

BYLAE AVOORBEELD VAN 'N HORIZONTAAL - LINEËREPROGRAM

Hierdie program is met toestemming van die uitgewers, die firma McGraw-Hill Book Company, <sup>1)</sup> oorgeneem uit: Holland, J.G. en Skinner, B.F. The analysis of behavior. New York, McGraw-Hill, c. 1961, 41 - 45.

1. Brief van McGraw-Hill, MM/is, 8 Augustus 1967.

PART II Operant Conditioning:Elementary Concepts

SET 7

Introduction to Operant Conditioning

Estimated time:8 minutes Turn to next page and begin ▷

when  
(if, after)

7.4

Reinforcement and behavior occur in the temporal order: (1) \_\_\_\_\_, (2) \_\_\_\_\_.

7.5

deprived  
of food  
(hungry)

7.9

If an animal's response is not followed by reinforcement, similar responses will occur \_\_\_\_\_ frequently in the future.

7.10

natural  
(non-deliberate)

7.14

Food is not reinforcing unless the animal has first been \* \* \* food for some time.

7.15

reinforce

7.19

In laboratory research, various devices are used to reinforce responses. Heat can be used to \_\_\_\_\_ the responses of a cold animal.

7.20

response  
(behavior)

7.24

The response of pressing a bar must be emitted at least once in order to be \_\_\_\_\_.

7.25

less frequent  
(become  
extinguished)

7.29

No eliciting stimuli are observed for bar pressing, flicking leaves in the park, etc. Therefore, responses of this type \* \* \* classified as reflexbehavior.

7.30



Performing animals are sometimes trained with "rewards." The behavior of a hungry animal can be "rewarded" with \_\_\_\_.

7.1

- (1) behavior
- (2) reinforcement

7.5

Food given to a hungry animal does not reinforce a particular response unless it is given almost immediately \_\_\_\_ the response.

7.6

less  
(in-)

7.10

To make sure an animal will perform, the trainer provides \_\_\_\_ for the response frequently.

7.11

deprived of  
(without,  
hungry for)

7.15

Reinforcing a response produces an increase in the \_\_\_\_ that the response will occur again.

7.16

reinforce

7.20

An electrically operated food magazine which presents food can be used to reinforce a(n) \_\_\_\_ of an organism deprived of food.

7.21

reinforced

7.25

Since no eliciting stimuli are observed for such responses as flicking leaves or bar pressing, we cannot say that these responses are \_\_\_\_ by stimuli, as are the responses in reflexes.

7.26

are not  
(cannot be,  
will not be)

7.30

End of Set

Page 42

food	7.1	A technical term for "reward" is reinforcement. To "reward" an organism with food is to ____ it with food.	7.2
after	7.6	Unlike a stimulus in a reflex, a reinforcing stimulus * * * act to elicit the response it reinforces.	7.7
reinforcement(s)	7.11	A hungry pigeon in the park flicks dead leaves about with quick movements of its beak. This behavior is ____ whenever it uncovers bits of food.	7.12
probability (likelihood, chances)	7.16	We do not observe "probability" directly. We say that a response has become more probable if it is observed to occur more ____ under controlled conditions.	7.17
response	7.21	If the cold (or food-deprived) organism turns on an electrically operated heat lamp (or food magazine), the response of turning on will be ____.	7.22
elicited	7.26	Responses such as bar pressing, flicking leaves, etc., are said to be <u>emitted</u> rather than <u>elicited</u> since there * * * (are or are not?) observed eliciting stimuli.	7.27

<p>reinforce</p> <p>7.2</p>	<p><u>Technically</u> speaking, a thirsty organism can be _____ with water.</p> <p>7.3</p>
<p>does not (will not)</p> <p>7.7</p>	<p>A reinforcement does not elicit a response; it simply makes it more _____ that an animal will respond in the same way again.</p> <p>7.8</p>
<p>reinforced</p> <p>7.12</p>	<p>A pigeon is occasionally reinforced for flicking leaves about because of the common natural arrangement of leaves over _____.</p> <p>7.13</p>
<p>frequently (often)</p> <p>7.17</p>	<p>When a response has been reinforced, it will be emitted _____ frequently in the future.</p> <p>7.18</p>
<p>reinforced</p> <p>7.22</p>	<p>The response of turning on the electrically operated heat lamp or food magazine will be emitted more _____ in the future if the organism is cold or hungry.</p> <p>7.23</p>
<p>are no</p> <p>7.27</p>	<p>If pressing the bar does not operate the food magazine, the response * * * reinforced.</p> <p>7.28</p>

