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**1**

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A.	.....	1
B.	.....	5
C.	.....	5
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< 30 >	5	(5)	.....	53
< 31 >	3	(4)	.....	53

.

A.

, .

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가

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가

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7

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가

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가

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가

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Buyers Erlwanger(1984) “ 가  
 가 , 가  
 ”  
 , 가  
 가  
 ( ,  
 1998).  
 , , ,  
 가  
 가 ,  
 가  
 가  
 가 ,  
 (Richard, 1986 ; Wagner,  
 1981).  
 (NCTM, 1989),

. , Kieran

.

,

가

가 가

가 ,

가

(NCTM, 1989).

가

.

,  
가

Clayton(1990)

가

가

가 ,

가

가  
가

7

7

B.

1. 1  
( , ) .
2. 1  
( ) .

C.

1.  
, , , , , 가  
가 .

2. (error)

「 」 ‘ ’ ‘ ’ ‘ ’  
「 」 ‘ ’ ‘ ’ ‘ ’  
「 」 ‘ ’ ‘ ’ ‘ ’  
가 ‘ ’  
‘ ’ ‘ ’ ‘ ’ ‘ ’

가

:

:

:

3.

1

4.

1

(x)

(m)



< - 1 >

< - 1 >

	x m	x m

5. (矯正)

「 」 ‘ ’  
,

D.

가 가

E.

1.

7

가

2.

A.

1. (algebraic symbolism)

가

symbolism)

(algebraic  
가

. Harper(1987)

가

(Kieran et al, 1990).

Diophantus

(rhetorical stage,

A.D. 250 )

(syncopated stage)

Diophantus

16

(symbolic algebra)

Vieta가

(unknowns)

(givens)

. (givens)  
 , ' , '  
 ,  
 .  
 가  
 ,  
 가  
 (procedural) (structural)  
 .  
 ' ' 가 ,  
 가  
 (Wheeler, 1989). ,  
 가  
 .  
 ,  
 .

2.

=, +, - .  
 ,  
 .  
 , 6  $230 + 320 = 550 - 150 =$   
 400 .  
 가

(G. Vergnaud, 1984).

$12m$   $12$  ,  $1$   $12$   
 $12$  .  $m$

$12m$   
가 가

.  $1$

(label)

,  $4m$   $4$  monkeys

가

가

가

가 " "

,  $5$   $8$

$5 + 8$

$13$

,  $a$

$b$

$a + b$

(procedural)

가

$a + b$

$a$   $b$  가  $a + b$

(process and object)

R. B. Davis - (process-product dilemma)

Collis

(acceptance of lack of closure)

3. 가 가

가

가

가

가

(Diophantus)

1600 Vieta

(indeterminate magnitude),

가

가

Wagner(1983)

가

가

1. 가

2. 가 (words) 가

가

(1)

, e, i

가

$x - 3 = 14, 3y = 5$

가

가

(2)

가  
 $3n - 11, y = x + 10$   
(simultaneous representation)

가  
(identification number)

가  
, 347 , 3  
 $mn$   
(juxtaposition convention)  
(Matiz, 1979).

,  $3mn - 3, m, n$   
, 가

(3)  
, 가  
,  $x^2 + 2x = 3$

x 가 , “  
 ”  
 (generality) (flexibility)

가  

$$S = \frac{1}{2} \cdot b \cdot h$$
 S(sum), b(base), h(height)

(4)  
 가 ,  $3(x + 2) + 5 = 17 - 2x$  x가

가  
 가  
 가  
 ( )

가  
 가  
 (domain) 가  
 (freedom of delimitation property)



.  
 . 가 ' (freedom of choice property)  
 (generality) 가 , ' ' , 'X  
 (flexibility) X  
 가 .  
 , . X  
 가 . ' ' ,  
 ' ' ' ' ,  
 ' ' ' ' .

4.

가 .  
 가 가 .  
 가 , , , , 5가 ( , ,  
 , , 1988).  
 ,  
 .  
 ,  
 ,

가 . 가  
5.

$x, y$   
 $x$   
가  
1 12 13

Piaget  
가 가

가

가

, 가 , ,

, 가 가

가

가

- 가

가

$$a = b$$

$$a(b + c) = ab + ac \quad a, b, c \text{가 } 2$$

가 ,

$\{x \mid p(x)\}$   $x$  ' .

B.

1.

Radatz(1979) , 1925 Buswell Judd가  
 30 , Weimer(1925)  
 Seemann(1925) .  
 가 ,  
 Gestalt theory  
 가 .  
 가 가 .  
 , 가 가 가  
 , 가 .  
 , .  
 , .  
 가 .  
 , , , .  
 1970 B. Holtan & J. Dan Knifong(1976),

Hendrik Radatz, Clements(1980) Newmann(1981),  
 N. M. Hadar & Zaslavsky(1987)

2.

