\frac{y^2}{axb^2}\right)^{\frac{7}{4}}$.
- (4) " $a^{\frac{7}{3}} \times a^{-\frac{3}{4}} \times \sqrt[3]{a^4} \times a^{\frac{7}{2}}$
 $\times \sqrt[8]{a^{\frac{25}{3}}} \times \left(a^{-\frac{7}{4}}\right)^{\frac{7}{5}}$.
- (5) $(a^{\frac{7}{2}} + b^{\frac{7}{2}} + a^{-\frac{7}{2}}b) \times (ab^{-\frac{7}{2}} - a^{\frac{7}{2}} + b^{\frac{7}{2}})$.
- (6) $(x^{\frac{3}{2}} - xy^{\frac{7}{2}} + x^{\frac{7}{2}}y - y^{\frac{3}{2}}) \times (x + x^{\frac{7}{2}}y^{\frac{7}{2}} + y)$.
- (7) $(a^{\frac{7}{2}} - a^3 + a^{\frac{5}{2}} - a^2 + a^{\frac{3}{2}} - a + a^{\frac{1}{2}} - 7)$
 $\times (a^{\frac{7}{2}} + 7)$.
- (8) $(a^{\frac{2}{3}} - a^{\frac{7}{3}} + 7 - a^{-\frac{2}{3}} + a^{-\frac{2}{3}}) \times (a^{\frac{7}{3}} + 7 + a^{-\frac{7}{3}})$.
- (9) $(-3a^{-5} + 2a^{-4}b^{-1}) \times (-2a^{-3} - 3a^{-4}b)$.
- (10) $(x^{\frac{3}{2}} - xy^{\frac{7}{2}} + x^{\frac{7}{2}}y - y^{\frac{3}{2}}) \div (x^{\frac{7}{2}} - y^{\frac{7}{2}})$.
- (11) $(x^{\frac{4}{3}} + x^{\frac{2}{3}}y^{\frac{2}{3}} + y^{\frac{5}{3}}) \div (x^{\frac{2}{3}} + x^{\frac{1}{3}}y^{\frac{7}{3}} + y^{\frac{2}{3}})$.
- (12) $(a^{\frac{3n}{2}} - a^{-\frac{3n}{2}}) \div (a^{\frac{n}{2}} - a^{-\frac{n}{2}})$.

根式變換

Transformation of Radicals.

Reduce the following radicals to a common index.

- (1) $2, 3^{\frac{7}{3}}, a^{\frac{7}{2}}, b^{\frac{7}{4}}$.
- (2) $a^{\frac{1}{2}}, b^2, c^{\frac{2}{3}}, d^{\frac{2}{3}}$.
- (3) $\sqrt{a+x}, \sqrt[3]{a-x}, \sqrt[4]{a^2-x^2}$.
- (4) $\sqrt{\frac{8}{3}}, \sqrt[3]{2}, 5\sqrt{3}$.
- (5) $ax, \sqrt{bx}, \sqrt[3]{cx}, \sqrt[4]{dx}$.
- (6) $cx^2, (dx^3)^{\frac{7}{4}}, (x^4)^{\frac{7}{2}}$.
- (7) $\sqrt[3]{7}, \sqrt{70}, \sqrt[6]{\frac{767}{49}}$.
- (8) $\sqrt{\frac{7}{2}}, \sqrt[4]{\frac{76}{49}}, \sqrt[6]{7337}$.
- (9) $\sqrt[3]{6}, \sqrt[4]{367}, \sqrt[6]{189}, \sqrt[8]{14647}$.
- (10) $\sqrt[5]{32}, \sqrt[3]{32}, \sqrt[4]{256}, \sqrt[6]{289}$.

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Miscellaneous examples.

- (1) $\sqrt{78} + \sqrt{32} + \sqrt{50} + \sqrt{72}.$
- (2) $2\sqrt{8} + 3\sqrt{50} + 6\sqrt{78}.$
- (3) $\sqrt{\frac{3}{5}} + \sqrt{\frac{7}{75}} + \sqrt{\frac{15}{49}}.$
- (4) $\frac{2}{3}\sqrt{\frac{2}{9}} + \frac{7}{6}\sqrt{\frac{7}{36}} + \frac{3}{5}\sqrt{\frac{3}{32}}.$
- (5) $x\sqrt{(72a^4x)} + 2a^2\sqrt{(27x^3)} + 3a\sqrt{(48a^2x^3)}$
 $+ 5a^2x\sqrt{(3x)}.$
- (6) $6\sqrt[6]{(4a^2)} + 2\sqrt[3]{(2a)} + \sqrt[9]{(8a^3)}.$
- (7) $2\sqrt{3} + \frac{7}{2}\sqrt{12} + 4\sqrt{27} + 2\sqrt{\frac{3}{76}}.$
- (8) $3b\sqrt[3]{(2a^5b^2)} + 7\sqrt[3]{(2a^5b^5)} + 8a\sqrt[3]{(2a^2b^5)}.$
- (9) $\sqrt{320} - \sqrt{80}.$
- (10) $b\sqrt[3]{(27a^6b)} - \sqrt[3]{(276a^6b^4)}.$
- (11) $\sqrt{(a^3 + 2a^2b + ab^2)} - \sqrt{(a^3 - 2a^2b + ab^2)}.$
- (12) $\frac{2}{3}\sqrt{\frac{2}{9}} + \frac{3}{5}\sqrt{\frac{3}{32}} - \frac{7}{6}\sqrt{\frac{7}{36}}.$
- (13) $\sqrt{(289a^2b)} - \sqrt{(744a^2b)}.$
- (14) $(2\sqrt{8a^3} + 5\sqrt{72a^3}) - (7a\sqrt{78a} + \sqrt{50ab^2}).$

(13) $(2x^5y^{-3} - 5x^4y^{-2} + 7x^3y^{-1} - 5x^2 + 2xy)$
 $\div (x^3y^{-3} - x^2y^{-2} + xy^{-1}).$

(14) $(a^{\frac{5}{2}} - a^{\frac{3}{2}}b + ab^{\frac{3}{2}} - 2a^{\frac{7}{2}}b^2 + b^{\frac{5}{2}})$
 $\div (a^{\frac{3}{2}} - ab^{\frac{7}{2}} + a^{\frac{7}{2}}b - b^{\frac{3}{2}}).$

(15) Simplify $\frac{a^{\frac{7}{2}} - a^{\frac{7}{2}}x + a^{\frac{7}{2}}x - x^{\frac{3}{2}}}{a^{\frac{5}{2}} - a^{\frac{7}{2}}x + 3a^{\frac{3}{2}}x - 3ax^{\frac{3}{2}} + a^{\frac{7}{2}}x^2 - x^{\frac{5}{2}}}.$

$$(29) \left(\frac{x}{b} \sqrt{\frac{a}{b}} + \sqrt{\frac{c}{d}} \right) \times \left(\frac{x}{b} \sqrt{\frac{a}{b}} - \sqrt{\frac{c}{d}} \right).$$

$$(30) \left(\sqrt[3]{a^{-\frac{7}{2}}} + \sqrt[6]{a^{\frac{7}{2}}b} \right) \times \left(\sqrt[3]{a^{-\frac{7}{2}}} - \sqrt[6]{a^{\frac{7}{2}}b} \right).$$

$$(31) \frac{7}{3} \sqrt[3]{\frac{2}{3}} \div \frac{73}{4} \sqrt[3]{\frac{7}{5}}.$$

$$(32) \frac{7}{4} \sqrt{\frac{2}{5}} \div \frac{3}{7} \sqrt{\frac{5}{2}}.$$

$$(33) \frac{7}{2} \sqrt{2ax} \div \frac{3}{4} \sqrt{2bx}.$$

$$(34) \frac{7}{2} \sqrt{\frac{2}{3}} \div \frac{7}{3} \sqrt[3]{\frac{7}{3}}.$$

$$(35) 2\sqrt{2ax} \div \sqrt[3]{4bx^2}.$$

$$(36) x + \sqrt{xy} + y \div \sqrt{x + \sqrt[4]{xy} + \sqrt{y}}.$$

$$(37) \left(16x - \frac{y^4}{76} \right) \div \left(2x^{\frac{7}{4}} - \frac{y}{2} \right).$$

Render the denominators of the following fractions rational:

$$(38) \frac{-2}{\sqrt{3} + \sqrt{4}}. \quad \text{根化不根数 60}$$

$$(39) \frac{3}{\sqrt{2} - \sqrt{3}}.$$

$$(75) (a-x)\sqrt{(a^2-x^2)} - \sqrt{\frac{a+x}{a-x}}.$$

$$(76) (\sqrt[3]{87} + \sqrt[3]{792}) - \sqrt[3]{512}.$$

$$(77) 3\sqrt{8} \times 4\sqrt{48}.$$

$$(78) \frac{7}{3} \sqrt[3]{\frac{2}{3}} \times \frac{73}{4} \sqrt[3]{\frac{3}{4}}.$$

$$(79) 4\sqrt{12} \times 3\sqrt{2}.$$

$$(20) \frac{7}{3} \sqrt[3]{4} \times \frac{3}{4} \sqrt[3]{72}.$$

$$(21) 5a\sqrt{(ax)} \times \frac{5}{2} \sqrt{(bx)}.$$

$$(22) \sqrt{(2ab^3)} \times \sqrt{(8a^3b)}.$$

$$(23) \sqrt{8} \times \sqrt[3]{5}.$$

$$(24) \sqrt[3]{\left(\frac{7}{2}\right)} \times \sqrt{\left(\frac{3}{4}\right)}.$$

$$(25) \frac{7}{8} \sqrt[3]{\left(\frac{7}{8}\right)} \times \frac{7}{6} \sqrt[3]{\left(\frac{7}{6}\right)}.$$

$$(26) (\sqrt[3]{x} + 2\sqrt[6]{x} + 4) \times (\sqrt[3]{x} + 2\sqrt[6]{x}).$$

$$(27) (a^{\frac{3}{4}} + a^{\frac{1}{2}}x^{\frac{7}{2}} + a^{\frac{1}{4}}x + x^{\frac{3}{2}}) \times (a^{\frac{1}{4}} - x^{\frac{7}{2}}).$$

$$(28) \left(x + \frac{p}{2} + \sqrt{q + \frac{p^2}{4}} \right) \times \left(x + \frac{p}{2} - \sqrt{q + \frac{p^2}{4}} \right).$$