<p>reinforced (NOT: rewarded)</p>	<p>7.3</p>	<p>The trainer reinforces the animal by giving it food ____ it has performed correctly.</p>	<p>7.4</p>
		<p>← To p. 41</p>	
<p>probable (likely)</p>	<p>7.8</p>	<p>Food is probably not reinforcing if the animal is not * * * .</p>	<p>7.9</p>
		<p>← To p. 41</p>	
<p>food (seed, insects, reinforcers)</p>	<p>7.13</p>	<p>The reinforcement used by animal trainers is deliberately arranged, while the arrangement of leaves and food in the park is * * * .</p>	<p>7.14</p>
		<p>← To p.41</p>	
<p>more</p>	<p>7.18</p>	<p>To get an animal to emit a response more frequently, we ____ the response.</p>	<p>7.19</p>
		<p>← To p. 41</p>	
<p>frequently (often)</p>	<p>7.23</p>	<p>In a typical apparatus, the depression of a horizontal bar automatically operates a food magazine. The apparatus selects "bar pressing" as the ____ to be reinforced.</p>	<p>7.24</p>
		<p>← To p. 41</p>	
<p>is not (will not be)</p>	<p>7.28</p>	<p>Reinforcement makes responses more frequent while failure to receive reinforcement makes responses * * * .</p>	<p>7.29</p>
		<p>← To p. 41</p>	

BYLAE BVOORBEELD VAN 'N VERTIKAAL-LINEËREPROGRAM

Hierdie program is van die Nasionale Instituut vir Personeelnavorsing van die Suid-Afrikaanse Wetenskaplike en Nywerheidsnavorsingsraad te Johannesburg verkry.

Dit word met hul toestemming <sup>1)</sup> en met die goedkeuring van die Kamer van Mynwese <sup>2)</sup> as n bylae aan hierdie proefskrif toegevoeg.

1. Briewe van die N.I.P.N.: DJG/LF, 15 Junie 1965 en TR/EM, 30 Augustus 1965.
2. Brief van die Kamer van Mynwese: ADM, 25 Mei 1965.

INTRODUCTORY ALGEBRA

FACTORIZATION: LESSON 26

Summary of Teaching Points

1. Introduction.
2. The difference between two squares.
3. The expression  $p^2 + q^2$  cannot be factorized.
4. Important examples.

	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	E	E	E	E	E	E	E	E	E	P	P	P	T											
2														E	E	E	E	E	E	P	P	T		
3																							E	E
4																								

	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	4	5	6	7	8	9	10
1													P				T	T						
2														P					T	T				
3	E	E	E	P	T	E	E	E							P						T	T		
4									E	E	P	T				P							T	T

E = Example

T = Test

P = Practice

Answers to Test Frames

T : 16     $(x + 1)(x - 1)$

T : 32    No

T : 25     $(y + z)(y - z)$

T : 39     $(d + f)(d - f)$



Answers to Diagnostic Test

DT : 3     $(k + 3)(k - 3)$

DT : 7     $a^2 + 2ab + b^2$

DT : 4     $(p + 1)(p - 1)$

DT : 8    No

DT : 5     $(a + b)(a - b)$

DT : 9     $(x + 6)(x - 6)$

DT : 6     $(y + z)(y - z)$

DT : 10     $(k + m)(k - m)$

I : 1

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INTRODUCTORY ALGEBRA

A. FACTORIZATION

LESSON 26: THE DIFFERENCE BETWEEN

TWO SQUARES

(44 frames)

I : 2

(\*) represents a letter, number or symbol.

(\*) represents a word.

Underlined words are important.

A : 1

No answer required.

I : 3

Contents:

1. Introduction.
2. The difference between two squares.
3. The expression  $p^2 + q^2$  cannot be factorized.
4. Important examples.

A : 2

No answer required.

F : 4

Complete:

$$(a + 1)(a + 1) = a^2 + (\#)a(\#)1$$

A : 3

No answer required.

F : 5

Complete:

$$(a - 1)(a - 1) = a^2 (\#)2a(\#)1$$

A : 4

$$a^2 + 2a + 1$$

F : 6

Important example:

$$\begin{aligned}(a + 1)(a - 1) &= a^2 - a + a - 1 \\ &= a^2 (\#)1\end{aligned}$$

A : 5

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

F : 7

Similarly:

$$\begin{aligned}(x+5)(x-5) &= x^2 - 5x + 5x - 25 \\ &= x^2 (\#)25\end{aligned}$$

A : 6

$$a^2 - 1$$

F : 8

Complete:

$$(x+8)(x-8) = x^2 - (\#)$$

A : 7

$$x^2 - 25$$

F : 9

We know what:  $(k+4)(k-4) = k^2 - 16$

Let's factorize:  $p^2 - 16$

Step one : The square root of  $p^2$  is  $p$ , and of  $16$  is  $(\mp)$ .

