

# 2장 MATLAB 기초

2.1 MATLAB 환경

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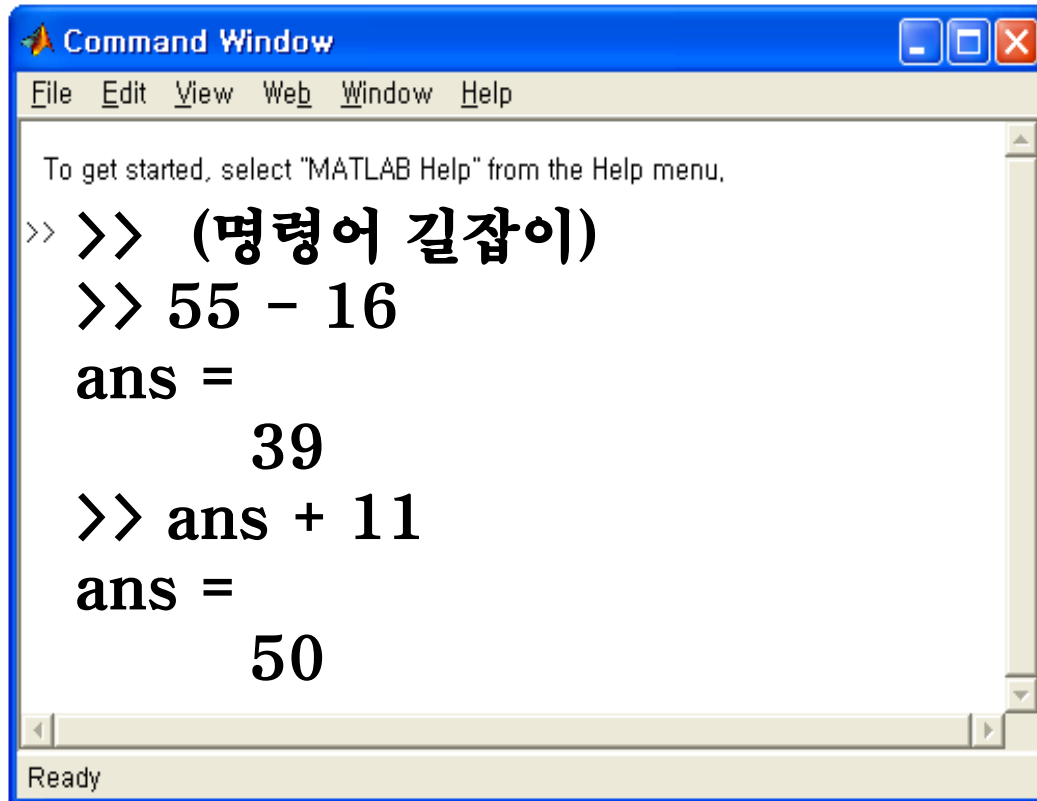
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2.5 그래픽