$$(54) \text{ of } 78 + 8\sqrt{5}.$$

$$(55) \text{ } \gg 75 - 72\sqrt{27}.$$

$$(56) \text{ } \gg 76 + 5\sqrt{7}.$$

$$(57) \text{ } \gg ab + c^2 + \sqrt{\{(a^2 - c^2)(b^2 - c^2)\}}.$$

$$(58) \text{ } \gg -9 + 6\sqrt{3}.$$

$$(59) \text{ } \gg 7 + (7 - c^2)^{-\frac{1}{2}}.$$

$$(60) \text{ } \gg 6 + 2\sqrt{2} + 2\sqrt{3} + 2\sqrt{6}.$$

$$(61) \text{ } \gg 5 + \sqrt{10} - \sqrt{6} - \sqrt{15}.$$

$$(62) \text{ } \gg 15 - 2\sqrt{3} - 2\sqrt{5} + 6\sqrt{2} - 2\sqrt{6} \\ + 2\sqrt{5} - 2\sqrt{30}.$$

$$(63) \text{ } \gg 77 + 2\sqrt{3} + 2\sqrt{7} + 2\sqrt{21}.$$

$$(64) \text{ } \gg 77 + 4\sqrt{2} - 4\sqrt{5} - 2\sqrt{10}.$$

Extract the cube roots:

$$(65) \text{ of } 7 + 5\sqrt{2}. \quad \text{立方}$$

$$(66) \text{ } \gg 76 + 8\sqrt{5}.$$

$$(67) \text{ } \gg 9\sqrt{3} - 77\sqrt{2}.$$

$$(68) \text{ } \gg 15\sqrt{6} - 27\sqrt{3}.$$

$$(40) \frac{4}{77 - 2\sqrt{3}}.$$

$$(41) \frac{3}{8 + \sqrt{2}}.$$

$$(42) (\sqrt{3} - \sqrt{2}) \div (\sqrt{2} + 1).$$

$$(43) 4 \div (\sqrt{5} + 1).$$

$$(44) (\sqrt{a+x} + \sqrt{a-x}) \div (\sqrt{a+x} - \sqrt{a-x}).$$

$$(45) \frac{(3+\sqrt{3})(3+\sqrt{5})(\sqrt{5}-2)}{(5-\sqrt{5})(7+\sqrt{3})}.$$

Extract the square roots:

$$(46) \text{ of } 14 + 6\sqrt{5}. \quad \text{平方}$$

$$(47) \text{ } \gg 78 - 2\sqrt{77}.$$

$$(48) \text{ } \gg 94 + 42\sqrt{5}.$$

$$(49) \text{ } \gg 28 + 70\sqrt{3}.$$

$$(50) \text{ } \gg (a+b)^2 - 4(a-b)\sqrt{ab}.$$

$$(51) \text{ } \gg 4 + 2\sqrt{3}.$$

$$(52) \text{ } \gg 7 - 4\sqrt{3}.$$

$$(53) \text{ } \gg 7 + 2\sqrt{10}.$$

根式方程

Radical Equations.

- (1) $\sqrt{x+16} = 2 + \sqrt{x}$.
- (2) $1 - \sqrt{7-x} = n(1 + \sqrt{7-x})$.
- (3) $\sqrt{a+x} - \sqrt{a-x} = \sqrt{ax}$.
- (4) $\frac{x-7}{\sqrt{x+7}} = 4 + \frac{\sqrt{x-7}}{2}$.
- (5) $\frac{x}{\sqrt{a^2+x^2}} = \frac{c-x}{\sqrt{b^2+(c-x)^2}}$.
- (6) $\frac{x-a}{\sqrt{x+a}} = \frac{\sqrt{x-a}}{3} + 2\sqrt{a}$.
- (7) $8\sqrt{3x} + \frac{87(3+4\sqrt{3x})}{76x-3} = 76x+3$.
- (8) $\sqrt{x} = 7 + \sqrt{x-9}$.
- (9) $\sqrt{x} + \sqrt{x-3} = 3$.
- (10) $\sqrt{x} - \sqrt{2} = \sqrt{x-2}$.
- (11) $\sqrt[3]{4x+3} = 3$.
- (12) $\sqrt{5x+4} = 2 + \sqrt{3x}$.
- (13) $2\sqrt{x-a} = 2\sqrt{x-a}$.
- (14) $a+x = \sqrt{x^2+5x-a}$.

(69) of $27\sqrt{6} - 23\sqrt{5}$.

(70) Simplify $\sqrt[3]{(\sqrt{5}+2)} - \sqrt[3]{(\sqrt{5}-2)}$.

Equations of the Second Degree with
but one unknown quantity.

$$(1) 3x^2 - 74x + 75 = 0.$$

$$(2) 4x - \frac{74-x}{x+7} = 74.$$

$$(3) \frac{3x+4}{5} - \frac{30-2x}{x-6} = \frac{7x-74}{70}.$$

$$(4) 5x^2 - 6x - 60 = 3.$$

$$(5) (x-72)(x+2) = 0.$$

$$(6) ax^2 - bx = c.$$

$$(7) \frac{70}{x} - \frac{74-2x}{x^2} = \frac{22}{9}.$$

$$(8) (x+2)^2 = 2x^2 + 8.$$

$$(9) 4x^2 - 9x = 90.$$

$$(10) \frac{x-3}{x+5} - \frac{x+4}{x-7} = 2\frac{7}{9}.$$

$$(11) x^2 - (a+b)x + ab = 0.$$

$$(12) \frac{4x^2}{3} = \frac{x}{3} + 77.$$

$$(15) \sqrt{a-x} = \frac{a}{\sqrt{a-x}} - x.$$

$$(16) \frac{\sqrt{x-2}}{3} + 3 = \frac{x-4}{\sqrt{x+2}}.$$

$$(17) x - \sqrt{a^2 + x\sqrt{x^2-1}} = a.$$

$$(18) \sqrt{x+a} = \sqrt{a} + \sqrt{x-a}.$$

$$(19) \sqrt{x} - \sqrt{a-x} = \frac{\sqrt{x} + \sqrt{a-x}}{2}.$$

$$(20) \sqrt[3]{7+x} + \sqrt[3]{7-x} = \sqrt[3]{2}.$$

$$(26) x^6 - 4x^3 = 32.$$

$$(27) x^4 - 2x^2 = 3.$$

$$(28) x^4 - 8x^2 = 9.$$

$$(29) x^3 - \sqrt{x^3} = 56.$$

$$(30) x^6 + 20x^3 = 69.$$

$$(31) x + \sqrt{70x+6} = 9.$$

$$(32) \frac{\sqrt{4x+20}}{4+\sqrt{x}} = \frac{4-\sqrt{x}}{\sqrt{x}}.$$

$$(33) 4x + 4\sqrt{x+2} = 7.$$

$$(34) x \pm \sqrt{5x+70} = 8.$$

$$(35) ax + 2\sqrt{n^2x + nax^2} = (3x-7)n.$$

$$(36) x^4 - 74x^2 = -7225.$$

$$(37) \frac{5x}{27}(x+7) - \frac{7}{9}(2x^2+x-7) = \frac{4}{35}(x+7).$$

$$(38) 8x + 77 + \frac{7}{x} = \frac{27+65x}{7}.$$

$$(39) \frac{6}{x} + \frac{x}{6} = \frac{5(x-7)}{4}.$$

$$(40) \frac{x}{7} + \frac{27}{x+5} = 3\frac{2}{7}.$$

$$(73) \frac{x}{x+7} + \frac{x+7}{x} = 2\frac{7}{6}.$$

$$(74) \frac{x+4}{3} - \frac{4x+7}{9} = \frac{7-x}{x-3} - 7.$$

$$(75) (x-7)^2 = 2(x^2+7).$$

$$(76) x^2(7 - \frac{7}{x}) = 8(x+2).$$

$$(77) 77x^2 + 79x - 7848 = 0.$$

$$(78) \frac{7}{2}x^2 - \frac{7}{3}x + 7\frac{3}{8} = 8.$$

$$(79) \frac{2x-70}{8-x} - \frac{x+3}{x-2} = 2.$$

$$(20) \frac{7}{x-7} - \frac{7}{x+3} = \frac{7}{35}.$$

$$(21) x + \frac{24}{x-7} = 3x-4.$$

$$(22) \frac{x^2+7}{2x} + \frac{x-7}{4} = 3x-2.$$

$$(23) x + \frac{7}{x} + 3(\frac{x-7}{4}) = \frac{7}{x}.$$

$$(24) x^3 + (5-x)^3 = 35.$$

$$(25) \frac{7200}{x} = \frac{7200}{40+x} + 5.$$

$$(53) x^4 - 74x^2 + 40 = 0.$$

$$(54) 2x + \sqrt{4x+8} = \frac{7}{2}.$$

$$(55) 2\sqrt{x} + \frac{2}{\sqrt{x}} = 5.$$

$$(56) \sqrt[4]{x} + 5\sqrt{x} - 22 = 0.$$

$$(57) 3\sqrt{x^3} - 4\sqrt[4]{x^3} = 7.$$

$$(58) x+5 - \sqrt{x+5} = 6.$$

$$(59) 2(x^{\frac{7}{2}} + x^{-\frac{7}{2}}) = 5.$$

$$(60) \sqrt{2x+7} + \sqrt{3x-78} = \sqrt{7x+7}.$$

$$(61) \frac{\sqrt{x^2-76}}{\sqrt{x-3}} + \sqrt{x+3} = \frac{7}{\sqrt{x-3}}.$$

$$(62) \sqrt{a+x} + \sqrt{a-x} = \sqrt{b}.$$

$$(63) \sqrt{x+9} = 2\sqrt{x} - 3.$$

$$(64) x + \sqrt{5x+70} = 8.$$

$$(65) (a^{\frac{7}{2}} + x^{\frac{7}{2}})^{\frac{2}{3}} = (a^{\frac{7}{3}} + x^{\frac{7}{3}})^{\frac{2}{2}}$$

$$(66) \frac{\sqrt{a+x}}{\sqrt{a} + \sqrt{a+x}} = \frac{\sqrt{a-x}}{\sqrt{a} - \sqrt{a-x}}.$$

$$(67) \left(\frac{x}{x-7}\right)^2 + \left(\frac{x}{x+7}\right)^2 = n(n-1).$$

$$(41) \frac{27}{5-x} - \frac{x}{7} = 3\frac{2}{7}.$$

$$(42) \frac{3}{2(x^2-7)} + \frac{x}{4(x+7)} = \frac{3}{8}.$$

$$(43) \frac{7}{2(x-7)} + \frac{3}{x^2-7} = \frac{7}{4}.$$

$$(44) \frac{x}{75} + \frac{40}{3(70-x)} = \frac{3(70+x)}{95}.$$

$$(45) \frac{2x}{75} + \frac{3x-50}{3(70+x)} = \frac{12x+70}{790}.$$

$$(46) \frac{x+2}{x-7} - \frac{4-x}{2x} = \frac{7}{3}.$$

$$(47) \frac{x^2-5x}{x+3} = x-3 + \frac{7}{x}.$$

$$(48) \frac{x-6}{x-12} - \frac{x-12}{x-6} = \frac{5}{6}.$$

$$(49) \frac{x+4}{x-4} + \frac{x-4}{x+4} = \frac{10}{3}.$$

$$(50) (7-4\sqrt{3})x^2 + (2-\sqrt{3})x = 2$$

$$(51) \sqrt[3]{x} + \frac{5}{2\sqrt[3]{x}} = 3\frac{7}{4}.$$

$$(52) \sqrt{2x} - 7x = -52.$$

$$(81) \frac{a^2+x^2}{a+x} + \frac{a^2-x^2}{a-x} = 4a.$$

$$(82) \frac{\sqrt{x^2+7} + \sqrt{x^2-7}}{\sqrt{x^2+7} - \sqrt{x^2-7}} + \frac{\sqrt{x^2+7} - \sqrt{x^2-7}}{\sqrt{x^2+7} + \sqrt{x^2-7}} = 4\sqrt{x^2-7}.$$