A : 8

$$x^2 - 64$$

F : 10

Factorize:  $p^2 - 16$

Final step:  $p^2 - 16 = (p(\mp)4)(p(\mp)4)$

Hint :

$$\left\{ \begin{array}{c} p + 4 \\ X \\ p + 4 \end{array} \right\} \text{ OR } \left\{ \begin{array}{c} p - 4 \\ X \\ p - 4 \end{array} \right\} \text{ OR } \left\{ \begin{array}{c} p + 4 \\ X \\ p - 4 \end{array} \right\}$$

A : 9

The square root of  $16$  is  $4$

F : 11

Are  $(p+4)$  and  $(p-4)$  the true factors of  $p^2 - 16$ ?

(Answer Yes or No.)

A : 10

$$p^2 - 16$$

$$= (p+4)(p-4)$$

(Note that  $(p+4)(p-4)$  is the same as  $(p-4)(p+4)$ ).

F : 12

Is  $(p+4)(p-4)$  the same as  $(p-4)(p+4)$ ?

(Answer Yes or No.)

A : 11

Yes, because  $(p+4)(p-4)$

$$= p^2 - 4p + 4p - 16$$

$$= p^2 - 16.$$

F : 13

Factorize:  $k^2 - 9$

Step one : The square root of  $k^2$  is  $k$ , and of  $9$  is  $(\mp)$ .

A : 12

Yes, because

$$(p+4)(p-4) = p^2 - 16$$

AND

$$(p-4)(p+4) = p^2 - 16$$

P : 14

Factorize:  $k^2 - 9$

Final step:  $k^2 - 9 = (k(\times)3)(k(\times)3)$

Hint :

$$\left\{ \begin{array}{c} k + 3 \\ X \\ k + 3 \end{array} \right\} \text{ OR } \left\{ \begin{array}{c} k - 3 \\ X \\ k - 3 \end{array} \right\} \text{ OR } \left\{ \begin{array}{c} k + 3 \\ X \\ k - 3 \end{array} \right\}$$

A : 13

The square root of 9 is 3

P : 15

Factorize:  $m^2 - 4$

(Complete answer required).

A : 14

$k^2 - 9$

$= (k+3)(k-3)$

(Note that  $(k+3)(k-3)$  is the same as  $(k-3)(k+3)$ )

T : 16

Factorize:  $x^2 - 1$

(Complete answer required).

A : 15

The square root of  $m^2$  is  $m$ , and of 4 is 2.

Therefore,

$$m^2 - 4 = (m+2)(m-2)$$

F : 17

Complete:

$$\begin{aligned} (a+x)(a-x) &= a^2 - ax + ax - x^2 \\ &= a^2 - (\times)(\times). \end{aligned}$$

A : 16

Test

F : 18

Complete:

$$(a-x)(a+x) = a^2(\times)x^2$$

A : 17

$$a^2 - x^2$$

F : 19

Is  $(k+m)(k-m)$  the same as  $(k-m)(k+m)$ ?  
(Answer Yes or No.)

A : 18

$$a^2 - x^2$$

F : 20

Complete:

$$p^2 - q^2 = (p(\ast)q)(p(\ast)q)$$

A : 19

Yes, because

$$(k+m)(k-m) = k^2 - m^2$$

AND

$$(k-m)(k+m) = k^2 - m^2$$

F : 21

Factorize:  $a^2 - b^2$

Step one : The square root of  $a^2$   
is  $a$ , and of  $b^2$  is  $(\ast)$ .

A : 20

$$p^2 - q^2$$

$$=(p+q)(p-q)$$

which is the same as

$$(p-q)(p+q)$$

F : 22

Factorize:  $a^2 - b^2$

Final step:  $a^2 - b^2 = (a+b)(a(\ast)(\ast))$

A : 21

$b$

P : 23

Factorize:  $x^2 - y^2$

Step one: Find the square roots of  
 $x^2$  and  $y^2$ .

Final step:  $x^2 - y^2 = ((\ast)+(\ast))((\ast)-(\ast))$

A : 22

$$(a+b)(a-b)$$

P : 24

Factorize:  $k^2 - m^2$

(Complete answer required).

A : 23

The square roots of  $x^2$   
and  $y^2$  are  $x$  and  $y$ .

$$x^2 - y^2 = (x+y)(x-y)$$

T : 25

Factorize:  $y^2 - z^2$

(Complete answer required).