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# 2.1 MATLAB 환경



## ■ 명령창

- 명령을 입력하는 창

## ■ 그래프창

- 그래프를 나타내는 창

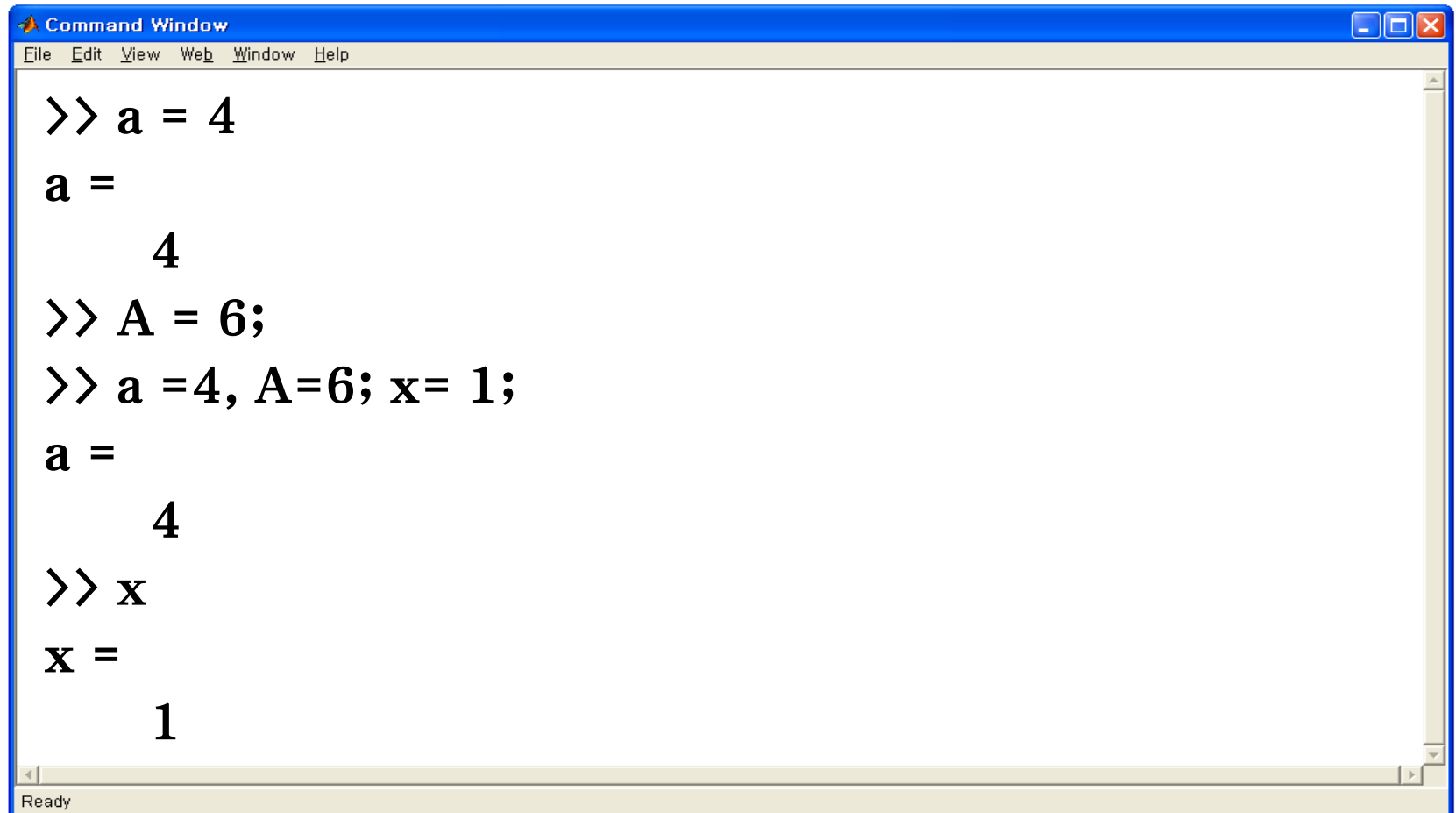
## ■ 편집창

- M-파일을 편집하는 창



## 2.2 배정 (1/10)

### [스칼라]

A screenshot of the MATLAB Command Window. The window has a blue title bar with the text "Command Window" and standard window control buttons (minimize, maximize, close) on the right. Below the title bar is a menu bar with "File", "Edit", "View", "Web", "Window", and "Help". The main area of the window contains MATLAB commands and their outputs. The commands are: ">> a = 4", ">> A = 6;", and ">> a = 4, A = 6; x = 1;". The outputs are: "a =" followed by "4" on the next line, and "x =" followed by "1" on the next line. The status bar at the bottom left says "Ready".

```
Command Window
File Edit View Web Window Help

>> a = 4
a =
    4

>> A = 6;
>> a = 4, A = 6; x = 1;
a =
    4

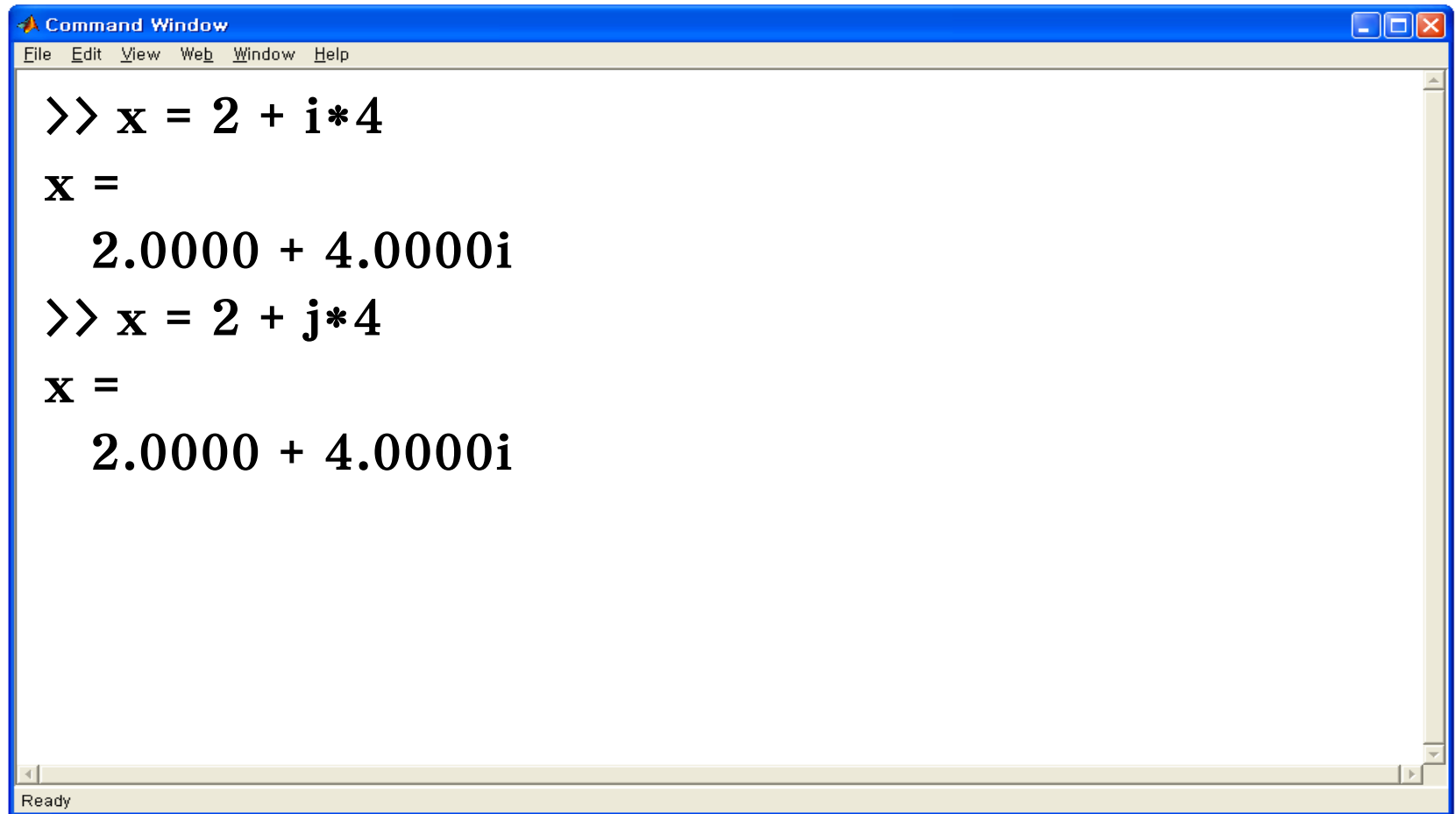
>> x
x =
    1

Ready
```