$$(83) \sqrt{7-x+x^2} - \sqrt{1+x+x^2} = m.$$

$$(84) \frac{x+\sqrt{x^2-7}}{x-\sqrt{x^2-7}} + \frac{x-\sqrt{x^2-7}}{x+\sqrt{x^2-7}} = 34.$$

$$(85) \sqrt{x^2-3ax+a^2} + \sqrt{x^2+3ax+a^2} = \sqrt{2a^2+2b^2}.$$

$$(86) x\sqrt{\frac{6}{x}-x} = \frac{7+x^2}{\sqrt{x}}.$$

$$(87) \sqrt[2p]{x^{p+q}} - \frac{7}{2c}(\sqrt[p]{x} + \sqrt[q]{x}) = 0.$$

$$(88) \sqrt{x} + \sqrt{x - \sqrt{7-x}} = 7.$$

$$(89) (x+a)^5 - (x-a)^5 = 242a^5.$$

$$(90) \frac{x^3+7}{x^2-7} = x + \sqrt{\frac{6}{x}}.$$

$$(91) \frac{25x^2-76}{70x+8} = \frac{3(x^2-4)}{2x-4}.$$

$$(68) (a+b)\sqrt{a^2+b^2+x^2} - (a-b)\sqrt{a^2+b^2-x^2} = a^2+b^2.$$

$$(69) x + \sqrt{x} + \sqrt{x+2} + \sqrt{x^2+2x} = a.$$

$$(70) 2x + \sqrt{2+2x} = c(1-x).$$

$$(71) \frac{a-x}{\sqrt{a} + \sqrt{a-x}} + \frac{a+x}{\sqrt{a} + \sqrt{a+x}} = \sqrt{a}.$$

$$(72) \frac{\sqrt{x+2a} - \sqrt{x-2a}}{\sqrt{x-2a} + \sqrt{x+2a}} = \frac{x}{2a}.$$

$$(73) \sqrt{x+8} - \sqrt{x+3} = \sqrt{x}.$$

$$(74) \sqrt{x+3} + \sqrt{x+8} = 5\sqrt{x}.$$

$$(75) \frac{x^2-a^2}{x^2+a^2} + \frac{x^2+a^2}{x^2-a^2} = \frac{34}{75}.$$

$$(76) \sqrt{x^nb+a} - \sqrt{a} = c\sqrt{x^nb}.$$

$$(77) \sqrt{x+4} - \sqrt{x} = \sqrt{x+\frac{3}{2}}.$$

$$(78) x^2 + \frac{7}{x^2} - a^2 - \frac{7}{a^2} = 0.$$

$$(79) \frac{850}{937} = \frac{x^2(x^4-a^4)}{x^6-a^6}.$$

$$(80) \frac{x^3-4x}{x-2} + \frac{x^2-7}{x+7} = 39.$$

二次方程式通解

General Properties of Equations
of the Second Degree.

Resolve the following five quadratic
expressions into the product of simple
factors.

(1) $3x^2 - 70x - 25$

(2) $x^2 + 73x + 780$

(3) $2x^2 + x - 6$

(4) $x^2 - 88x + 7672$

(5) $5x^2 - 3x - 770$

Form the quadratic equations,

(6) whose roots are 6 and 8.

(7) whose roots are 4 and 5.

(8) whose roots are 7 and -2.

(9) whose roots are $1 \pm \sqrt{5}$.

(92) $\sqrt{(x^2 + ax + b^2)} + \sqrt{(x^2 + bx + a^2)} = a + b.$

(93) $\sqrt{(2x + 9)} + \sqrt{(3x - 15)} = \sqrt{(7x + 8)}.$

(94) $\sqrt{\frac{x}{a}} + \sqrt{\left\{\frac{(b-c)(ac-bx)}{abc}\right\}} = 1.$

(95) $\sqrt{(x^2 + 2x - 7)} + \sqrt{(x^2 + x + 1)} = \sqrt{2} + \sqrt{3}.$

(96) $\sqrt{(x^2 + ax - 1)} + \sqrt{(x^2 + bx - 1)} = \sqrt{a} + \sqrt{b}.$

(97) $\frac{x}{2} + \frac{\sqrt{(x-7)^3}}{\sqrt{(4x-7)}} = \frac{17}{16}.$

(98) $(x^2 + 7)(x + 2) = 2.$

(99) $(x-a)(x-b)(x-c) + abc = 0.$

(100) $\frac{1}{x+a+b} + \frac{1}{x-a+b} + \frac{1}{x+a-b}$
 $+ \frac{1}{x-a-b} = 0.$

Equations of the Second Degree
involving several unknown
quantities.

- (1) $x^2 + 72xy + y^2 = 85, x + 3y = 77.$
- (2) $x^2 + y^2 = 202, x + y = 20.$
- (3) $x^2 + y^2 = 394, x - y = 2.$
- (4) $x^2 - 2xy + y^2 = 9, x + y = 77.$
- (5) $x + y = 6, x^2 + y^2 = 26.$
- (6) $x^2 - y^2 = 16, x + y = 8.$
- (7) $x^2 + xy = 70, y^2 + xy = 75.$
- (8) $x^2 + y^2 = 67, x^2 - xy = 6.$
- (9) $x^2 + xy + y^2 = 37, x^2 - xy + y^2 = 73.$
- (10) $x^2 - 2xy = 5, x^2 + y^2 = 29.$
- (11) $3x^2 = 2xy + 24, y^2 = xy - 3.$
- (12) $4xy - 3y^2 = 64, 2xy + 2x^2 - y^2 = 738.$
- (13) $x^2 + y^2 + x + y = 922, \sqrt{xy} = 20.$

- (10) whose roots are 2 and -3.
- (11) whose roots are 5 and $-\frac{2}{3}$.
- (12) whose roots are a and b.
- (13) whose roots are $\frac{3}{7}$ and $\frac{7}{3}$.
- (14) whose roots are -7 and -3.
- (15) whose roots are $-\frac{3}{4}$ and $\frac{5}{2}$.

Very Easy

$$(26) \quad x - \frac{x-y}{2} = 4, \quad y - \frac{x+3y}{x+2} = 1.$$

$$(27) \quad x^2 + y^2 = 65, \quad xy = 28.$$

$$(28) \quad xy = 7, \quad 3x - 5y = 2.$$

$$(29) \quad \frac{7}{x} + \frac{7}{y} = 2, \quad x + y = 2.$$

$$(30) \quad x^2 + xy + 2y^2 = 74, \\ 2x^2 + 2xy + y^2 = 73.$$

$$(31) \quad 2x + 3y = 37, \quad \frac{7}{x} + \frac{7}{y} = \frac{74}{45}.$$

$$(32) \quad x^2 + 3xy = 54, \quad xy + 4y^2 = 715.$$

$$(33) \quad x^2 + xy = 15, \quad xy - y^2 = 2.$$

$$(34) \quad x^2 + xy + 4y^2 = 6, \quad 3x^2 + 8y^2 = 74.$$

$$(35) \quad x^2 + xy = 12, \quad xy - 2y^2 = 1.$$

$$(36) \quad x^2 - xy + y^2 = 27, \quad y^2 - 2xy + 15 = 0.$$

$$(37) \quad x^2 - 4y^2 = 9, \quad xy + 2y^2 = 3.$$

$$(38) \quad 7x^2 - 8xy = 759, \quad 5x + 2y = 7.$$

$$(39) \quad x^2 - 2xy - y^2 = 1, \quad x + y = 2.$$

$$(74) \quad x + y + \sqrt{(x+y)} = 72, \quad x^3 + y^3 = 789.$$

$$(75) \quad x - y = 2, \quad x^4 + y^4 = 272.$$

$$(76) \quad x^2 + 2xy + y + 3x = 73, \\ y^2 + x + 3y = 44.$$

$$(77) \quad 3x^2 - 7y^2 + 7 = 0, \quad xy = 6.$$

$$(78) \quad x^4 - 2x^2y + y^2 = 49, \\ x^4 - 2x^2y^2 + y^4 - x^2 + y^2 = 20.$$

$$(79) \quad \frac{x}{y} - \frac{y}{x} = \frac{77}{30}, \quad x^2 + xy = 66.$$

$$(80) \quad x^2y^4 + y^2 = 70, \quad xy^2 + y = 4.$$

$$(27) \quad x^3 + y^3 = 789, \quad x^2y + xy^2 = 780.$$

$$(22) \quad \frac{x+y}{x-y} = a^2, \quad x^2 - y^2 = b^2.$$

$$(23) \quad 9x^2 = 4y^2, \quad 3xy + 2x + y = 485.$$

$$(24) \quad x^2 + y^2 - x - y = 78, \\ xy + x + y = 39.$$

$$(25) \quad \frac{7}{y} - \frac{1}{x} = \frac{7}{4}, \quad x^2y - xy^2 = 76.$$

$$(52) \quad xy(x+y) = 30, \quad x^3 + y^3 = 35.$$

$$(53) \quad \frac{x^2}{y} + \frac{y^2}{x} = 78, \quad x+y = 12.$$

$$(54) \quad x + \sqrt{(x^2 - y^2)} = 8, \quad x - y = 7.$$

$$(55) \quad x^2(x+y) = 80, \quad x^2(2x-3y) = 80.$$

$$(56) \quad x^2y + y^2x = 20, \quad \frac{1}{x} + \frac{1}{y} = \frac{5}{4}.$$

$$(57) \quad x^2 + y^2 = 7 + xy, \quad x^3 + y^3 = 6xy - 7.$$

$$(58) \quad x^2 + y^2 = 8, \quad \frac{1}{x^2} + \frac{1}{y^2} = \frac{1}{2}.$$

$$(59) \quad x+y = 4, \quad x^4 + y^4 = 82.$$

$$(60) \quad x^5 - y^5 = 3093, \quad x - y = 3.$$

$$(61) \quad \left(3 - \frac{6y}{x+y}\right)^2 + \left(3 + \frac{6y}{x-y}\right)^2 = 82, \quad xy = 2.$$