A : 24

$$k^2 - m^2$$

$$= (k+m)(k-m)$$

F : 26

Complete:

$$(a+b)(a+b) = a^2 + ab + ab + b^2$$

$$= a^2 + (\oplus)ab(\oplus)b^2$$

A : 25

Test

F : 27

Complete:

$$(a-b)(a-b) = a^2 - ab - ab + b^2$$

$$= a^2 (\ominus) 2ab (\ominus) b^2$$

A : 26

$$a^2 + 2ab + b^2$$

F : 28

Complete:

$$(a+b)(a-b) = a^2 - ab + ab - b^2$$

$$= a^2 (\oplus) b^2$$

A : 27

$$a^2 - 2ab + b^2$$

F : 29

Complete:

$$(a-b)(a+b) = a^2 (\oplus) b^2$$

A : 28

$$a^2 - b^2$$

F : 30

Complete:

$$a^2 + b^2 = (a(\oplus)b)(a(\oplus)b)$$

A : 29

$$a^2 - b^2$$

P : 31

Can  $k^2 + m^2$  be factorized?

(Answer Yes or No.)

A : 30

It is IMPOSSIBLE.

T : 32

Can  $p^2 + q^2$  be factorized?  
(Answer Yes or No).

A : 31

No, because  
 $k^2 + m^2 = (k(\times)m)(k(\times)m)$   
is IMPOSSIBLE.

F : 33

Now factorize  $p^2 - q^2$   
(Complete answer required).

A : 32

Test

F : 34

Are  $(p+q)$  and  $(p-q)$  the true factors of  $p^2 - q^2$ ?  
(Answer Yes or No.)

A : 33

$$p^2 - q^2 \\ = (p + q)(p - q)$$

F : 35

Are  $(p + q)$  and  $(p - q)$  the true factors of  $p^2 + q^2$ ?  
(Answer Yes or No.)

A : 34

Yes, because

$$(p + q)(p - q) \\ = p^2 - pq + pq - q^2 \\ = p^2 - q^2$$

F : 36

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

A : 35

No, because  
 $p^2 + q^2 = (p(\times)q)(p(\times)q)$   
is IMPOSSIBLE,  
and  $(p + q)(p + q)$   
 $= p^2 + 2pq + q^2$

F : 37

Complete:  
 $k^2 - m^2 = (k(\times)m)(k(\times)(\times))$

A : 36

$(x + 3)(x - 3)$ ,  
which is the same as  
 $(x - 3)(x + 3)$

P : 38

Factorize:  $p^2 - 16$   
(Complete answer required).

A : 37

$(k + m)(k - m)$ ,  
which is the same as  
 $(k - m)(k + m)$

T : 39

Factorize:  $d^2 - f^2$   
(Complete answer required).

A : 38

$(p + 4)(p - 4)$

P : 40

Complete:  
 $x^2 - 36 = (x(\#)6)(x(\#)6)$

A : 39

Test

P : 41

Factorize:  $a^2 - b^2$   
(Complete answer required).

A : 40

$(x + 6)(x - 6)$

P : 42

Can  $a^2 + b^2$  be factorized?  
(Answer Yes or No.)

A : 41

$(a + b)(a - b)$

P : 43

Factorize:  $k^2 - 25$   
(Complete answer required).

A : 42

No, because  
 $a^2 + b^2 = (a(\#)b)(a(\#)b)$   
is IMPOSSIBLE.

I : 44

You have now completed Lesson 26.  
Do the Diagnostic Test for Lesson 26 before proceeding to Lesson 27.

A : 43

$(k + 5)(k - 5)$



I : 1

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INTRODUCTORY ALGEBRA

A. FACTORIZATION

DIAGNOSTIC TEST FOR LESSON 26

(10 frames)

DT : 2

(\*) represents a letter, number or  
symbol.

(\*) represents a word.

DT : 3

Complete:

$$k^2 - 9 = (k(*)3)(k(*)3)$$

DT : 4

Factorize:  $p^2 - 1$

(Complete answer required).

DT : 5

Complete:

$$a^2 - b^2 = (a(*)b)(a(*)b)$$

DT : 6

Factorize:  $y^2 - z^2$

(Complete answer required.)

DT : 7

Complete:

$$(a + b)(a + b) = a^2 + (\times)ab(\times)b^2$$

DT : 8

Can  $a^2 + b^2$  be factorized?

(Answer Yes or No.)

DT : 9

Factorize:  $x^2 - 36$

(Complete answer required.)

DT : 10

Factorize:  $k^2 - m^2$

(Complete answer required).