## 2.2 배정 [2/10]

### [스칼라] 복소수

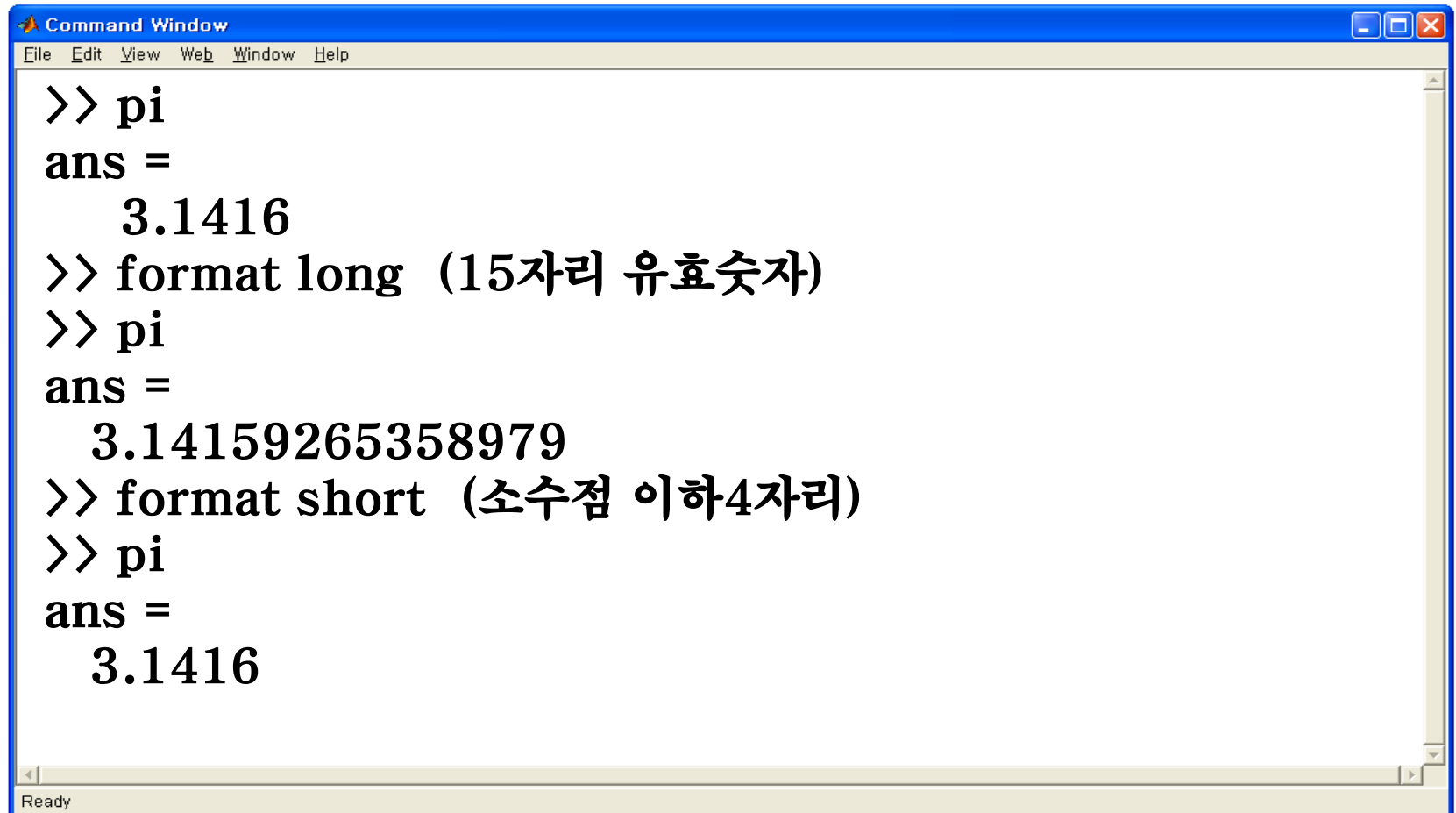
A screenshot of the MATLAB Command Window. The window has a blue title bar with the text "Command Window" and standard window control buttons (minimize, maximize, close). Below the title bar is a menu bar with "File", "Edit", "View", "Web", "Window", and "Help". The main area of the window contains the following text:

```
>> x = 2 + i*4  
x =  
    2.0000 + 4.0000i  
>> x = 2 + j*4  
x =  
    2.0000 + 4.0000i
```