$$(62) \quad x^2 - x^2y^2 + y^2 = 79, \quad x - xy + y = 4.$$

$$(63) \quad x^2 - xy + y^2 = 7, \quad x^4 + x^2y^2 + y^4 = 133.$$

$$(64) \quad x^2 + xy + y^2 = 49, \quad x^4 + x^2y^2 + y^4 = 937.$$

$$(65) \quad x^4 - x^2 + y^4 - y^2 = 84,$$

$$x^2 + x^2y^2 + y^2 = 49.$$

$$(40) \quad \frac{x+y}{x-y} + \frac{x-y}{x+y} = \frac{70}{3}, \quad x^2 + y^2 = 45.$$

$$(41) \quad \frac{x+y}{x-y} + \frac{x-y}{x+y} = \frac{5}{2}, \quad x^2 + y^2 = 20.$$

$$(42) \quad .3x + .725y = 3x - y,$$

$$3x - .5y = 2.25xy + 3y.$$

$$(43) \quad .7y + .725x = y - x,$$

$$y - .5x = .75xy - 3x.$$

$$(44) \quad y^2 - 4xy + 20x^2 + 3y - 264x = 0,$$

$$5y^2 - 38xy + x^2 - 72y + 7056x = 0.$$

$$(45) \quad x+y = x^2, \quad 3y - x = y^2.$$

$$(46) \quad x^2 + y^2 = \frac{5}{2}xy, \quad x - y = \frac{7}{4}xy.$$

$$(47) \quad x + 2y + \frac{3x}{y} = 76, \quad 3x + y + \frac{3x}{y} = 23.$$

$$(48) \quad 4(x+y) = 3xy, \quad x+y+x^2+y^2 = 26.$$

$$(49) \quad x - y = 2, \quad x^3 - y^3 = 8.$$

$$(50) \quad x + y = 5, \quad x^3 + y^3 = 65.$$

$$(51) \quad x + y = 17, \quad x^3 + y^3 = 7007.$$

$$(75) \sqrt{x+y} + 2\sqrt{x-y} = \frac{2(x-7)}{\sqrt{x-y}},$$

$$\frac{x^2+y^2}{xy} = \frac{34}{75}.$$

$$(76) yz = bc, \quad \frac{x}{a} + \frac{y}{b} = 7, \quad \frac{x}{a} + \frac{z}{c} = 7.$$

$$(77) \frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 9, \quad \frac{2}{x} + \frac{3}{y} = 13,$$

$$8x + 3y = 5.$$

$$(78) x(x+y+z) = 24, \quad y(x+y+z) = 28,$$

$$z(x+y+z) = 12.$$

$$(79) \frac{1}{29}\left(x + \frac{y}{z}\right) = \frac{1}{6}, \quad \frac{1}{34}\left(y + \frac{x}{z}\right) = \frac{1}{6},$$

$$x + y + z = 15.$$

$$(80) xy + xz + yz = 26,$$

$$xy(x+y) + yz(y+z) + zx(z+x) = 162,$$

$$xy(x^2+y^2) + yz(y^2+z^2) + zx(x^2+z^2) = 538.$$

$$(66) x(72-xy) = y(xy-3),$$

$$xy(y+4x-xy) = 72(x+y-3).$$

$$(67) x+y+\sqrt{xy} = 74,$$

$$x^2+y^2+xy = 84.$$

$$(68) x+y-\sqrt{xy} = 7,$$

$$x^2+y^2+xy = 733.$$

$$(69) x+y = 72, \quad \sqrt[3]{x} + \sqrt[3]{y} = 6.$$

$$(70) \sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} = \frac{7}{\sqrt{xy}} + 1,$$

$$\sqrt{(x^3y)} + \sqrt{(y^3x)} = 78.$$

$$(71) x+y = 70, \quad \sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} = \frac{5}{2}.$$

$$(72) \sqrt{3+x^2} + 2y = 8,$$

$$2x^2 + \sqrt{5y^2+4x^4} = 9.$$

$$(73) \frac{x}{a} + \frac{y}{b} = 1, \quad \frac{a}{x} + \frac{b}{y} = 4.$$

$$(74) \sqrt{(x^2+y^2)} + \sqrt{(x^2-y^2)} = 2y,$$

$$x^4 - y^4 = a^4.$$

Answers.

- (26) $-8b - 709e + 37f - 70g + h.$
 (27) $6a^2b + 5abc - 3b^2c - 74c^3 + 2cd^2 - 3d^3$
 (28) $70a^2bc + b^2x + 75af.$
 (29) $a^2n^2 - 3a^3m + 6b + 5mn.$
 (30) $5a^3b^2c + 5ax^3d + 25a^4x.$

Subtraction.

- (1) $3a^2b^2c.$ (2) $4a^2b.$ (3) $4a^2bc.$
 (4) $6ab.$ (5) $77ac$ (6) $73b^2d.$
 (7) $-77a^2bc.$ (8) $2a^4b^n.$ (9) $3a^2 - 3b.$
 (10) $-2x^2 + 2x^2y + 17.$
 (11) $7xy^2 - 3z + 6x^3.$ (12) $a + 2b - c.$
 (13) $2ac - b + d.$ (14) $7ab - 72.$
 (15) $2y^2 - 5y.$
 (16) $793a^3 + 157ab^2 - 721a^2b + 155b^3.$
 (17) $-2a - 3x + 3y - 4z + 2w.$
 (18) $2x^3 - 3x^2y + xy^2 + xy^3.$

Answers.

- (8) $9a + 8d$ (9) $5cx^2 + 2dy^2 + z^3 + d$
 (10) $5ab + 8c + 4(a + b)$
 (11) $2x^2y + 8(a + b)z^2$
 (12) $2a + 2b + 2c$
 (13) $20ax + 73by$ (14) $22a^2 + 7ab - 8b^2.$
 (15) $-2x^3 + 6x^2y + 10xy^2 - 2y^3$
 (16) $73x + 73y + 28z + 72.$
 (17) $9x^3 + 2y^3 + 3xyz.$
 (18) $4x^4 + 74x^3y - 43x^2z + 27xv.$
 (19) $3ax + x - by - y.$
 (20) $7ax + 3bx + 6by - ay.$
 (21) $9px - 6qy + 2c.$
 (22) $3x^2 - a^2x - 5ax - x$
 (23) $-4a^2x - 2x^2 + ax.$
 (24) $-2a - 2x + 4y - z.$
 (25) $3ax^2y + 6xy^2z^2 + dx^2y^2z^2 + 2cxz^3 + 4bdx.$

Answers.

- (17) $789a^4 - 97a^3b + 62a^2b^2 - 73ab^3 + 5b^4$
 (18) $x^3 + ax^2 + bx^2 + cx^2 + abx + acx + bcx + abc$
 (19) $a^3 + b^3 + c^3 - 3abc$. (20) $a^5 - b^5$
 (21) $4a^2 - b^2c^2 + 4b^3c - 4b^4$
 (22) $24a^2b^2 - 6a^2c^2$
 (23) $a^2 + abx + acx + bcx^2$
 (24) $x^3 - 5x^2 - 4bx - 40$
 (25) $x^4 - 70x^3 - 37x^2 + 64bx - 7680$
 (26) $a^6 - 3a^4b^2 + 3a^2b^4 - b^6$
 (27) $x^6 - a^6$
 (28) $3x^{n+1}y^n - 6ax^ny^{n+1} + 3xy^{n+1}$
 (29) $a^{m+n} + 2a^2mb^n + a^{m+1}b^2 - a^nb^n - 2a^mb^{2n} - ab^{2+n}$
 (30) $x^{2n} + 2x^ny^n + y^{2n}$
 (31) $x^{2m+n} - x^ny^{2m} - x^{2m}y^n + y^{2m+n}$

Answers.

- (19) $x^4 - 4x^3y + 6x^2y^2 - 5xy^3 + y^4$
 (20) $px^2 - 4qxy - ry^2$
 (21) $x^3 + 3xy^2 - 3x^2y - y^3$
 (22) $70x^2 + xyz + 78x + p + q^3$
 (23) $x^3 - 3x^2y + 3xy^2 - y^3$
 (24) $2x + 2y + 2a$
 (25) $a^2 - 3b^2 + 3c^2$. (26) $2y + 2z$
 (27) $a - b + c - d$. (28) $a - 7b$
 (29) $5a$. (30) $72x - 8y$

Multiplication.

- (1) $a^2b + ab^2$. (2) $xyz + y^2z$
 (3) $2a^2b^2c + 3ab^3c$. (4) $7a^2c^2bd + 5c^3b^2d$
 (5) $6x^3y^2z + x^2y^3z$. (6) $x^3 + y^3$
 (7) $x^4 + x^2y^2 + y^4$
 (8) $3x^4 + 4x^3y - 4x^2y^2 - 73x^2 + 22xy - 30$
 (9) $x^7 + y^7$. (10) $x^5 + 32y^5$

Answers.

- (16) $4x^3 + 8x^2 + 16x + 32.$
 (17) $x^3 + 3x^2y + 3xy^2 + y^3.$
 (18) $x^{2n} - x^ny^n + y^{2n}.$ (19) $a + b - c.$
 (20) $x^2 - 2xy - 5y^2.$ (21) $x^2 - ax - b.$
 (22) $px^2 + qx - r.$ (23) $ax - a + x.$
 (24) $-a^5x^2 + 7a^7x^3 + 8a^3x^4.$
 (25) $a^2 - 4ax + 4x^2 - \frac{3x^3}{a+x}.$
 (26) $a^3 + a^2b + ab^2 + 2b^3 + \frac{ab^4 - 3b^5}{a^2 - ab + b^2}.$
 (27) $x^2 + rx + ax + r^2 + ar + b + \frac{r^3 + ar^2 + br + c}{x-r}.$
 (28) $1 + 5x + 15x^2 + 45x^3 + \dots$
 (29) $1 + 3x + 4x^2 + 7x^3 + \dots$
 (30) $1 - x + x^2 - x^3 + x^4, \dots$

Factoring.

- (1) $7abc(ac^2 - 4).$ (2) $2x^2y^2(2x^2 - 7).$
 (3) $6xy^2(x + 2y).$ (4) $ab(2a + c - d).$
 (5) $7x^2y^2(x - y + z).$ (6) $5acd(3a + 4c - 3d).$

Answers.

- (26) $x^8 + x^4 + 7.$
 (27) $x^8 - a^2x^6 - b^2x^4 - c^2x^2 - d^2 + 2abx^5$
 $- 2acx^4 + 2adx^3 + 2bcx^3 - 2bdx^2 +$
 $2cdx.$
 (28) $x^5 + 757x - 264.$
 (29) $x^5 - 47x - 720.$
 (30) $a^8 + 2a^6 + 3a^4 + 2a^2 + 7.$

Division.

- (1) $3b - 4x + 2ay.$ (2) $2a^2 - 3x.$
 (3) $7 + 4x - 9a.$ (4) $3a + 4b.$
 (5) $-2a^2x + 3ay.$ (6) $a - b.$
 (7) $2x + y.$ (8) $a - x.$
 (9) $a + b.$ (10) $x - y.$
 (11) $a + 2x.$ (12) $a^2 - 2ax + x^2.$
 (13) $(a^2 + 4ax + x^2).$ (14) $(a - b).$
 (15) $a^2 - 2ay + y^2.$

Answers.