B. Holtan & J. D. Knifong(1976) 6 35

MAT(Metropolitan Achievement Test)

< - 1 >

< - 1 >

1.	12.5	3%
	61.5	13%
	88.5	19%
	80.5	17%
2.	22.5	5%
	30.5	6%
	58.5	12%
	85.5	18%
가	30.5	6%
	470	100%

Hendrik Radatz(1979)

가

(language difficulties)

(difficulties in obtain information)

(difficient mastery of prerequisite skills, facts, and concepts)

(incorrect associations or rigidity of thinking).

(application of irrelevant rules or strategies)

Pippigg(1975)

가

1996.

).

:

:

:

:

가

:

Pippigg

가

Clements(1980)

Newmann(1981)

5 7

< - 2 >

< - 2 >

	Clements (1)	Clements (2)	Newman
(Reading)	8	5	13
(Comprehension)	14	8	22
(Transformation)	27	25	12
(Process skill)	27	32	26
(Encoding)	2	2	2
(Careless)	22	28	25

가

Casey(1980) (many step problems)

Newman Clements

. Casey

(Question form)

(Reading)

(Comprehension)

(Strategy selection)

(Skills selection)

(Skills manipulation)

N. M. Hadar & O. Zaslavsky(1987)

가

(Misused Data) :

(Misinterpreted language) :

(Logically invalid inference) :

가

(Distorted theorem or definition) :

(Unverified solution) :

가

(Technical error) :

150 , 280

130 ,

< - 3 >



< - 3 >

(%)

	22	20
	17	18
	2	1
	34	32
	0	2
	25	27

< - 3 >

가

(1990)

3

12

가

Hadar 가  
가

가 가  
가

가

(%)

< - 4 >

(%)

	(%)
(Misused data)	16.8
(Misinterpreted language)	11.8
(Logically invalid inference)	4.6
(Misunderstood theorem or definition)	30.2
(Unmatched solution)	5.5
(Technical errors)	11.4
(Omission of solving process)	16.2
(Ambiguity of error)	3.5

< - 5 >

	1*	2*	3*	4*	5*	6*	7*	8*	
	3	2	13	9	5	2	8		42
	8	9		1	2	3	2	1	36
	12	2	2	1	7	4	3		31
	2	12		1	3	11	5		36
	14	7	1	2		3	13	3	43
	2	2	1	39	1	3	2	1	51
	3			38	6	13	7		67
	2	2		39		1	6	3	53
		2		1	1	8	4	2	18
	13	2		1		1	5	4	26
	17		4	2		3	1	2	43
	1	12		4			4		21
									457

\* : < - 4 >

3.

(1)

가

가

(2)

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(idea)

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(1)

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(2)

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,

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가

가

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(3)

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가

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가

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C. (Protocol methods)

protocol methods(talking aloud procedure ) 가

(protocol methods)

(written protocol)

(protocol)

1. (Talking aloud method)

(protocol)

가

가

2. (Clinical interview)

가

가

가

“

”

가

가

“ ”  
가

5+5=10

5+5=?

가

( )  
, ) 가 ,  
, 가 ,

3.

가 가

, ,  
, 가 ,  
가 ,

4.

가 가 가  
가

(critical tests)





A.

가  
C 1 , 1  
2 . ,

가 1 1 , 1 ' '

B.

1.

, , ,  
가 가  
1 1

2.

1 2

,

1

2

가

가

45

1

,

2

12

2

2

C.

,  
(clinical) .

1.

,

가

, Casey 6가 ( , ,  
, , , ) Polya 4 ( ,  
, , , , ) .  
1 40 , 42 297 ,  
866 .

Nitsa Movshovitz Hadar Orit Zaslavsky가 6가  
, 6가

2.

2

, Polya  
,

4 ( ,  
가

, 가

2가

2

(written protocol)

가

가

(verbal protocol)

1 : 1

가

가

D.

1

2

2

가

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가

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4가

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7

7

(1)

가

$$\begin{aligned} < 1 > & \quad 10 \quad (6) \\ & (5x + 3) - (4x - 1) \end{aligned}$$

$$= 8x - 3x = 5x.$$

$$\begin{aligned} < 2 > & \quad 3 \quad (2) \\ & (a + b) \times (a + b) \times 4 \end{aligned}$$

$$= 4(a + b) = 8a + 8b$$

3 (2)

$$(a + b) \times (a + b) \times 4$$

$$= 4a^2b^2$$

< 3 > 2 (6)

$$x - 3x$$

$$= -3x^2$$

< 4 > 8

yz

①, ②

y z y \times z y + z 25+26 25 \times 26 y - z

< 5 > 2 (1)

$$5x - 5$$

X



$$\langle 6 \rangle \quad 6 \quad (2)$$

$$x^2$$

$$= -2^2 = 4.$$

$$\langle 7 \rangle \quad 6 \quad (3)$$

$$-x^2$$

$$= +(-2)^2 = \boxed{4}$$

$$\langle 8 \rangle \quad 6 \quad (4)$$

$$x^3$$

$$= \overset{-2 \times 2 \times 2}{-2^3} = -8.$$

< 9 >            6   (5)