At the bottom of the window, there is a status bar that says "Ready".

## 2.2 배정 (3/10)

### [스칼라] 포맷 형태

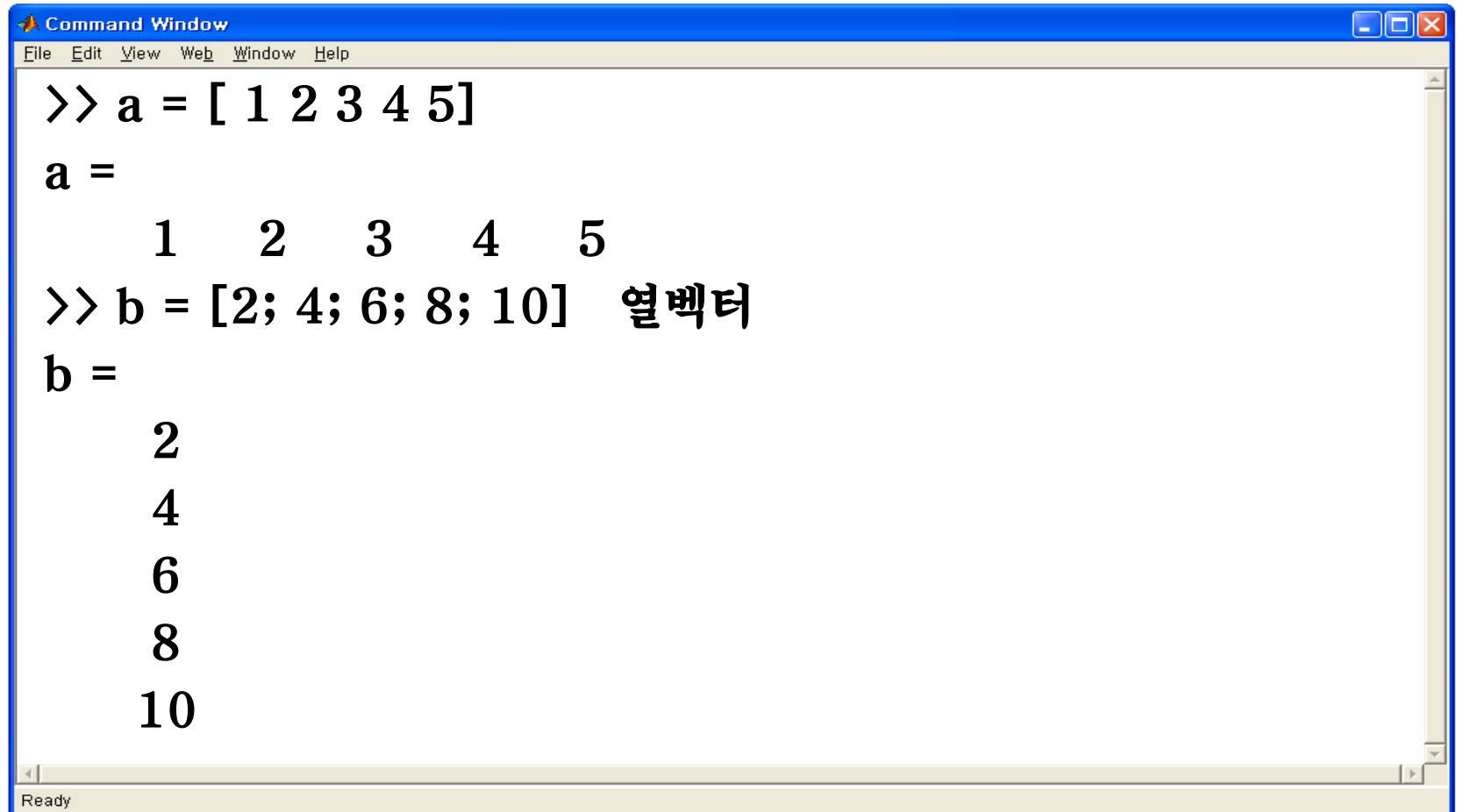
A screenshot of the MATLAB Command Window. The window has a blue title bar with the text 'Command Window' and standard window control buttons. Below the title bar is a menu bar with 'File', 'Edit', 'View', 'Web', 'Window', and 'Help'. The main area of the window contains the following text:

```
>> pi  
ans =  
    3.1416  
>> format long (15자리 유효숫자)  
>> pi  
ans =  
    3.14159265358979  
>> format short (소수점 이하4자리)  
>> pi  
ans =  
    3.1416
```