INTRODUCTORY ALGEBRA

FACTORIZATION : LESSON 27

Summary of Teaching Points

1. Introduction.
2. The difference between two squares.
3. Factorizing the sum of two squares is impossible.
4. Difficult examples.

	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
1	E	E	E	E	E	P	P	T															
2									E	E	E	E	E	E	E	P	P	T					
3																			E	E	E	P	
4																							

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
1								P							T	T									
2									P	P							T	T							
3	T										P								T						
4		E	E	E	E	E	P	T					P	P								T	T	T	

E = Example

T = Test

P = Practice

Answers to Test Frames

T : 11     $16p^2 - 49q^2$

T : 26    No.

T : 21     $(2x + 7y)(2x - 7y)$

T : 33     $(mn + 2d)(mn - 2d)$

Answers to Diagnostic Test

DT : 3     $x^2 - 25y^2$

DT : 7    Impossible.

DT : 4     $4p^2 - 9q^2$

DT : 8     $(1 + 4p)(1 - 4p)$

DT : 5     $(5k + m)(5k - m)$

DT : 9     $(9k + m)(9k - m)$

DT : 6     $(2x + 5)(2x - 5)$

DT : 10     $(5x + yz)(5x - yz)$

---

I : 1

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INTRODUCTORY ALGEBRA

A. FACTORIZATION

LESSON 27 : THE DIFFERENCE BETWEEN TWO

SQUARES

(40 frames)

I : 2

(\*) represents a letter, number or  
symbol.

(\*) represents a word.

Underlined words are important.

A : 1

No answer required.

I : 3

Contents:

1. Introduction.
2. The difference between two squares.
3. Factorizing the sum of two squares is impossible.
4. Difficult examples.

A : 2

No answer required.

F : 4

Complete:

$$\begin{aligned}(x + 1)(x - 1) &= x^2 - x + x - 1 \\ &= x^2 (*) 1\end{aligned}$$

A : 3

No answer required.

F : 5

Complete:

$$\begin{aligned}(a + b)(a - b) &= a^2 - ab + ab - b^2 \\ &= a^2 (\text{✗}) b^2\end{aligned}$$

A : 4

$$x^2 - 1$$

F : 6

Complete:

$$\begin{aligned}(5k + m)(5k - m) &= 25k^2 - 5km + \\ &\quad 5km - m^2 \\ &= 25k^2 (\text{✗}) m^2\end{aligned}$$

A : 5

$$a^2 - b^2$$

F : 7

Complete:

$$\begin{aligned}(x + 6y)(x - 6y) &= x^2 - 6xy + 6xy - \\ &\quad 36y^2 \\ &= x^2 (\text{✗}) 36y^2\end{aligned}$$

A : 6

$$25k^2 - m^2$$

F : 8

Complete:

$$\begin{aligned}(2p + 3q)(2p - 3q) &= 4p^2 - 6pq + \\ &\quad 6pq - 9q^2 \\ &= 4p^2 (\text{✗}) 9q^2\end{aligned}$$

A : 7

$$x^2 - 36y^2$$

P : 9

Complete:

$$(k + 2m)(k - 2m) = k^2 - (\text{✗}) m^2$$

A : 8

$$4p^2 - 9q^2$$

P : 10

Remove the brackets from

$$(2x + y)(2x - y)$$

(Complete answer required).

A : 9

$$k^2 - 4m^2$$

T : 11

Remove the brackets from  
 $(4p + 7q)(4p - 7q)$   
(Complete answer required).

A : 10

$$\begin{aligned} & (2x + y)(2x - y) \\ &= 4^2 - 2xy + 2xy - y^2 \\ &= 4x^2 - y^2 \text{ (sic)} \end{aligned}$$

F : 12

Let's factorize  $p^2 - q^2$ .  
Step one: The square root of  $p^2$   
is  $p$ , and of  $q^2$  is  $(*)$ .

A : 11

Test.

F : 13

Factorize  $p^2 - q^2$   
Final step:  
 $p^2 - q^2 = (p(*)q)(p(*)q)$

A : 12

The square root of  $p^2$  is  
 $p$ , and of  $q^2$  is  $q$ .

F : 14

Let's factorize  $4p^2 - q^2$   
Step one: The square root of  
 $4p^2$  is  $2p$ , and of  $q^2$  is  $(*)$ .

A : 13

$$\begin{aligned} & p^2 - q^2 \\ &= (p + q)(p - q) \\ & \text{which is the same as} \\ & (p - q)(p + q) \end{aligned}$$

F : 15

Factorize  $4p^2 - q^2$   
Final step:  
 $4p^2 - q^2 = (2p + (*))((*) - q)$

A : 14

The square root of  $4p^2$   
is  $2p$ , and of  $q^2$  is  $q$ .