- (37) $(a+4m)(a^2-4am+16m^2)$.
 (32) $(4a^2+6ab+9b^2)(4a^2-6ab+9b^2)$.
 (33) $(a^2b^2+9c^2)(ab+3c)(ab-3c)$.
 (34) $(3x^2y+4xy^2)(3x^2y+4xy^2)$.
 (35) $(2x-3y)(2x-3y)$.
 (36) $c^2(ab+d)(ab-d)$.
 (37) $(x+6)(x+3)$. (38) $2x^2(a+b)(a-b)$.
 (39) $(a+b-c)(a-b+c)$.
 (40) $(a^2+3ab+c^2)(a^2-3ab-c^2)$.
 (41) $(3x-4y)(2x+3y)$.
 (42) $(a+b-c)(a+b+c)$.
 (43) $(2a-b+3c)(3a-2c)$.
 (44) $(x+2y)(x^4-2x^3y+4x^2y^2-8xy^3+16y^4)$.
 (45) $(2x-3y)(2x+3y)(4x^2-6xy+9y^2)$
 $(4x^2+6xy+9y^2)$.

Answers.

- (7) $(a+b)(a+b)$. (8) $(2x+3y)(2x+3y)$.
 (9) $(x+b)(x+b)$. (10) $(2x^2+y)(2x^2+y)$.
 (11) $(2ab+3c)(2ab+3c)$.
 (12) $(4a^2y^2+y^2x^2)(4a^2y^2+y^2x^2)$.
 (13) $(a-b)(a-b)$. (14) $(ax-c)(ax-c)$.
 (15) $(2x-y)(2x-y)$. (16) $(3ab-4ac)(3ab-4ac)$.
 (17) $(2x^2-y)(2x^2-y)$. (18) $(6x-2y)(6x-2y)$.
 (19) $(2xy-z)(2xy-z)$.
 (20) $(a+b)(a-b)$. (21) $(2x+3y)(2x-3y)$.
 (22) $(ac+bd)(ac-bd)$.
 (23) $(3ax+4ay)(3ax-4ay)$.
 (24) $(5a^2b^2x^2+2x)(5a^2b^2x^2-2x)$.
 (25) $(7x^2+4y)(7x^2-4y)$. (26) $(x+6)(x+7)$.
 (27) $(x-3)(x+5)$. (28) $(x-7)(x-8)$.
 (29) $(x+8)(x-9)$.
 (30) $(2a-b)(4a^2+2ab+b^2)$.

最大公約數

Answers.

- (31) $x^2 - 3$.
- (32) $x + 3$.
- (33) $x^2 + x + 7$.
- (34) $x^2 - x + 7$.
- (35) $x + y + z$.

Least common multiple.

- (1) $18a^2b^2$.
- (2) $24a^2x^2y^2$.
- (3) $a^3 - a^2b - ab^2 + b^3$.
- (4) $30x^3y^3$.
- (5) $78x^2y^3z$.
- (6) $12abc^3d$.
- (7) $ax^2y^2 - bx^2y^2$.
- (8) $(a-b)^2(a+b)$.
- (9) $120x^5(x^2 - y^2)(x - y)$.
- (10) $4a^2x(a^2 - x^2)$.
- (11) $a^4 + a^3x - ax^3 - x^4$.
- (12) $4x^2 - 1$.
- (13) $(x+3)(x+4)(x+5)$.
- (14) $x^5 - 2x^4y + x^3y^2 + x^2y^3 - 2xy^4 + y^5$.
- (15) $(x^2 + 2x - 8)(x^2 + 5x + 6)$.
- (16) $(x^2 - 7)(x + 5)$.
- (17) $40xy(x^2 - y^2)$.
- (18) $900x^5(x - y)^3$.
- (19) $x^4 + 2x^3 - x - 2$.
- (20) $6x^3 + 77x^2 - 3x - 2$.

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Answers.

Greatest common divisor.

- (1) $74ax$.
- (2) $8ax^2y$.
- (3) $2x(x - y)$.
- (4) $a + x$.
- (5) $a(a - x)$.
- (6) $x - y$.
- (7) $2c - 3x$.
- (8) $4ax^2 - 4ay^2$.
- (9) $2x(a + b)^3$.
- (10) $x + y$.
- (11) $x - 3$.
- (12) $3a(x - y)$.
- (13) $a + 2$.
- (14) $a + b$.
- (15) $x^2 - b^2$.
- (16) $x + 3$.
- (17) $3x + 3y$.
- (18) $x^2 + ax + a^2$.
- (19) $5x^2 - 7$.
- (20) $a^2 - 2ab + b^2$.
- (21) $2x^2$.
- (22) $x + 4$.
- (23) $3a^{n-1}x^{n-1}$.
- (24) $a - b$.
- (25) $a + b$.
- (25) $x^2 - 2x$.
- (27) $x + 2y$.
- (28) $3(a + b)$.
- (29) $x + 3$.
- (30) $x - 7$.

Answers.

(5) $2 - 3x + \frac{5x^2}{5-x}$ (6) $x + \frac{3-y}{4-x}$
 (7) $x + 7 + \frac{3}{x-4}$ (8) $2y + 6 + \frac{23}{y-3}$

Fractional form.

(7) $\frac{ac+b}{c}$ (2) $\frac{a^2}{a-x}$ (3) $\frac{x-y+c}{x-y}$

(4) $\frac{2ac+ad+d}{c+d}$ (5) $\frac{2x^2}{x-y}$

(6) $\frac{(a+b)^2 - c^2}{2ab}$ (7) $\frac{2ab(c+d)}{c+2d}$

Common denominator.

(7) $\frac{adx}{bdx}, \frac{bcx}{bdx}, \frac{bd^2}{bdx}$ (2) $\frac{bx}{abc}, \frac{cx}{abc}, \frac{ax}{abc}$

(3) $\frac{a(x+y)}{x^2-y^2}, \frac{a(x-y)}{\dots}$ (4) $\frac{xy(x+y)}{(x+y)^2}, \frac{axy}{\dots}$

(5) $\frac{a(x+a)}{ab}, \frac{a^2}{\dots}, \frac{b(a-x)}{\dots}$

(6) $\frac{a}{a^2-x^2}, \frac{b(a+x)}{\dots}, \frac{c(a-x)}{\dots}$

(7) $\frac{m(a-x)}{4a(a^2-x^2)}, \frac{na}{\dots}$

Answers.

(27) $a^4 + a^3x - ax^3 - x^4$

(22) $6x^3 - 25x^2 + 23x - 6$

(23) $(3x-2)(4x^3 - 4x^2 - x + 1)$

(24) $76x^4 - 7$ (25) $(x^2 - 4a^2)^3$

Transformation of fractions.

Lowest terms.

(7) $\frac{3ad}{4b}$ (2) $\frac{2x}{3y}$ (3) $\frac{5xy}{4ab}$

(4) $\frac{2x}{3ab}$ (5) $\frac{3(a+b)}{4}$ (6) $\frac{2(x+y)}{x-y}$

(7) $\frac{7}{2}(a+x)$ (8) $\frac{x-a}{x+a}$ (9) $\frac{3a}{2y}$

(10) $\frac{3x}{2y}$ (11) $\frac{x+a}{3(x-a)}$ (12) $\frac{x+2}{2x^2+2x-7}$

(13) $\frac{x-3}{x-4}$ (14) $\frac{x-a}{y(7x-3a)}$ (15) $\frac{72x-3y}{6x^2+2y^2}$

Mixed quantity.

(7) $a - x + \frac{2x^2}{a+x}$ (2) $x - 7 - \frac{2}{x+2}$

(3) $a - 2x + \frac{3x^2}{a+x}$ (4) $x - a + \frac{3}{x-a}$

Answers.

(8) $\frac{7}{7-ax}$ (9) $\frac{85x-20y}{84}$ (10) 0.

Subtraction of fractions.

(1) $\frac{8ax}{a^2-4x^2}$ (2) $2a + \frac{3(a-b)}{c}$

(3) $\frac{27x+23y}{20}$ (4) $\frac{a^2+x^2}{a^2-x^2}$

(5) $\frac{4xy}{x^2-y^2}$ (6) $a - \frac{4x}{a^2-x^2}$

(7) $\frac{737x+5}{705}$ (8) $\frac{x+y-1}{y^2-x^2}$

(9) $\frac{4a}{a+x}$ (10) $\frac{87a-4b}{84}$

Multiplication of fractions.

(1) $\frac{27ax}{20cy}$ (2) $\frac{2x(x+y)}{3}$ (3) 2.

(4) $\frac{3abx^2y}{2c}$ (5) $\frac{28yx^2yz}{9bcd}$

(6) $\frac{74x^2-72x}{75}$ (7) $\frac{2(x+y)}{a}$ (8) $\frac{3bx^2}{a(4-x)}$

(9) $\frac{4x(x-2)}{3}$ (10) $\frac{(ax+b)(bx+a)}{x^2}$

(11) $\frac{(72+x)(x^2+4)}{4x}$ (12) $2x(a+b)$

Answers.

(8) $\frac{45x}{60}, \frac{40}{...}, \frac{48x^2}{...}$ (9) $\frac{70b}{75}, \frac{45c}{...}, \frac{72d}{...}$

(10) $\frac{72a}{72}, \frac{9b^2}{...}, \frac{10c^3}{...}$

(11) $\frac{x(7-x)^2}{(7-x)^3}, \frac{x^2(7-x)}{...}, \frac{x^3}{...}$

(12) $\frac{3bx^2(a^2-x^2)}{x(a^2-x^2)}, \frac{ax(a-x)}{...}, \frac{bx}{...}, \frac{c(a^2-x^2)}{...}$

(13) $\frac{cx(a+x)}{a^2-x^2}, \frac{dx^2(a-x)}{...}, \frac{x^3(a-x)}{...}$

(14) $\frac{4x^3}{x^3(c-x)}, \frac{5x(c-x)}{...}, \frac{6(c-x)}{...}$

(15) $\frac{4y(a^4-x^4)}{y(a^4-x^4)}, \frac{5y(a^2+x^2)}{...}, \frac{6y(a^2-x^2)}{...}$

$\frac{7(a^4-x^4)}{...}$

Addition of fractions.

(1) $\frac{(4a^3+4a+3x)b+2a^2}{4a^2b}$

(2) $\frac{2a+3b+4}{a^3b^3}$ (3) $\frac{6x^2+5ax+8a}{72x^2}$

(4) $\frac{a^2+b^2}{a^2-b^2}$ (5) $\frac{1}{7-x}$

(6) $\frac{4x^2-5x+3}{(x-7)^3}$ (7) $\frac{1}{(7+a)(7-x)}$

Answers.