At the bottom of the window, there is a status bar that says 'Ready'.

## 2.2 배정 [4/10]

### [배열, 벡터와 행렬]

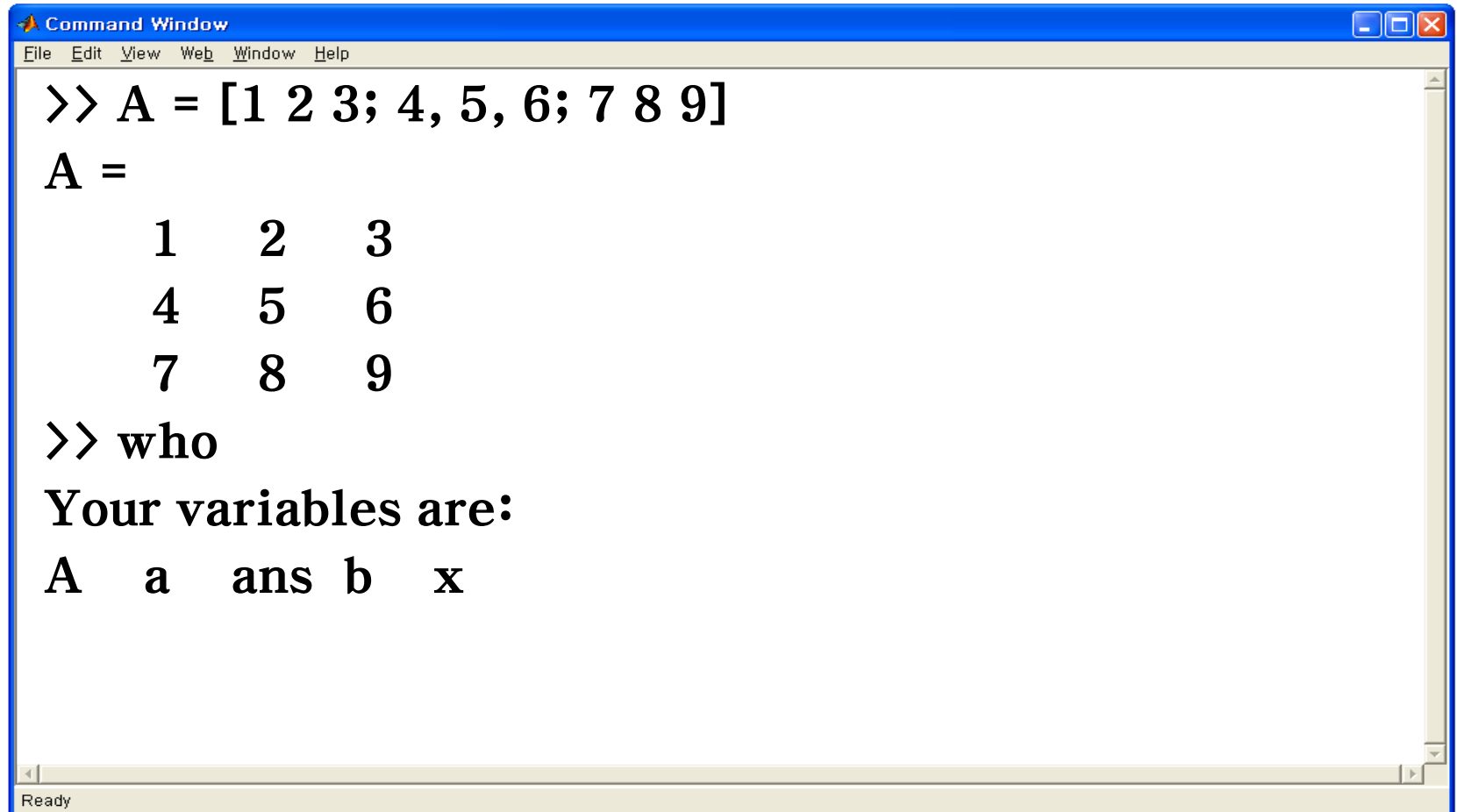
A screenshot of the MATLAB Command Window. The window has a blue title bar with the text "Command Window" and standard window control buttons (minimize, maximize, close). Below the title bar is a menu bar with "File", "Edit", "View", "Web", "Window", and "Help". The main area of the window contains MATLAB commands and their outputs. The status bar at the bottom says "Ready".

```
>> a = [ 1 2 3 4 5]
a =
     1     2     3     4     5
>> b = [2; 4; 6; 8; 10] 열벡터
b =
     2
     4
     6
     8
    10
```