$$|x+2| - |2x-3|$$

$$= x+2-2x-3$$

$$= x-2x+2-3$$

$$= -x-1$$

가

< 10 >            4   (1)

$$1000 - x$$

$$1000 - \left(1000 \frac{x}{100}\right) = \boxed{1000 - 10x}$$

4   (1)

$$1000 - x$$

$$1000x$$

< 11 >      1 (1)

$$\frac{1}{n} = \frac{x}{1}$$

$$\frac{nx}{n}$$

< 12 >      12

A, B 가  $A = 3x + 2$ ,  $B = -7x + 4$  ,

$2A + B = ax + b$  .

,  $a + b =$  .

$$2(3x+2) + (-7x+4)$$

$$6x + 4 - 7x + 4$$

$$-x = -8$$

$$a = -1$$

$$b = -8$$

$$a + b = -9$$

< 13 > 11 (4)

$$\frac{10x - 15}{5} - \frac{12x - 8}{4}$$

$$\begin{aligned} &= 4(10x - 15) - 5(12x - 8) \\ &= 40x - 60 - 60x + 40 \\ &= -20x - 20 \end{aligned}$$

(2)

< 14 > 3 (4)

$$a \div 5 - (b - c) \div 4$$

$$= a \times \frac{1}{5} - b + c \times \frac{1}{4} = \frac{a}{5} - b + \frac{c}{4}$$

$$= \frac{1}{5}a - \frac{1}{4}(b + c)$$

< 15 > 10 (6)

$$(5x + 3) - (4x - 1)$$

$$5x + 3 - 4x - 1$$

$$\begin{aligned} < \mathbf{16} > & \quad 11 \quad (1) \\ & 2(x - 1) + 3(x + 1) \end{aligned}$$

$$\begin{aligned} &= 2x - 2 + 3x + 1 \\ &= 5x - 1 \end{aligned}$$

$$\begin{aligned} < \mathbf{17} > & \quad 2 \quad (3) \\ & a + 2(1 - a) \end{aligned}$$

$$= a + 2 - a = 2$$

(3)

$$\begin{aligned} < \mathbf{18} > & \quad 2 \quad (3) \\ & a + 2(1 - a) \end{aligned}$$

$$= a + (2 - 2a)$$

$$\begin{aligned} < \mathbf{19} > & \quad 3 \quad (2) \\ & (a + b) \times (a + b) \times 4 \end{aligned}$$

$$= 4(a+b)(a+b)$$

< 20 >      11    (3)

$$4\left(x - \frac{1}{2}\right) - 3\left(\frac{x}{3} + 2\right)$$

$$4x - 2 - x - 6$$

< 21 >      10    (7)

$$0.4x - 1.6x$$

$$= -1.2x$$

(1)

가

$$\begin{aligned} < 1 > & \quad 10 \quad (3) \\ & (3 - a) + (3 + a) \\ & = 0 \end{aligned}$$

$$\begin{aligned} & \quad 10 \quad (3) \\ & (3 - a) + (3 + a) \\ & = 3 - a + 3 + a = 6a \end{aligned}$$

$$\begin{aligned} & \quad 10 \quad (3) \\ & (3 - a) + (3 + a) \\ & = 3 + 3 + a - a \\ & \quad \quad \quad 6 + a - a \end{aligned}$$

$$< 2 > \quad 10 \quad (4)$$

$$x - 2y + 1 - \frac{2}{3}x + y$$

$$x - \frac{2}{3}x - 2y + y + 1$$

$$= -\frac{2}{3}x - y + 1$$

$$< 3 > \quad 10 \quad (6)$$

$$(5x + 3) - (4x - 1)$$

$$= 8x - 3x = 5x$$

$$< 4 > \quad 2 \quad (3)$$

$$a + 2(1 - a)$$

$$= a^2 + 2 - 1$$

$$< 5 > \quad 2 \quad (4)$$

$$a + a$$

$$= a^2$$



$$\begin{aligned} < 6 > & \quad 11 \quad (1) \\ & 2(x - 1) + 3(x + 1) \end{aligned}$$

$$= \begin{array}{l} 2x - 2 + 3x + 3 \\ \hline 5x + 1 \\ 6x \end{array}$$

$$\begin{aligned} < 7 > & \quad 11 \quad (2) \\ & (-2a - 1) - (-2 - 3a) \end{aligned}$$

$$= \begin{array}{l} -3a + -1a \\ -4a \end{array}$$

$$\begin{aligned} < 8 > & \quad 2 \quad (5) \\ & a \times a \end{aligned}$$

$$= 2a$$

$$\begin{aligned} < 9 > & \quad 3 \quad (2) \\ & (a + b) \times (a + b) \times 4 \end{aligned}$$

$$= \cancel{2a} 8ab$$

< 10 >      2    (1)

$$5x - 5$$

$$= 5 \cdot \frac{x}{x} - \frac{5}{1} = 5$$

< 11 >      2    (2)

$$5x - x$$

$$\frac{5x - 5}{5x - 5} = x$$

< 12 >      7

$$5y$$

- ~~①~~  $5 + y$     ②  $5xy$     ~~③~~  $5와 y$     ④  $5+5+5+5+5$     ⑤  $y+y+y+y+y$