- (8) $\frac{2a+x}{c^2+cX+X^2}$ (9) $\frac{x}{y}$
 (10) $\frac{x-3}{x+2}$ (11) $\frac{abc}{ab+ac+bc}$
 (12) $a^3+a+\frac{1}{a}+\frac{1}{a^3}$ (13) $\frac{x+y}{y}$
 (14) 7. (15) 1.

Miscellaneous examples.

- (1) a^2+b^2 (2) $\frac{4a}{a^4-1}$ (3) y
 (4) $\frac{2}{x+y}$ (5) $\frac{y}{x-y}$ (6) y
 (7) $\frac{78(2y+75)}{16y^4-81}$ (8) $x+\frac{x^4}{(1-x)^3}$ (9) 7.
 (10) $\frac{(x-4)(x-7)}{x^2}$ (11) $x^{2n}+2$
 (12) $\frac{4a(a^2-x^2)}{3b(c^2-x^2)}$ (13) $\frac{a+bX}{b+aX}$
 (14) $\frac{a^2-x^2}{a^2+x^2}$ (15) $\frac{a^2x(b+2x)+a(x+b)-7}{b(x-a)}$

Answers.

- (73) $\frac{2y(3x^2+7)}{6}$ (74) $\frac{x^2-7}{y}$
 (75) $m^2+7+\frac{7}{m^2}$ (76) $\frac{x^4-y^4}{x^2y}$
 (77) $\frac{ax}{a^2-x^2}$ (78) $\frac{a^2(a-b)}{x}$
 (79) x^2 (80) $\frac{(a-x)^3}{a^3+a^2x+ax^2+x^3}$
 (81) $x^2+7+\frac{7}{x^2}$ (82) $x^2+7+\frac{7}{x^2}$
 (83) $\frac{b-3a}{2ab}$ (84) $\frac{(a^2+b^2)c}{(a+b)(a+c)(b+c)}$
 (85) $\frac{7-y}{x}$ (86) $\frac{a^2+b^2}{a}$
 (87) 2. (88) $\frac{a^2-ab+b^2}{a^2+ab+b^2}$
 (89) $\frac{x^4}{a^4}+\frac{x^2}{a^2}+7$ (90) $\frac{2(a-b)^2}{3b^2(a+b)}$

Division of fractions.

- (1) $\frac{3a}{a-b}$ (2) $\frac{3}{4}$ (3) x^2-y^2
 (4) $\frac{x}{x-2}$ (5) $(x-a)^2$
 (6) $\frac{x^3+x^2y+xy^2+y^3}{a+b}$ (7) $\frac{ax^2+a}{x}$

Answers.

- (40) $\frac{2}{3}$. (47) 56. (42) 7.
 (43) 7. (44) $8\frac{3}{5}$. (45) $4\frac{1}{2}$.
 (46) $2\frac{3}{7}$. (47) $1\frac{4}{7}$. (48) 3.
 (49) 2. (50) 12.

Equations of the First Degree with two unknown quantities.

- (1) $x=6, y=15$. (2) $x=2, y=3$.
 (3) $x=3, y=3$. (4) $x=4, y=2$.
 (5) $x=7, y=4$. (6) $x=7, y=6$.
 (7) $x=\frac{7}{2}, y=3$. (8) $x=7, y=\frac{7}{3}$.
 (9) $x=9, y=12$. (10) $x=10, y=4$.
 (11) $x=4, y=6$. (12) $x=3, y=5$.
 (13) $x=12, y=18$. (14) $x=18, y=6$.
 (15) $x=2, y=13$. (16) $x=8, y=7$.
 (17) $x=-6, y=12$. (18) $x=10, y=20$.
 (19) $x=7, y=11$. (20) $x=.4, y=.7$.

Answers.

Equations of the First Degree with one unknown quantity.

- (1) $\frac{10}{11}$. (2) $3\frac{9}{22}$. (3) $2\frac{34}{53}$.
 (4) 8. (5) $6\frac{2}{3}$. (6) 0.
 (7) $37\frac{6}{19}$. (8) $4\frac{1}{4}$. (9) $\frac{2}{3}$.
 (10) $1\frac{3}{19}$. (11) 5. (12) $\frac{1}{ab}$.
 (13) 2. (14) 12. (15) $-a$.
 (16) 11. (17) 10. (18) 5.
 (19) $\frac{67}{83}$. (20) $\frac{80}{67}$. (21) $25a+24b$.
 (22) $\frac{a^2-b^2}{b-4a}$. (23) $\frac{3b}{3a-2b}$. (24) $\frac{a^2-b^2}{c}$.
 (25) $-\frac{2}{9}$. (26) $23\frac{1}{4}$. (27) 2.
 (28) 12. (29) $7\frac{1}{3}$. (30) $3\frac{2}{11}$.
 (31) 19. (32) $\frac{b(h-g)}{a-bg}$. (33) 4.
 (34) $\frac{43}{9}$. (35) 12. (36) 4.
 (37) 9. (38) 4. (39) 1.

Answers.

- (4) $x=3, y=7, z=4.$
(5) $x=24, y=60, z=720.$
(6) $x=4, y=6, z=2.$
(7) $x=62, y=46, z=34.$
(8) $x=10, y=7, z=3.$
(9) $x=\frac{7}{2}, y=\frac{1}{3}, z=\frac{1}{4}.$
(10) $x=6, y=9, z=\frac{1}{3}.$
(11) $x=8, y=4, z=2.$
(12) $x=10, y=2, z=3.$
(13) $x=4, y=3, z=5.$
(14) $x=3, y=4, z=6.$
(15) $x=\frac{7}{6}, y=-\frac{7}{2}, z=\frac{27}{10}.$
(16) $x=2, y=3, z=7.$
(17) $x=4, y=9, z=16, u=25.$
(18) $u=4, x=72, y=5, z=7.$
(19) $x=3, y=7, u=9, z=5.$

Answers.

- (27) $x=y=\frac{a}{b}.$ (22) $x=y=m+n.$
(23) $x=.02, y=2.9.$
(24) $x=\frac{(ab+ac-bc)abc}{b^2a^2+a^2c^2-b^2c^2},$
 $y=\frac{(ac-ab-bc)abc}{b^2a^2+a^2c^2-b^2c^2}.$
(25) $x=7, y=4.$
(26) $x=3a, y=-2b.$
(27) $x=4, y=7.$ (28) $x=\frac{10}{3}, y=\frac{20}{3}.$
(29) $x=\frac{nc+bd}{mb+na}, y=\frac{mc-ad}{mb+na}.$
(30) $x=12, y=6.$

*Equations of the First Degree with
more than two unknown
quantities.*

- (1) $x=4, y=2, z=2.$
(2) $x=7, y=2, z=3.$
(3) $x=2, y=2, z=3.$

Answers.

(16) $c^6 - 6c^5d + 75c^4d^2 - 20c^3d^3 + 75c^2d^4 - 6cd^5 + d^6$

(17) $7 + 4x + 70x^2 + 72x^3 + 9x^4$

(18) $a^3 + 3a^2b - 3a^2c + 3b^2a + 3c^2a + b^3 - 6abc - 3b^2c + 3c^2b - c^3$

(19) $7 + 6x + 75x^2 + 20x^3 + 75x^4 + 6x^5 + x^6$

(20) $7 - 6x + 75x^2 - 20x^3 + 75x^4 - 6x^5 + x^6$

Square roots.

(1) $a^2 - a + 7$. (2) $3x - 5a - \frac{a^2}{2}$

(3) $2x^2 + 2ax + 4b^2$ (4) $\frac{a}{b} + \frac{b}{a} + 1$

(5) $\frac{x}{2} + \frac{y}{3} - \frac{z}{4}$. (6) $\frac{x}{3} + \frac{2y}{5} - \frac{z}{4}$

(7) $x^2 + px - q$. (8) $x - x^{-1} - 2$

(9) $2x^2 + 3x - 7$. (10) $2x^2 - x + 7$

(11) $2x^2 - 3ax + 4a^2$

(12) $5x^2 - 3ax + 4a^2$

Answers.

(20) $x=2, y=1, z=3, u=-7, v=-2$.

Involution.

(1) $8a^6y^3x^9$. (2) $-8a^3x^3y^6$

(3) $87a^8b^4c^2x^4$. (4) a^{-4}

(5) x^6y^{-2} . (6) $\frac{7}{4}x^{-4}y^{-6}$

(7) $\frac{7}{4}x^4y^6$. (8) $a^{-3}x^{-6}y^{-9}z^6$

(9) $a^3 + 3a^2b + 3ab^2 + b^3$

(10) $c^4 + 4c^3d + 6c^2d^2 + 4cd^3 + d^4$

(11) $a^5 + 5a^4b + 70a^3b^2 + 70a^2b^3 + 5ab^4 + b^5$

(12) $a^6 + 6a^5b + 75a^4b^2 + 20a^3b^3 + 75a^2b^4 + 6ab^5 + b^6$

(13) $a^3 - 3a^2b + 3ab^2 - b^3$

(14) $c^4 - 4c^3d + 6c^2d^2 - 4cd^3 + d^4$

(15) $a^5 - 5a^4b + 70a^3b^2 - 10a^2b^3 + 5ab^4 - b^5$

Answers.

- (3) $\sqrt[12]{(a+x)^6}$, $\sqrt[12]{(a-x)^4}$, $\sqrt[12]{(a^2-x^2)^3}$.
 (4) $2\sqrt[6]{\frac{8}{27}}$, $\sqrt[6]{4}$, $5\sqrt[6]{27}$.
 (5) $(a^{12}x^{12})^{\frac{1}{12}}$, $(b^6x^6)^{\frac{1}{12}}$, $(c^4x^4)^{\frac{1}{12}}$, $(d^3x^3)^{\frac{1}{12}}$.
 (6) $(cx^2)^{\frac{4}{4}}$, $(dx^3)^{\frac{7}{4}}$, $(x^4)^{\frac{2}{4}}$.
 (7) $\sqrt[6]{49}$, $\sqrt[6]{1000}$, $\sqrt[6]{\frac{161}{49}}$.
 (8) $\sqrt{\frac{7}{2}}$, $\sqrt{\frac{4}{7}}$, $\sqrt{11}$.
 (9) $\sqrt[6]{36}$, $\sqrt[6]{(19)^3}$, $\sqrt[6]{189}$, $\sqrt[6]{(11)^3}$.
 (10) $\sqrt[3]{8}$, $\sqrt[3]{32}$, $\sqrt[3]{64}$, $\sqrt[3]{17}$.

Theory of Indices.