## 2.2 배정 [5/10]

### [배열, 벡터와 행렬]

A screenshot of the MATLAB Command Window. The window has a blue title bar with the text "Command Window" and standard window control buttons (minimize, maximize, close). Below the title bar is a menu bar with "File", "Edit", "View", "Web", "Window", and "Help". The main area of the window contains the following text:

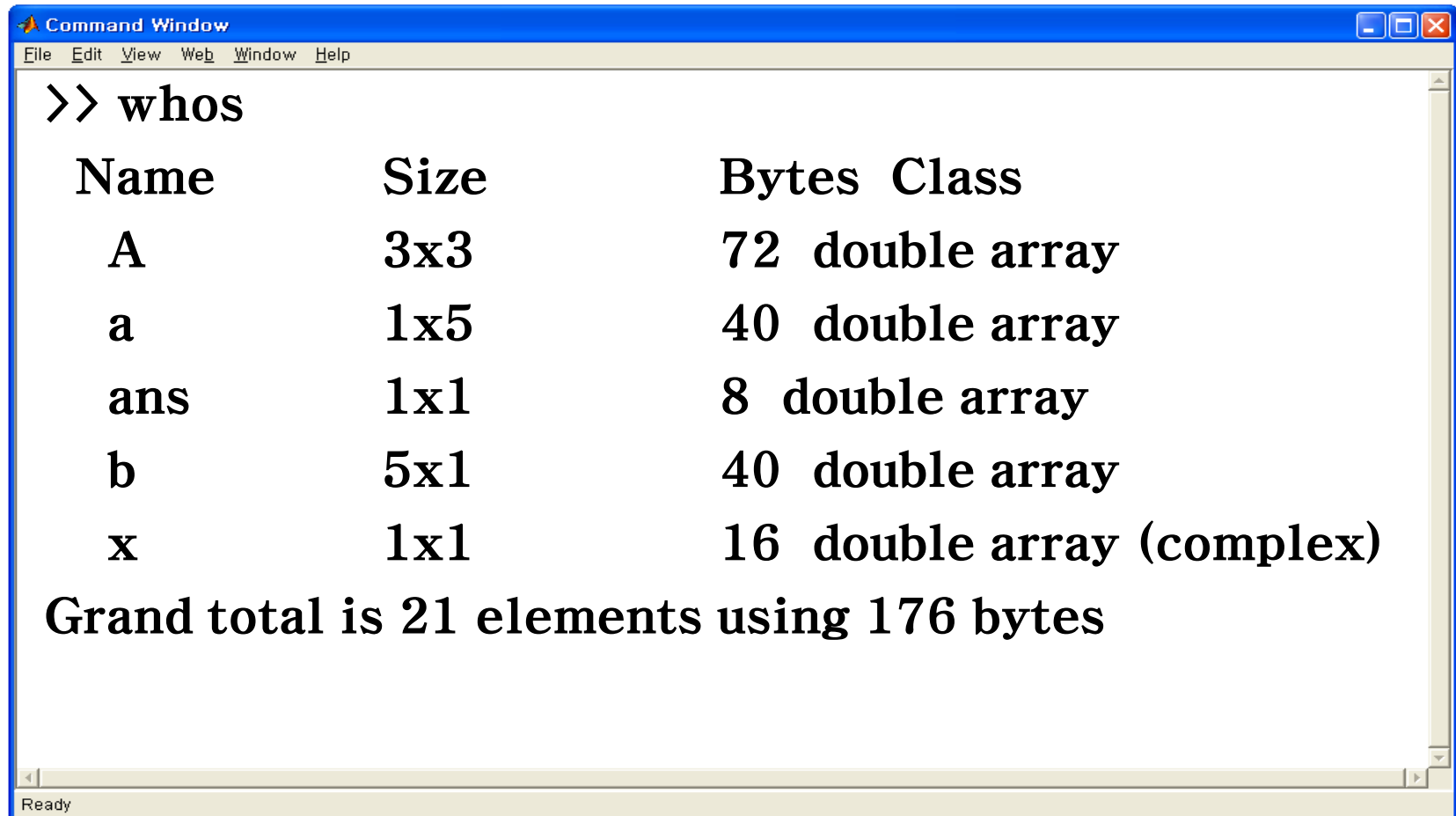
```
>> A = [1 2 3; 4, 5, 6; 7 8 9]
A =
     1     2     3
     4     5     6
     7     8     9

>> who
Your variables are:
A  a  ans  b  x
```

The status bar at the bottom of the window shows the word "Ready".