< 13 >      9

$$3a + 6$$

$(a+2)$ 에 3을 곱한 것과 같은 것을 모두 고르시오. ✨ 1.6

- ①  $a+6$     ②  $3x(a+6)$     ③  $3x2a$     ④  $a+2$     ⑤  $3a+6$     ⑥  $a+2 \times 3$



< 17 >      11    (1)

$$2(x - 1) + 3(x + 1) = \boxed{5x}$$

$$\begin{array}{l} \cancel{2x} - \cancel{2} + \cancel{3x} + \cancel{3} \\ 2x - 1 + 3x + 1 = 5x \end{array}$$

가

< 18 >      4    (1)

1000      x

100      ~~100~~

< 19 >      4    (3)  
                    $x$       1000                     $n$   
                   가                                    가

$$\frac{\cancel{x-1000}}{\dots} \quad \frac{n}{x-1000}$$

< 20 >      1    (2)  
                   가                    가  $a$ ,                    가  $b$

$$a \times b$$

< 21 > 12

두 다항식  $A, B$  가  $A = 3x + 2$ ,  $B = -7x + 4$  일 때  $2A + B$  를 간단히 하여  $ax + b$  의 꼴로 나타내었다. 이 때,  $a + b$  의 값을 구하여라.  $-8x$

$$\begin{aligned} & 2(3x+2) \\ & (6x+4) + (-7x+4) \\ & = (6x-7x) + (4+4) \\ & = -x+8 \end{aligned}$$

(2)

< 22 > 11 (2)

$$(-2a - 1) - (-2 - 3a)$$

$$\begin{aligned} & -2a - 1 + 2 - 3a(a-3) \\ & -2a - 3a - 1 + 2 \end{aligned}$$

< 23 > 11 (4)

$$\begin{aligned} & \frac{\overset{2}{10x} - \overset{3}{15}}{\underset{5}{5}} - \frac{\overset{2}{12x} - \overset{2}{8}}{\underset{4}{4}} \\ & 2x - 3 - 3x - 2 \\ & 2x - 3x - 3 - 2 \\ & -x - 5 \end{aligned}$$

< 24 > 3 (4)

$$\begin{aligned} & a \div 5 - (b - c) \div 4 \\ & = \frac{a}{5} - b + c \times \frac{1}{4} = \frac{a}{5} - b + \frac{c}{4} \end{aligned}$$

< 25 > 3 (5)

$$a \times \left(-\frac{1}{2}\right) \div b$$

$$= a - \frac{1}{2b}$$

< 26 > 10 (3)

$$\begin{aligned} (3 - a) + (3 + a) &= -a + a \\ (3 - 3) + (-a + a) & \end{aligned}$$

< 27 >      6 (2)

$$x^2$$

$$= -2x - 2 = -4$$

< 28 >      6 (5)

$$\begin{aligned} | \overset{0}{-2}x + 2 | - | \overset{-1}{2}x - 3 | \\ = -1 \end{aligned}$$

(3)

< 29 >      11 (1)

$$2(x - 1) + 3(x + 1)$$

$$= 2x - 2 + 3x + 3$$



$$< 30 > \quad 5 \quad (5)$$

$$5x - \frac{1}{3}y$$

27

(4)

$$< 31 > \quad 3 \quad (4)$$

$$a \div 5 - (b - c) \div 4$$

$$= \frac{(b-c)k}{25}$$

.

A.

1. (1)

: 1

( , )

.

1

( , )

.

40 ,

42

가

,

40

297

,

42

866

< - 1 >

< - 1 >

(%)

	58.2 %	25.3 %	16.5%	0%
	60.8%	20.4%	13.6%	5.2%

< - 1>

'가 가

가

가

< - 1>

58.2 %

60.8 %가

'가 가

25.3%

20.4%가

가

2. (2)

: 1  
( ) .

가

42  
2 ( -1 , -1 )

(protocol)

C ( ) 17

(Verbal Protocol)

< 1 >

(1)  $a - 3a$

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

(3)  $(5x + 3) - (4x - 1)$

(4)  $(2a - 3b) + (4a + 5b)$

(5)  $a + a$

(6)  $a \times a$

: ' ' 가?

: .

:

가

:

: ( )

: 가?

: .

: 가?

: , ...

: 가 가?

: ...

: .

: ( . . . )

$a - 3a = -3$  가 ? [ \_\_\_\_\_ ]

: ? -3 ?