- (1) $x^{\frac{4}{3}}$. (2) $a^{-\frac{17}{60}}$. (3) $\frac{y^{\frac{1}{3}}}{(bx)^{\frac{7}{8}}}$. (4) 1.
 (5) $a^{\frac{3}{2}}b^{-\frac{7}{2}} + a^{\frac{7}{2}}b^{\frac{7}{2}} + a^{-\frac{7}{2}}b^{\frac{3}{2}}$.
 (6) $x^{\frac{5}{2}} + x^{\frac{3}{2}}y - xy^{\frac{3}{2}} - y^{\frac{5}{2}}$. (7) $a^4 - 1$.
 (8) $a + a^{\frac{1}{3}} - 1 + a^{-\frac{1}{3}} + a^{-1}$.
 (9) $-4a^{-7}b^{-1} + 9a^{-9}b$. (10) $x + y$.

Answers.

- (73) $(x-a)^3$. (74) $a^2 + b^2$.
 (75) $(a^2+b^2)(c^2+d^2)$. (76) $a^2 - b^2 + c^2 - d^2$.
 (77) $3a^m - 5c^{m-2} + a^{2m+7}$.
 (78) $7x^2 - \frac{x}{5} + 3$.
 (79) $7 + \frac{x}{2} - \frac{x^2}{8} + \frac{x^3}{76} - 8c$.
 (20) $\frac{x^2}{2y^2} + \frac{2y^2}{x^2} + 1$.

Cube roots.

- (21) $2x - 7$. (22) $x^2 - 2x + 7$.
 (23) $4a^2 - 6a - 9$. (24) $7 - 2x + 3x^2$.
 (25) $a + b - c$. (26) $2x + 3y - 2z$.
 (27) $2x^2 - 3x + 7$. (28) $2x^2 + 4cx - 3c^2$.
 (29) $2x^2 - 3cx + 4c^2$. (30) $x - \frac{7}{x} - 1$.

Common index.

- (1) $(2^{12})^{\frac{7}{12}}$, $(3^4)^{\frac{7}{12}}$, $(a^6)^{\frac{7}{12}}$, $(b^3)^{\frac{7}{12}}$.
 (2) $(a^3)^{\frac{7}{6}}$, $(b^{12})^{\frac{7}{6}}$, $(c^4)^{\frac{7}{6}}$, $(d^4)^{\frac{7}{6}}$.

Answers.

- (23) $2\sqrt[6]{200}$. (24) $\sqrt[6]{\frac{2^7}{256}}$.
 (25) $\frac{7}{96}\sqrt[3]{\frac{7}{6}}$. (26) $\sqrt[3]{x^2+4}\sqrt{x+8}\sqrt[3]{x+8}\sqrt[6]{x}$.
 (27) $a-x^2$. (28) x^2+px-q .
 (29) $\frac{ax^2}{b^3}-\frac{c}{d}$. (30) $\sqrt[3]{a^{-7}}-\sqrt[3]{(a^2b)}$.
 (31) $\frac{28}{39}\sqrt[3]{\frac{70}{3}}$. (32) $\frac{7}{30}$. (33) $\frac{2}{3}\sqrt{\frac{a}{b}}$.
 (34) $\frac{3}{2}\sqrt[6]{\frac{8}{3}}$. (35) $2\sqrt[6]{\frac{a^3}{2b^2x}}$.
 (36) $\sqrt{x}-\sqrt[4]{xy}+\sqrt{y}$.
 (37) $8x^{\frac{3}{4}}+2x^{\frac{7}{2}}y+\frac{7}{2}x^{\frac{7}{4}}y^2+\frac{7}{8}y^3$.
 (38) $-2(2-\sqrt{3})$. (39) $-3(\sqrt{2}+\sqrt{3})$.
 (40) $\frac{44+8\sqrt{3}}{709}$. (41) $\frac{24-3\sqrt{2}}{62}$.
 (42) $\sqrt{2}-\sqrt{3}+\sqrt{6}-2$. (43) $\sqrt{5}-7$.
 (44) $\frac{a}{x}+\sqrt{(\frac{a^2}{x^2}-7)}$. (45) $\frac{7}{5}\sqrt{75}$.
 (46) $3+\sqrt{5}$. (47) $\sqrt{77}-\sqrt{7}$.

Answers.

- (11) $x^{\frac{2}{3}}-x^{\frac{7}{3}}y^{\frac{1}{3}}+y^{\frac{2}{3}}$. (12) $a^{12}+1+a^{-12}$.
 (13) $2x^2-3xy+2y^2$.
 (14) $a+a^{\frac{1}{2}}b^{\frac{1}{2}}-b$. (15) $\frac{x+a}{x^2+3xa+a^2}$.

Miscellaneous examples.

- (1) $18\sqrt{2}$. (2) $37\sqrt{2}$. (3) $\frac{43}{705}\sqrt{75}$.
 (4) $\frac{2}{5}\sqrt[3]{6}$. (5) $25a^2x\sqrt{3x}$.
 (6) $9\sqrt[3]{2a}$. (7) $\frac{37}{2}\sqrt{3}$.
 (8) $18ab\sqrt[3]{(2a^2b^2)}$. (9) $4\sqrt{5}$.
 (10) $-3a^2b\sqrt[3]{b}$. (11) $2b\sqrt{a}$.
 (12) $\frac{37}{90}\sqrt[3]{6}$. (13) $5a\sqrt{b}$.
 (14) $(73a-5b)\sqrt{2a}$.
 (15) $(a-x-\frac{7}{a-x})\sqrt{(a^2-x^2)}$. (16) $7\sqrt[3]{3}-8$.
 (17) $96\sqrt{6}$. (18) $\frac{97}{24}\sqrt[3]{4}$.
 (19) $24\sqrt{6}$. (20) $\frac{7}{2}\sqrt[3]{6}$.
 (21) $\frac{25ax}{2}\sqrt[3]{(ab)}$. (22) $4a^2b^2$.

Answers.
Radical Equations.

- (7) 9. (2) $\frac{4n}{(7+n)^2}$ (3) $\frac{4a^2}{a^2+4}$
 (4) 87. (5) $\frac{ac}{a+b}$ (6) $76a$.
 (7) 3. (8) 25. (9) 4.
 (10) 2. (11) 6. (12) 72 .
 (13) $\frac{25a}{76}$. (14) $\frac{a^2+a}{5-2a}$ (15) $a-7$.
 (16) $42\frac{7}{4}$. (17) $\frac{4a^2+7}{4a}$ (18) $\frac{5a}{4}$.
 (19) $\frac{9a}{70}$. (20) ± 7 .

*Equations of the Second Degree with
but one unknown quantity.*

- (1) 3, $\frac{5}{3}$. (2) 4, $-\frac{7}{4}$. (3) 36, 72.
 (4) $\frac{27}{5}$, -3. (5) 72, -2.
 (6) $\frac{-b \pm \sqrt{b^2+4ac}}{2a}$ (7) 3, $\frac{27}{77}$.

Answers.

- (48) $7+3\sqrt{5}$. (49) $5+\sqrt{3}$.
 (50) $a-2\sqrt{ab}-b$. (51) $7+\sqrt{3}$.
 (52) $2-\sqrt{3}$. (53) $\sqrt{5+\sqrt{2}}$.
 (54) $\sqrt{70}+2\sqrt{2}$. (55) $3\sqrt{7}-2\sqrt{3}$.
 (56) $\sqrt{\frac{25}{2}}+\sqrt{\frac{7}{2}}$.
 (57) $\sqrt{\frac{(a+c)(b+c)}{2}}+\sqrt{\frac{(a-c)(b-c)}{2}}$.
 (58) $\sqrt[4]{3}\left(\frac{3}{\sqrt{2}}-\frac{\sqrt{3}}{\sqrt{2}}\right)$.
 (59) $\sqrt[4]{(7-c^2)}\left\{\sqrt{\frac{7+c}{2}}+\sqrt{\frac{7-c}{2}}\right\}$.
 (60) $7+\sqrt{2}+\sqrt{3}$. (61) $7+\sqrt{\frac{5}{2}}-\sqrt{\frac{3}{2}}$.
 (62) $\sqrt{6}+\sqrt{3}-\sqrt{5}-7$. (63) $7+\sqrt{3}+\sqrt{7}$.
 (64) $2+\sqrt{2}-\sqrt{5}$. (65) $7+\sqrt{2}$.
 (66) $7+\sqrt{5}$. (67) $\sqrt{3}-\sqrt{2}$.
 (68) $\sqrt{6}-\sqrt{3}$. (69) $\sqrt{6}-\sqrt{5}$.
 (70) 1.

Answers.

- (43) 5, -3. (44) 29, -70. (45) 70, -29.
 (46) 3, $-\frac{4}{5}$. (47) 7, $\frac{3}{5}$. (48) 24, $\frac{42}{5}$.
 (49) 8, -8. (50) $2+\sqrt{3}$, $-2(2+\sqrt{3})$.
 (51) 8, $\frac{125}{64}$. (52) 8, $(-\frac{73}{7}\sqrt{2})^2$.
 (53) ± 2 , $\pm\sqrt{70}$. (54) $\frac{17}{4}$, $\frac{7}{4}$.
 (55) 4, $\frac{7}{4}$. (56) 76, $(-\frac{77}{5})^4$.
 (57) $(-7)^{\frac{4}{3}}$, $(\frac{7}{3})^{\frac{4}{3}}$. (58) 4, -7.
 (59) 2^n , $\frac{1}{2^n}$. (60) 9, $-\frac{78}{5}$. (61) ± 5 .
 (62) $\frac{\pm\sqrt{4ab-b^2}}{2}$. (63) 76, 0.
 (64) 78, 3. (65) 0, $\frac{a\{7\pm\sqrt{(-8)}\}^6}{3^6}$.
 (66) 0, $\frac{\pm\sqrt{3}}{2}a$. (67) $x^2 = \frac{n}{n-2}$ or $\frac{n-1}{n+1}$.
 (68) $x^2 = -ab \pm \frac{1}{2}\sqrt{3a^4+3b^4-ba^2b^2}$.
 (69) $\sqrt{x} = \frac{-(2+a) \pm \sqrt{(2a^3+3a^2)}}{2+2a}$.

Answers.

- (8) 2. (9) 6, $-\frac{75}{4}$. (10) 4, $-8\frac{27}{5}$.
 (11) a, b. (12) 3, $-\frac{17}{4}$. (13) 2, -3.
 (14) 27, 5. (15) -7. (16) $\frac{9 \pm \sqrt{745}}{2}$.
 (17) $9\frac{75}{77}$, -17. (18) $\frac{3}{2}$, $-\frac{5}{8}$. (19) 7, $\frac{4}{5}$.
 (20) 77, -73. (21) 5, -2. (22) 7, $-\frac{2}{9}$.
 (23) $\frac{3 \pm \sqrt{687}}{74}$. (24) 3, 2. (25) 80, -720.
 (26) 2, $\sqrt[3]{-4}$. (27) $\pm\sqrt{3}$, $\pm\sqrt{-7}$.
 (28) ± 3 , $\pm\sqrt{-7}$. (29) 4, $\sqrt[3]{49}$.
 (30) $\sqrt[3]{3}$, $\sqrt[3]{-23}$. (31) 25, 3.
 (32) 4, $-\frac{64}{3}$. (33) $4\frac{7}{4}$, $\frac{7}{4}$.
 (34) 78, 3. (35) $\frac{n}{n-a}$, $\frac{n}{9n-a}$.
 (36) ± 7 , ± 5 . (37) $\frac{3}{5}$, -7.
 (38) 7, $-\frac{7}{9}$. (39) 3, $-\frac{24}{73}$.
 (40) 2, 76. (41) -2, -76. (42) 3, -5.