## 2.2 배정 [6/10]

### [배열, 벡터와 행렬]



A screenshot of the MATLAB Command Window. The title bar reads 'Command Window'. The menu bar includes 'File', 'Edit', 'View', 'Web', 'Window', and 'Help'. The command prompt shows '>> whos'. The output is a table with four columns: Name, Size, Bytes, and Class. The table lists variables A, a, ans, b, and x with their respective sizes and memory usage. At the bottom, it states 'Grand total is 21 elements using 176 bytes'. The status bar at the bottom left says 'Ready'.

```
>> whos
```

Name	Size	Bytes	Class
A	3x3	72	double array
a	1x5	40	double array
ans	1x1	8	double array
b	5x1	40	double array
x	1x1	16	double array (complex)

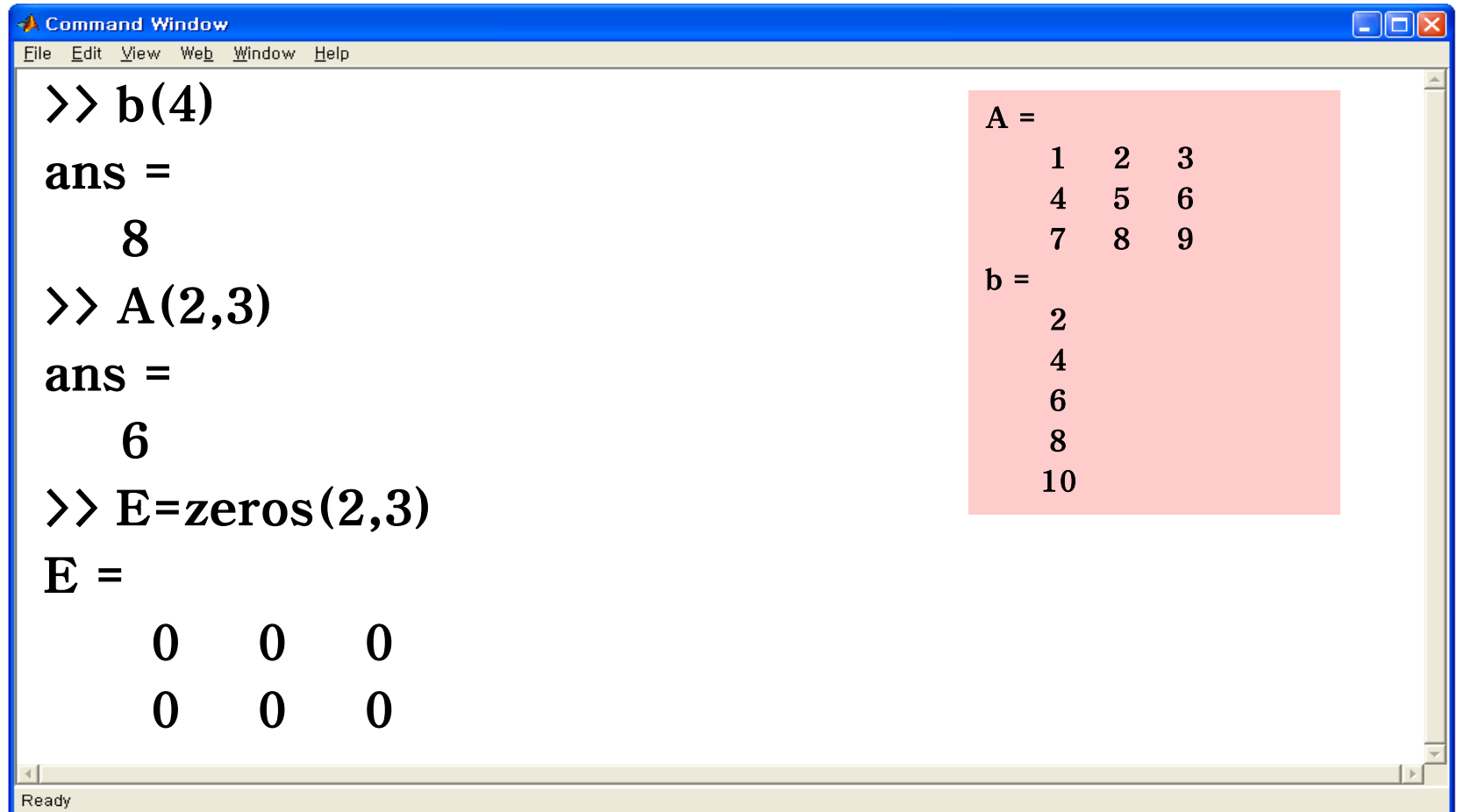
Grand total is 21 elements using 176 bytes