: . . . ( )

$a$   $a$  -3 .

:  $a$ 가 ?

: . . .

:  $a$  , . ?

: . . .

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 1 ? ?  
 : .  
 : , a ' ' , 가  
 ' ' .  
 ' ' ,  
 가 .  
 : .  
 : ?  
 : .  
 : a 1 .  
 :  $1 - 3 \cdot 1 = 1 - 3 = -2$  가 .  
 : , . , a 2 .  
 :  $2 - 3 \cdot 2 = 2 - 6 = -4$  .  
 : . 가  $a - 3a$  .  
 ?  
 a + a ?  
 :  $2a$  ?  
 :  $2a$ 가 ?  
 : . . . ( ) .  
 : 1 + 1 a + a .  
 : 1 a ..  
 : , a .  
 1 a .

,  
 : .  
 : 가  $a - 3a$  .  
 $a$  가 ,  $-3a - a$  가 ?  
 : ,  $-3a - a$  가 3 .  
 : .  
 :  $a - 3a \equiv a + (-a - a - a) \equiv -a - a \equiv -2a$  가 ? 【    】  
 : .  
 가  
 ?  
 : ...  
 : 가  
 $2a + 3a^2 + 3a + 2a^2$        $2a - 3a, 3a^2$   
 $2a^2$  .  
 : .  
 :       $2^3$        $5^5$   $5a$  가  
 ,  $3^2$        $5a^2$  .  
 ?  
 : .  
 $a - 3a$     1    3       $-2a$  가 .  
 : ,      ?  
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 : 가      ?  
 : (      가) .

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: . x .

$$\frac{1}{2}x \pm \frac{2}{3}x \equiv \frac{1}{6}x \pm \frac{2}{6}x = \left(\frac{1}{6} + \frac{2}{6}\right)x = \frac{3}{6}x \quad \left[ \underline{\hspace{1cm}} \underline{\hspace{1cm}} \underline{\hspace{1cm}} \right]$$

: ?

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$$\frac{1}{2}x \pm \frac{2}{3}x \equiv \frac{3}{6}x \pm \frac{4}{6}x \equiv \left(\frac{3}{6} \pm \frac{4}{6}\right)x \equiv \frac{7}{6}x \quad \left[ \quad \right]$$

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가 ?

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 : .

$$\begin{aligned}
 : (5x + 3) - (4x - 1) &= (5x + 3) - 4x - 1 \quad [ \underline{\hspace{2cm}} ] \\
 &= 5x - 4x + 3 - 1 \\
 &= x + 2
 \end{aligned}$$

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 : 가 ?

: ( 가) !  
 : , 1 , ?

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 : 가 .

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$$\begin{aligned}
 (5x + 3) - (4x - 1) &= (5x + 3) - 4x + 1 \\
 &= 5x - 4x + 3 + 1 \\
 &= x + 4 \quad [ \quad ]
 \end{aligned}$$

: 가 ?  
 : . 가 .  
 : .  
 : 4 .  
 : .  
 : ?  
 : ( ) .  
 : , ?  
 : .  
 : ?  
 : ( ) .  
 : .  
 :  $(2a - 3b) + (4a + 5b) = (2a - 3b) + 4a + 5b$   
 $= (2a + 4a) + (-3b + 5b)$   
 $= 6a + 2b$   
 : , .  
 가 가 ,  
 가 ?  
 : ( 가) 가 가 ?  
 : ?  
 : .  
 : .  
 $(2x + 1) - (3x + 2)$  ?  
 :  $(2x + 1) - (3x + 2) = (2x + 1) - 3x - 2$   
 $= (2x - 3x) + (1 - 2)$   
 $= x - 1$  [ \_\_\_\_\_ ]  
 : ?

: ?, ( ..) -x - 1 .【    】

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5

:  $a + a \equiv a^2$  {            }

:                    ?

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:                     $a \quad a$                     ?

!

: !  $2a$  .【    】

:            ?                    ...

가

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6

:  $a \times a \equiv 2a$  {            }

!                    !                    !

$a \times a \equiv a^2$  .【    】

: .                    !

5                    6

$2a \times a$

:  $2a \times a = 2 \times a \times a = 2a^2$  !

: ,                    !                    ,  $2a + a$  ?

:  $3a$  .

: !                    ?

가

?

: .

:

:

< 2 >  $x = -3$  ,

(1)  $x^2$

(2)  $-x^2$

(3)  $x^3$

(4)  $|x + 3| - |2x - 3|$

:

:( )

:

? 1

: ,  $x$

:

:  $x = -3$  ,  $x^2 = x \times x = (-3) \times (-3) = 9$  .

:

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: . . . .

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가

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$x$

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가

: , .  $x = -3$   $x^2 = 9$  .