F : 16

Let's factorize  $4p^2 - 25q^2$   
Step one: The square root of  $4p^2$   
is  $2p$ , and of  $25q^2$  is  $(*)(*)$ .

A : 15

$$\begin{aligned} & 4p^2 - q^2 \\ &= (2p + q)(2p - q) \end{aligned}$$

F : 17

Factorize  $4p^2 - 25q^2$

Final step:

$$4p^2 - 25q^2 = ((\times)p + (\times)q)((\times)p - (\times)q)$$

A : 16

The square root of  $4p^2$  is  $2p$ , and of  $25q^2$  is  $5q$ .

F : 18

Are  $(2p + 5q)$  and  $(2p - 5q)$   
the true factors of  $4p^2 - 25q^2$ ?  
(Answer Yes/No.)

A : 17

$$4p^2 - 25q^2 = (2p + 5q)(2p - 5q)$$

P : 19

Factorize  $9x^2 - 16y^2$ .

Step one: Find the square roots  
of  $9x^2$  and  $16y^2$ .

Final step:  $9x^2 - 16y^2 = ((\times)x + (\times)y)$   
 $((\times)x - (\times)y)$

A : 18

Yes, because

$$(2p + 5q)(2p - 5q) = 4p^2 - 10pq + 10pq - 25q^2 = 4p^2 - 25q^2$$

P : 20

Factorize  $4a^2 - 25b^2$ .  
(Complete answer required).

A : 19

The square root of  $9x^2$  is  $3x$ , and of  $16y^2$  is  $4y$ .

Therefore,

$$9x^2 - 16y^2 = (3x + 4y)(3x - 4y)$$

T : 21

Factorize  $4x^2 - 49y^2$   
(Complete answer required).

A : 20

$$4a^2 - 25b^2 = (2a + 5b)(2a - 5b)$$



F : 22

Let's factorize  $36a^2 + 49b^2$

Step one: The square root of  $36a^2$  is  $6a$ , and of  $49b^2$  is  $(7)(7)$ .

A : 21

Test.

F : 23

Factorize  $36a^2 + 49b^2$

Final step:  $36a^2 + 49b^2$   
 $= (6a(7)7b)(6a(7)7b)$

A : 22

The square root of  $36a^2$  is  $6a$ , and of  $49b^2$  is  $7b$ .

F : 24

Complete:

$$36a^2 - 49b^2 = (6a(7)7b)(6a(7)7b)$$

A : 23

It is impossible.

Therefore

$$36a^2 + 49b^2$$

CANNOT be factorized.

P : 25

Can  $16a^2 - 25b^2$  be factorized?

(Answer Yes/No.)

A : 24

$$(6a + 7b)(6a - 7b)$$

which is the same as

$$(6a - 7b)(6a + 7b)$$

T : 26

Can  $16a^2 + 25b^2$  be factorized?

(Answer Yes/No.)

A : 25

Yes, because

$$16a^2 - 25b^2$$

$$= (4a + 5b)(4a - 5b)$$

F : 27

Complete:

$$\begin{aligned}(ab + cd)(ab - cd) &= a^2b^2 - abcd + \\ &\quad abcd - c^2d^2 \\ &= a^2b^2 - c^2d^2.\end{aligned}$$

A : 26

Test.

F : 28

Complete:

$$(2x + yz)(2x - yz) = 4x^2(\ast)y^2z^2$$

A : 27

$$a^2b^2 - c^2d^2$$

F : 29

Complete:

$$81a^2 - b^2c^2 = (9a(\ast)bc)(9a(\ast)bc)$$

A : 28

$$4x^2 - y^2z^2$$

F : 30

Let's factorize  $k^2m^2 - 25p^2$ .

Step one: The square root of  $k^2m^2$  is  $km$ , and of  $25p^2$  is  $(\ast)(\ast)$ .

A : 29

$$(9a + bc)(9a - bc)$$

F : 31

Factorize  $k^2m^2 - 25p^2$

Final step:  $k^2m^2 - 25p^2$   
 $= (km + (\ast)(\ast))(km - (\ast)(\ast))$

A : 30

The square root of  $k^2m^2$  is  $km$ , and of  $25p^2$  is  $5p$ .

P : 32

Factorize  $a^2b^2 - 16$

(Complete answer required).

A : 31

$$(km + 5p)(km - 5p)$$

T : 33

Factorize  $m^2n^2 - 4d^2$ .

(Complete answer required).

A : 32

$$a^2b^2 - 16$$

$$= (ab + 4)(ab - 4)$$

P : 34

Remove the brackets from

$$(2p + 3q)(2p - 3q)$$

(Complete answer required).