Answers.

(95) $1, \frac{47-44\sqrt{6}}{23}$ (96) $1, \frac{(\sqrt{a+\sqrt{b}})^2+4}{(\sqrt{a-\sqrt{b}})^2-4}$

(97) $x = \frac{5}{4}$. (98) $0, -1$.

(99) $0, \frac{1}{2}\{a+b+c \pm \sqrt{(a^2+b^2+c^2-2bc-2ac-2ab)}\}$.

(100) $0, \pm \sqrt{(a^2+b^2)}$.

General Properties of Equations.

(1) $3(x-5)(x+\frac{5}{3})$. (2) $(x+60)(x+13)$.

(3) $2(x+2)(x-\frac{3}{2})$. (4) $(x-62)(x-26)$.

(5) $5(x-5)(x+\frac{22}{5})$. (6) $x^2-74x+48=0$.

(7) $x^2-9x+20=0$. (8) $x^2+x-2=0$.

(9) $x^2-2x-4=0$. (10) $x^2+x=6$.

(11) $x^2-\frac{73}{3}x=\frac{70}{3}$. (12) $x^2-(a+b)x=-ab$.

(13) $x^2-\frac{58}{27}x=-1$. (14) $x^2+70x=-21$.

Answers.

(70) $1, \frac{c^2-2}{(c+2)^2}$. (71) $0, \pm \frac{a\sqrt{3}}{2}$.

(72) $2a, -2a$. (73) $1, -\frac{25}{3}$.

(74) $1, \frac{7}{27}$. (75) $\pm 2a, \pm 2a\sqrt{-1}$.

(76) $x^n=0$, or $\frac{4c^2a}{(c^2-1)^2b}$. (77) $\frac{7}{2}, -\frac{25}{6}$.

(78) $\pm a, \pm \frac{7}{a}$. (79) $\pm \frac{5a}{3}, \pm \frac{a\sqrt{-34}}{3}$.

(80) $5, -8$. (81) $\frac{a}{2}(1 \pm \sqrt{5})$. (82) $\pm \sqrt{2}$.

(83) $x^2 = \frac{m^4-4m^2}{4(m^2-7)}$. (84) $x^2=9$.

(85) $x^2 = \frac{a^4-b^4}{7a^2-2b^2}$. (86) $x^2 = \frac{2 \pm \sqrt{2}}{2}$.

(87) $\{c \pm \sqrt{(c^2-7)}\}^{\frac{229}{9-7}}$. (88) $0, \frac{76}{25}$.

(89) $\pm 2a, \pm a\sqrt{-6}$. (90) $\frac{3}{2}, \frac{2}{3}$.

(91) 5 . (92) $0, -\frac{4(a+b)(a^2+b^2)}{3a^2+3b^2+70ab}$.

(93) $8, -\frac{23}{5}$. (94) $\frac{ac^2}{b^2}$.

Answers.

(20) $x=3, y=7.$ (27) $x=5, y=4.$

(22) $x = \frac{b}{2a}(a^2+1), y = \frac{b}{2a}(a^2-1).$

(23) $x=10, y=15.$ (24) $x=9, y=3.$

(25) $x=4, y=2.$

(26) $x=2, 5; y=6, 3.$

(27) $x = \pm 7, \pm 4; y = \pm 4, \pm 7.$

(28) $x = -1, \frac{5}{8}; y = -1, \frac{3}{5}.$

(29) $x=7, y=7.$ (30) $x = \pm 3, \mp 8; y = \pm 5.$

(37) $x=5, \frac{333}{28}; y=9, \frac{370}{84}.$

(32) $x = \pm 3 \pm 36; y = \pm 5, \mp \frac{23}{2}.$

(33) $x = \pm 3, \pm \frac{5}{\sqrt{2}}; y = \pm 2, \pm \frac{1}{\sqrt{2}}.$

(34) $x = \pm 2, \pm \sqrt{\frac{2}{5}}; y = \pm \frac{7}{2}, \mp 2\sqrt{\frac{2}{5}}.$

(35) $x = \pm 3, \pm \frac{8}{\sqrt{6}}; y = \pm 7, \pm \frac{7}{\sqrt{6}}.$

(36) $x = \pm 4, \pm 3\sqrt{3}; y = \pm 5 \pm \sqrt{3}.$

Answers.

(75) $x^2 - \frac{7}{4}x = \frac{15}{8}.$

Equations involving several unknown quantities.

(1) $x=2, 12\frac{5}{13}; y=3, -\frac{6}{13}.$

(2) $x=17, 9; y=9, 77.$

(3) $x=75, -13; y=13, -75.$

(4) $x=7, 4; y=4, 7.$

(5) $x=5, 7; y=7, 5.$

(6) $x=5, y=3.$ (7) $x=2, y=3.$

(8) $x=6, y=5.$ (9) $x=3, y=4.$

(10) $x=5, y=2.$ (17) $x=4, y=3.$

(12) $x=7, y=4.$ (13) $x=25, y=76.$

(14) $x=5, y=4.$ (15) $x=4, y=2.$

(16) $x=4, y=5.$ (17) $x=3, y=2.$

(18) $x=3, y=2.$ (19) $x=6, y=5.$

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12

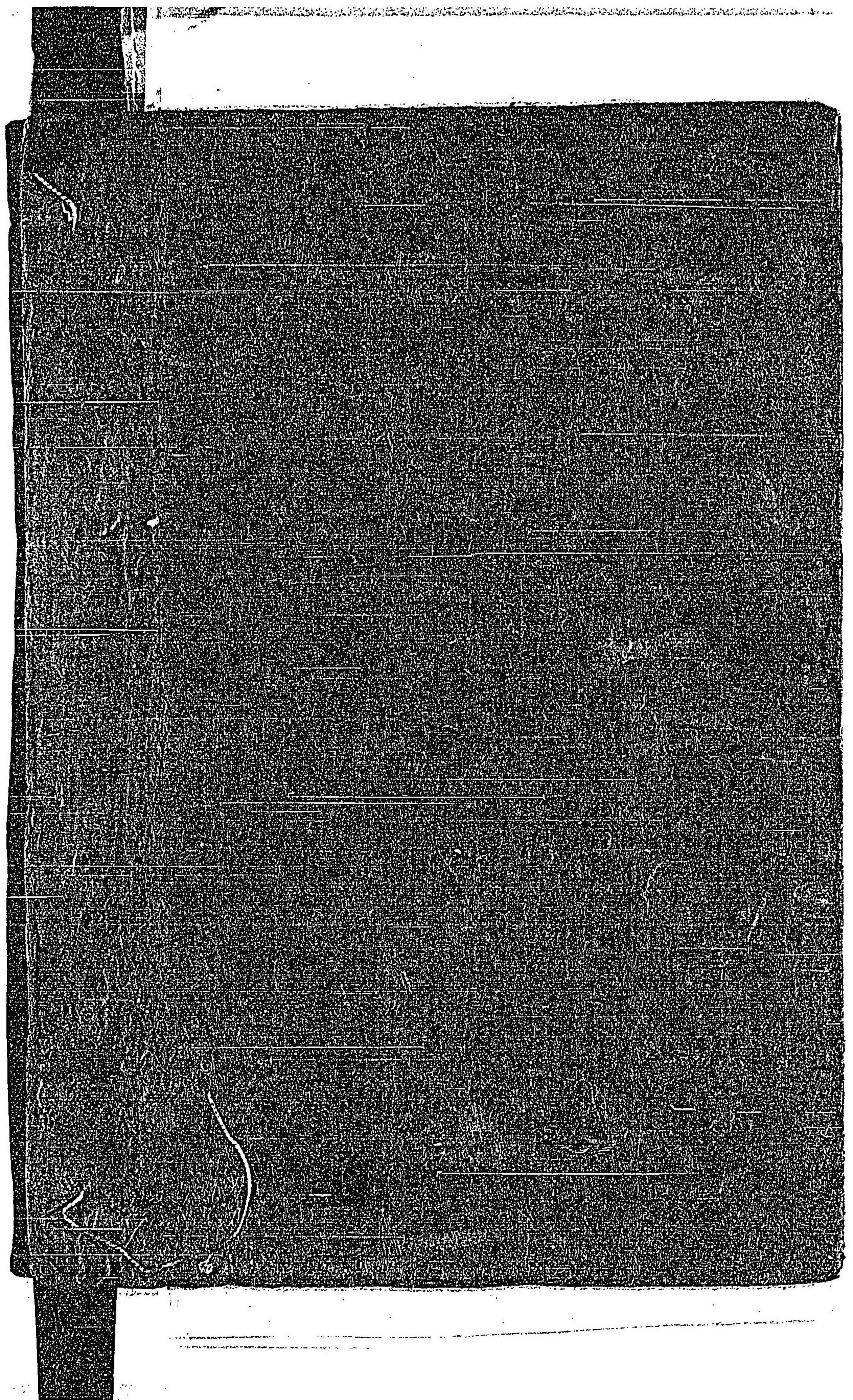
$$\begin{array}{r|l} 2a+2x & 3a+5x \\ \hline 3a+3x & 1 \end{array}$$

$$x^2(3a+3x)$$

$$x(2a+2x)$$

Answers.

- (68) $x=9, 4; y=4, 9.$
- (69) $x=8, 64; y=64, 8.$
- (70) $x=4, 9; y=9, 4.$
- (71) $x=2, 8; y=8, 2.$
- (72) $x=\pm 1, y=3.$ (73) $x=\frac{a}{2}, y=\frac{b}{2}.$
- (74) $x^2=\pm \frac{5a^2}{3}, \pm a^2; y^2=\frac{4a^2}{3}, 0.$
- (75) $x=5, y=3.$
- (76) $x=0, 2a; y=b, -b; z=c, -c.$
- (77) $x=\frac{7}{2}, \frac{5}{2b}; y=\frac{7}{3}, \frac{75}{13}; z=\frac{7}{4}, \frac{15}{44}.$
- (78) $x=\pm 3, y=\pm \frac{7}{2}, z=\pm \frac{3}{2}.$
- (79) $x=6, x=4, y=5;$
 $z=-\frac{5}{2}, x=\frac{355}{42}, y=\frac{790}{27}.$
- (80) $x=2, 2, 3, 3, 4, 4.$
 $y=3, 4, 2, 4, 2, 3.$
 $z=4, 3, 4, 2, 3, 2.$



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