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 :  
 : 2  
 :  $-x^2 = -(-3) \times (-3) = (+3) \times (+3) = 9$  [ \_\_\_\_\_ ]  
 : ?  $-x^2$   $x^2$  (-) ?  
 가

:  
 :  $-x^2 = -(-3) \times (-3) = -(+9) = -9$  [ \_\_\_\_\_ ]  
 : 9가 ?

: !  
 :  $-x^2 = -(-3) \times (-3) = -(+9) = -9$  【     】  
 : ,

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$-x^2 = -(-3)^2 = -9$  가 ?

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 ? 가 ?  
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 : ,

$$x^3 = (-3) \times (-3) \times (-3) = (+9) \times (-3) = -27$$

: . ! ?

가 ?

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$$: x^3 = (-3)^3 = -27$$

: . !

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: .

$$|x + 3| - |2x - 3| = |-3 + 3| - |2 \cdot (-3) - 3|$$

$$= 0 - |-6 - 3| = 9 \text{ [ _____ ]}$$

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: . . . .

$$|x + 3| - |2x - 3| = |-3 + 3| - |2 \cdot (-3) - 3|$$

$$= 0 - |-6 - 3| = -9 \text{ [     ]}$$

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: 가 ?  
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< 3 > .

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

:  
 : ( )  
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 : ,  
 : , 1  
 :  $(3 - a) + (3 + a) = -3a + 3a = 0$  [ \_\_\_\_\_ ]

: 가 ?  
 : . . . .  
 :  $3 - a$  ?  
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$$\begin{aligned} (3 - a) + (3 + a) &= (3 - a) + 3 + a \\ &= (3 + 3) + (-a + a) \\ &= \underline{6 + (-a + a)} \text{ [ _____ ]} \end{aligned}$$

: ?  
 - a + a ?  
 : ( ) , 0 .  
 : , 가 .  
 -1 + 1 ? 0 , - a a  
 0 ?  
 : , 6 . 【 】  
 : , ! !  
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 : .  
 : 2 .  
 :  $2(x - 1) + 3(2x + 5) = (2x - 2) + (6x + 15)$   
 $= (2x + 6x) + (-2 + 15)$   
 $= 8x + 13x$   
 : ?  
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 : 1 , .  
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 : 3 .  
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 : ( )  
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$$\begin{aligned}
 & : \underline{(-3a - 2) - (-3 - 2a)} \equiv \underline{(-3a - 2) + 3 - 2a} \text{ [ \underline{\hspace{2cm}} ]} \\
 & \qquad = (-3a - 2a) + 3 - 2 \\
 & \qquad = -5a + 1
 \end{aligned}$$

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 :                    .  
 :                    .  
 : ,                    ,                    가                    .

$$\begin{aligned}
 & \underline{(-3a - 2) - (-3 - 2a)} \equiv \underline{(-3a - 2) + 3 + 2a} \\
 & \qquad = (-3a + 2a) + 3 - 2 \\
 & \qquad = -a + 1 \text{ 【        】}
 \end{aligned}$$

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$$\begin{aligned}
: 4(x - \frac{1}{4}) - 3(\frac{x}{3} + 1) &= 4x - 1 - \frac{3x}{3} - 3 \\
&= 4x - \frac{3x}{3} - 1 - 3 \\
&= \underline{4x - \frac{3x}{3} - 4} \quad [ \underline{\hspace{2cm}} ]
\end{aligned}$$

: ?

: . . .

:

$$3 \times \frac{1}{3} \quad ?$$

: 1

: .  $3 \times \frac{x}{3}$  가 ?

:  $3 \times \frac{x}{3}$   $3 \times \frac{1}{3}x$  ?

:

: .  $3 \times \frac{x}{3} = 3 \times \frac{1}{3}x = x$  가 .

!

$$\begin{aligned}
4(x - \frac{1}{4}) - 3(\frac{x}{3} + 1) &= 4x - 1 - 3 \cdot \frac{x}{3} - 3 \\
&= 4x - 3 \cdot \frac{x}{3} - 1 - 3 \\
&= 4x - 3 \cdot \frac{x}{3} - 1 - 3 \\
&= \underline{4x - 3 \cdot \frac{x}{3} - 4}
\end{aligned}$$

$$= \frac{4x - x - 4}{3x - 4} \quad \text{【 } \quad \text{】}$$

: , 가 ?  
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C ( ) 39 (Verbal Protocol)

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- (1)  $(x - y) \times (-1)$
- (2)  $a \div 5 - (b - c) \div 4$
- (3)  $x \div 3 \times x$
- (4)  $a \times (-\frac{1}{2}) \div b$
- (5)  $(x - 2) \div 3 \times y$

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 :  $\times \div$  ,  
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 : ,  
 :  $(x - y) \times (-1) = (-1) \times (x - y)$   
 $= (-1)(x - y) = -x - y$  [                      ]  
 : ?  
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 : 1 .  
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 : 1 -1  
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 : x . ?  
 : , y ?  
 : , ?  
 : , 가 .  
 :  
 :  $(x - y) \times (-1) = (-1) \times (x - y)$   
 $= \underline{(-1)(x - y)}$   
 $= \underline{-x - y}$  【    】  
 : , 가 ?  
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가 .