A : 33

Test.

P : 35

Factorize  $x^2 - 16p^2$ .

Step one: Find the square roots of  $x^2$  and  $16p^2$ .

Final step:  $x^2 - 16p^2 = (x(\neq)4p)$   
 $(x(\neq)4p)$

A : 34

$$(2p + 3q)(2p - 3q)$$
$$= 4p^2 - 6pq + 6pq - 9q^2$$
$$= 4p^2 - 9q^2$$

P : 36

Factorize  $9x^2 - 100y^2$ .

(Complete answer required).

A : 35

The square root of  $x^2$  is  $x$ , and of  $16p^2$  is  $4p$ .

Therefore

$$x^2 - 16p^2 = (x + 4p)(x - 4p)$$

P : 37

Can  $9x^2 + 100y^2$  be factorized?

(Answer Yes/No.)

A : 36

$$9x^2 - 100y^2$$
$$= (3x + 10y)(3x - 10y)$$

P : 38

Factorize  $x^2y^2 - 1$

(Complete answer required).

A : 37

No, because

$$9x^2 + 100y^2$$
$$= (3x(\neq)10y)(3x(\neq)10y)$$

is IMPOSSIBLE.

P : 39

Factorize  $k^2 - 64m^2n^2$ .

(Complete answer required).

A : 38

$$x^2y^2 - 1$$
$$= (xy + 1)(xy - 1),$$

which is the same as

$$(xy - 1)(xy + 1)$$

I : 40

You have now completed Lesson 27.

Do the Diagnostic Test for Lesson 27 before proceeding to Lesson 28.

A : 39

$$k^2 - 64m^2n^2$$
$$= (k + 8mn)(k - 8mn)$$

I : 1

INTRODUCTORY ALGEBRA

A. FACTORIZATION

DIAGNOSTIC TEST FOR LESSON 27

(10 frames)

I : 2

(\*) represents a letter, number or symbol.

(⌘) represents a word.

DT : 3

Complete:

$$\begin{aligned}(x + 5y)(x - 5y) &= x^2 - 5xy + 5xy \\ &\quad - 25y^2 \\ &= x^2(\text{*})25y^2\end{aligned}$$

DT : 4

Remove the brackets from

$$(2p + 3q)(2p - 3q)$$

(Complete answer required).

DT : 5

Factorize  $25k^2 - m^2$ .

Step one: Find the square roots of  $25k^2$  and of  $m^2$ .

Final step:  $25k^2 - m^2 = (5k(\text{*})m)$   
 $(5k(\text{*})m)$

DT : 6

Factorize  $4x^2 - 25$ .

(Complete answer required).

DT : 7

Complete:

$$36a^2 + 49b^2 = (6a(\times)7b)(6a(\times)7b)$$

DT : 8

Factorize  $1 - 16p^2$ .

(Complete answer required).

DT : 9

Factorize  $81k^2 - m^2$

(Complete answer required).

DT : 10

Factorize  $25x^2 - y^2z^2$ .

(Complete answer required).

BYLAE CVOORBEELD VAN 'N INTRINSIEKE VERTAKKINGS-  
PROGRAM

Hierdie program is met toestemming van die uitgewers, die firma Bell Punch Company,<sup>1)</sup> vroeër die firma Lamson Technical Products, oorgeneem uit: Thomas, C.A. e.a. Programmed learning in perspective. A guide to programme writing. Herne Bay, Lamson, 1963, tussen bl. 20 en 21.

1. Brief van Bell Punch Company, ASW/ID, 25 Julie 1967.

FRAME	STIMULUS	ACTION Response
1	<p>During the summer months you will have noticed that telegraph wires, which are made of copper, tend to sag from pole to pole. In the winter months the same copper wires appear taut, and shorter in length between the two poles. Thus the length of the copper wires varies from summer to winter.</p> <p>The copper wires change their length because:</p> <p>(a) There is more rainfall in the summer months and the wires sag because of the weight of the rain.</p> <p>(b) The wind is stronger in the summer and therefore stretches the copper wire.</p> <p>(c) The temperature change between summer and winter produces a change in length of the copper wire.</p>	<p>Press Button A</p> <p>Press Button B</p> <p>Press Button C</p>
1 (a)	<p>You have said that the weight of the additional rainfall in the summer months causes the wire to sag. Whilst it is perfectly true that any load on the wires will cause them to sag, the weight of droplets of rain collecting on the wires will be insufficient to produce any noticeable increase in length.</p> <p>Press the RETURN button and select another answer.</p>	<p>Press Button R</p>
1 (b)	<p>You have said that the stronger winds of the summer months will produce an extension in the wires. It is highly improbable that the force of wind acting on the thin round copper wire will produce any noticeable extension in length.</p> <p>Press the RETURN button and try again.</p>	<p>Press Button R</p>

You are correct. The variation in length of the copper wires is due to the variation in temperature from summer to winter. Copper wire, and indeed other metals such as iron, platinum, gold etc., EXPAND when heated and CONTRACT when cooled. The increase in length, or 'linear expansion' will depend upon two factors:

- (a) the temperature change;
- (b) the nature of the metal.