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:  $a \div 5 - (b - c) \div 4 \equiv \frac{a}{5} - b \pm c \div 4$

$= \frac{a}{5} - b + \frac{c}{4}$

$= \frac{a}{5} - b + \frac{c}{4} \times 20$

$= 4a - 20b + 5c$  [                      ]

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$$\begin{aligned}
 : \quad . \quad a \div 5 - (b - c) \div 4 &= \frac{a}{5} - (b - c) \div 4 \\
 &= \frac{a}{5} = \frac{(b - c)}{4} \\
 &= \frac{a}{5} = \frac{(b - c)}{4} \times \frac{20}{20} \quad [ \underline{\hspace{2cm}} \quad \underline{\hspace{2cm}} ] \\
 &= 4a - 5(b - c)
 \end{aligned}$$

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$$: a \div 5 - (b - c) \div 4 = \frac{a}{5} - (b - c) \div 4$$

$$= \frac{a}{5} - \frac{(b - c)}{4} \quad \text{【 } \quad \text{】}$$

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$$: \frac{x \div 3 \times x \equiv x \times \frac{1}{3} \times x \equiv \frac{2}{3} x \quad \text{[ } \quad \text{ ]}}{\underline{\hspace{10em}}}$$

: !

가

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$$\underline{x \div 3 \times x \equiv x \times \frac{1}{3} \times x \equiv \frac{x}{3} \times x \equiv \frac{x}{3} x} \quad [ \underline{\quad \quad} ]$$

: ?

: . . . .

: x x ?

:  $x^2$  .

:  $\frac{x}{3} x$  ?

: . . . .

: ?

: .

:

: , .  $\frac{x}{3} x$  .

: , 가 ?

: . . . .

$$\underline{x \div 3 \times x \equiv x \times \frac{1}{3} \times x \equiv \frac{x}{3} \times x \equiv \frac{x^2}{3}} \quad [ \quad ]$$

: . . . .

: . . . .

: 4 .

$$: a \times (-\frac{1}{2}) \div b = a \times (-\frac{1}{2}) \times \frac{1}{b}$$

$$= (-\frac{1}{2} a) \times \frac{1}{b}$$





: .

:  $a \div b$  ?

:  $\frac{a}{b}$  .

: 가 !

: ! .

$$\frac{(x - 2) \div 3 \times y \equiv \frac{(x - 2)}{3} \times y \equiv \frac{(x - 2)}{3} y \quad \text{【 } \quad \text{】}}$$

: . 가 ?

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< 5 >  $a = 2$  ,  $b = -3$  ,

(1)  $2(a - b)$

(2)  $3a + 4b$

(3)  $a^2 - 3ab$

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

(5)  $|b - 2a| - |1 - b^2|$

:

: ( )

: ? 가?

:  $a$   $b$

: . .

:  $2(a - b) \equiv 2a - 2b \equiv 4 - 6 \equiv -2$  [ \_\_\_\_\_ ]

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$$\underline{2(a - b) \equiv 2a - 2b}$$

$$= \underline{2 \cdot 2 - 2 \cdot (-3)}$$

$$= \underline{4 + 6 \equiv 10} \quad . [ \quad ]$$

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$$\underline{3a \pm 4b \equiv 6 \pm 12 \equiv 18} \quad [ \underline{\quad \quad \quad} ]$$

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$$= (+ 4) + (+ 9) = + 13 = 13 \text{ [ \underline{\hspace{2cm}} ]}$$

- : ?
- : ( ) .
- : ! . 가  $-a^2$  ?
- : . . . .
- : 가  $-a^2$  .
- $a^2$  ?
- :  $a^2 = a \times a$  .
- :  $a^2 = 2^2$  ?
- :  $2 \times 2 = 4$  .
- : .  $a$  가  $-2$  ?
- :  $a^2 = a \times a = (-2) \times (-2) = +4 = 4$  .
- : . . . .
- $a$ 가  $a^2$  가 ?
- : ( ) ?
- : . 가 ?
- : ?
- : !
- : ,  $a^2 = +4$  .
- : .  $-a^2$  ?
- : ( )  $a^2$  - 가 ?
- : .
- : .
- $-a^2 + b^2 = -4 + (+9) = -4 + 9 = 5$  . 【    】
- : . . . . ?

:  $-a^2$  .  
 :  $a$  - .  
 : .  
 : 가 .  
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$$|b - 2a| - |1 - b^2| = |-3 - 2 \cdot 2| - |1 - (-3)^2|$$

$$= |-3 - 4| - |1 - (+9)|$$

$$= \underline{|-7| - |1 - 9|}$$

$$= \underline{7 + 8 = 15} \text{ [ _____ ]}$$
 : ?  
 : . . . .  
 : , 가 .  
 : . . . .  
 :  $|-2|$  ?  
 : 2 .