It is important, for many reasons, to have a precise knowledge of this linear expansion of metals. The linear expansion of any particular metal is directly proportional to the variation in temperature. If a copper wire expands by 0.2 cm. when its temperature rises by  $100^{\circ}\text{C}$  a temperature increase of  $200^{\circ}\text{C}$  will produce an expansion of:

- (a) 0.1 cm.
- (b) 0.4 cm.
- (c) 0.2 cm.

Press  
Button C

Press  
Button A

Press  
Button B

Fig. 4:4 - An Example of a Branched Programme



BYLAE DVOORBEELD VAN 'N MATETIESE PROGRAM

Hierdie program is deur TOR Education, Vyfde laan 55, New York vervaardig. Dit is met toestemming van die uitgewers, John Wiley and Sons, <sup>1)</sup> oorgeneem uit: Margulies, S en Eigen, L.D. (red). Applied programmed instruction, New York, John Wiley, 1962, 387.

1. Brief aan John Wiley van J.C.W. Kroeze en aan laasgenoemde teruggestuur met die stempel:  
"Permission granted", 18 September 1967.

## A MEMOREASE

This is a fast method of memorizing a poem. If you follow the directions, you should memorize this poem in about ten minutes.

In this poem Miss Dickinson is expressing wonder as to the nature of immortality. There have been two events in her life which presented a foretaste of dying. Can the third event (death) compare with those two? Parting is after all all we know about death.

### MY LIFE CLOSED TWICE BEFORE ITS CLOSE

By Emily Dickinson

"My life closed twice before its close;  
It yet remains to see  
If Immortality unveil  
A third event to me,  
So huge, so hopeless to conceive,  
As these that twice befell.  
Parting is all we know of heaven  
And all we need of hell".

### Directions

Read the first exercise on the pleated sheet.  
Orally supply the missing word or words.  
Fold the first pleat back and read the second, filling  
in all missing words.

Continue until you are at the bottom of the page.  
Unfold the pleats and continue on the back side.  
Complete the poem each time. Look back one exercise  
if you should forget something.

Now, FOLD THIS PAGE BACK

So huge, so hopeless to conceive,  
As these that twice befell.  
Parting is all we know of heaven  
And all we need of .....

---

So huge, so hopeless to conceive,  
As these that twice befell.  
Parting is all \_\_\_\_\_  
And all \_\_\_\_\_

---

So huge, so hopeless to conceive,  
As these that twice \_\_\_\_\_  
Parting \_\_\_\_\_  
\_\_\_\_\_

---

\_\_\_\_\_ huge, so hopeless to \_\_\_\_\_  
As \_\_\_\_\_ that twice \_\_\_\_\_  
Parting \_\_\_\_\_  
\_\_\_\_\_

---

If Immortality unveil  
A third event to me,  
\_\_\_\_\_ huge, so hopeless to \_\_\_\_\_  
\_\_\_\_\_ that \_\_\_\_\_  
...

---

My life closed twice before its close;

It yet remains to see

If Immortality \_\_\_

A \_\_\_ \_\_\_ to me

\_\_\_ \_\_\_, \_\_\_ hopeless \_\_\_ \_\_\_

\_\_\_ \_\_\_ that \_\_\_ \_\_\_

...

---

My life closed twice before its \_\_\_

It yet \_\_\_ to see

If Immortality \_\_\_

\_\_\_ \_\_\_ \_\_\_ \_\_\_ \_\_\_

....

---

My life \_\_\_ twice \_\_\_ its \_\_\_

\_\_\_ yet \_\_\_ to see

If Immortality \_\_\_

\_\_\_ \_\_\_ \_\_\_ \_\_\_ \_\_\_

....

---

My life \_\_\_ \_\_\_ \_\_\_ its \_\_\_

\_\_\_ yet \_\_\_ \_\_\_ \_\_\_

If \_\_\_ \_\_\_

\_\_\_ \_\_\_ \_\_\_ \_\_\_ \_\_\_

...

---

My \_\_\_ \_\_\_ \_\_\_ \_\_\_ \_\_\_

.....

---

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