: , - 가 ?  
 $-|-2|$  ?

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$$\begin{aligned} : \quad |b - 2a| - |1 - b^2| &= |-3 - 2 \cdot 2| - |1 - (-3)^2| \\ &= |-3 - 4| - |1 - 9| \\ &= \underline{7 - |-8|} \\ &= \underline{7 - 8 = -1} \quad . \mathbf{【 \quad \quad 】} \end{aligned}$$

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$$2a+3, 5a, 2a+3b, 5ab$$

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2. (2)



< 2 >

-  $x^2$

$x^2$   $x^3$

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1. .

(1)  $n \times x + 1$

(2) 가 가  $a$ , 가  $b$

(3) 130  $a$  1000

2. .

(1)  $5x - 5$

(2)  $5x - x$

(3)  $a + 2(1 - a)$

(4)  $a + a$

(5)  $a \times a$

(6)  $x - 3x$

(7)  $3n + (5m + 4n)$

3.  $\times, \div$  .

(1)  $-1 \times x \times y$

(2)  $(a + b) \times (a + b) \times 4$

(3)  $a \div 2 \times b \div c$

(4)  $a \div 5 - (b - c) \div 4$

$$(5) a \times \left(-\frac{1}{2}\right) \div b$$

4.  $\times, \div$

(1)  $1000x$

(2)  $a \cdot b \cdot 10$

(3)  $x \cdot 1000 \cdot n$  가

(4)  $20 \cdot 3 \cdot x$

5.  $x = 3, y = -4$

(1)  $4y$

(2)  $4xy$

(3)  $3x - 4y$

(4)  $2(x - y)$

(5)  $5x - \frac{1}{3}y$

6.  $x = -2$

(1)  $-x + 5$

(2)  $x^2$

(3)  $-x^2$

(4)  $x^3$

(5)  $|x + 2| - |2x - 3|$

7.  $5y$  .

$5 + y$      $5xy$      $5$      $y$      $5+5+5+5+5$      $y + y + y + y + y$

8.  $yz$  .

$y$      $z$      $y \times z$      $y + z$      $25+26$      $25 \times 26$      $y - z$

9.  $a + 2$      $3$  .

$a+6$      $3x(a+6)$      $3 \times 2 a$      $a+2$      $3 a+6$      $a+2 \times 3$

10. .

(1)  $2a + 5a$

(2)  $-2a + 4a$

(3)  $(3 - a) + (3 + a)$

(4)  $x - 2y + 1 - \frac{2}{3}x + y$

(5)  $2a + 5b + a$

(6)  $(5x + 3) - (4x - 1)$

(7)  $0.4x - 1.6x$

11. .

(1)  $2(x - 1) + 3(x + 1)$

(2)  $(-2a - 1) - (-2 - 3a)$

(3)  $4(x - \frac{1}{2}) - 3(\frac{x}{3} + 2)$

(4)  $\frac{10x - 15}{5} - \frac{12x - 8}{4}$

12.  $A, B$  가  $A = 3x + 2$ ,  $B = -7x + 4$ , .

$2A + B$   $ax + b$  . ,  $a + b$

< B >

(1)

(2)

(3)

가  
가

(4)

(5)

(6)

가 ,

1. .

(1)  $-2a + 4a$

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

(3)  $(5x + 3) - (4x - 1)$

(4)  $(2a - 3b) + (4a + 5b)$

(5)  $a + a$

(6)  $a \times a$

2.  $x = -3$  , .

(1)  $x^2$

(2)  $-x^2$

(3)  $x^3$

(4)  $|x + 3| - |2x - 3|$

3. .

(1)  $(3 - a) + (3 + a)$

(2)  $2(x - 1) + 3(2x + 5)$

(3)  $(-3a - 2) - (-3 - 2a)$

(4)  $4(x - \frac{1}{4}) - 3(\frac{x}{3} + 1)$

$$(5) \frac{15x - 10}{5} - \frac{8x - 12}{4}$$

4.  $\times, \div$

$$(1) (x - y) \times (-1)$$

$$(2) (x - 2y) \times 3$$

$$(3) a \div 5 - (b - c) \div 4$$

$$(4) (x - 2) \div 3 \times y$$

$$(5) a \times a \times (-3) \times b$$

5.  $a = 2, b = -3$

$$(1) 3a + 2b$$

$$(2) 2(a - b)$$

$$(3) a^2 - 3ab$$

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

$$(5) |b - 2a| - |1 - b^2|$$



< C >

1. .
2. 가?
3. 가?
4. 가?
5. 가?
6. 가?
7. 가?
8. 가?
9. 가?
10. 가?
11. 가?
12. .
13. 가 가?
14. 가?
15. 가 가?
16. 가?