## 2.2 배정 [7/10]

### [배열, 벡터와 행렬]



The screenshot shows the MATLAB Command Window with the following commands and outputs:

```
>> b(4)
ans =
    8

>> A(2,3)
ans =
    6

>> E=zeros(2,3)
E =
    0    0    0
    0    0    0
```

On the right side of the window, the contents of variables A and b are displayed:

A =

1	2	3
4	5	6
7	8	9

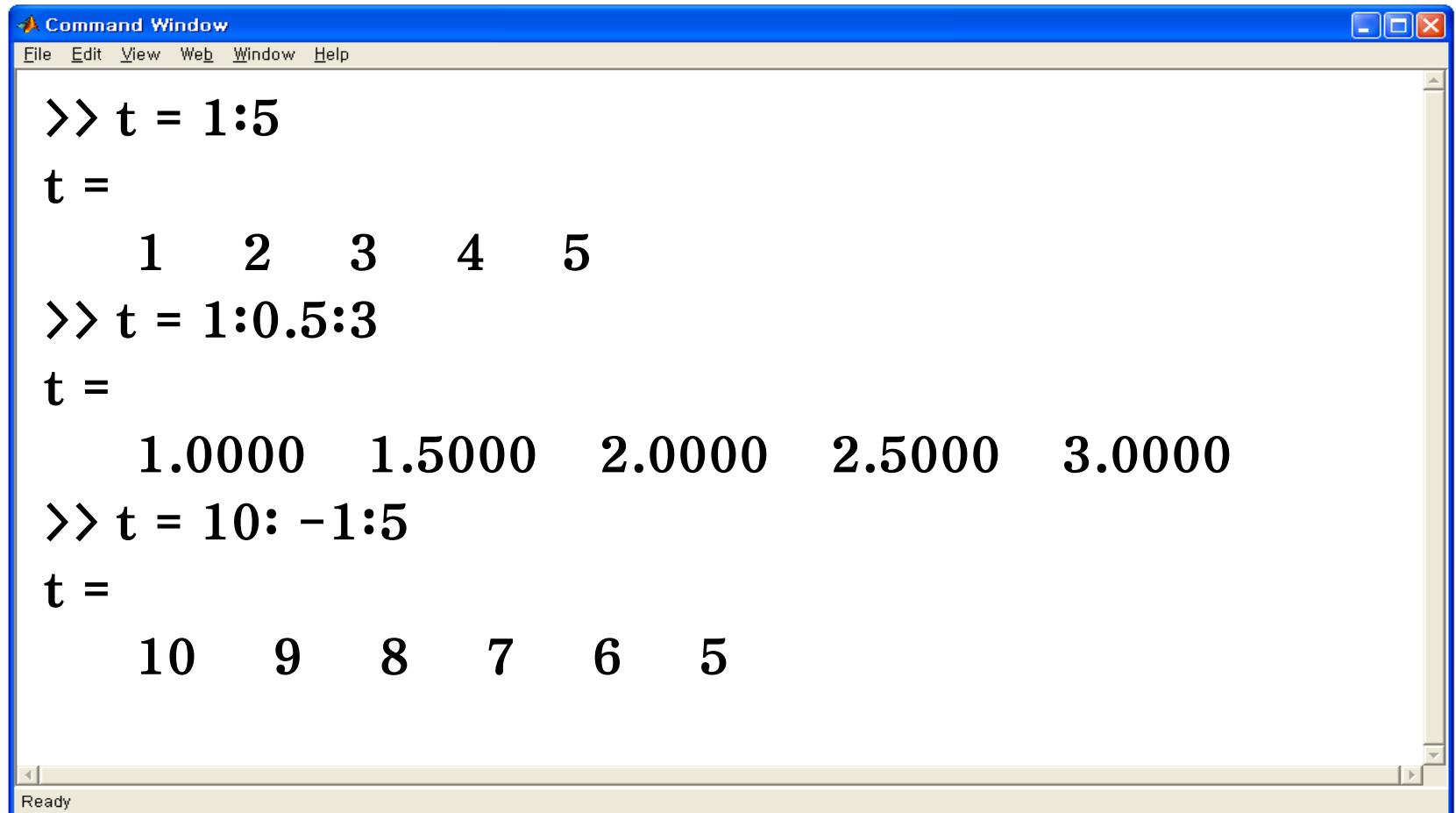
b =

2
4
6
8
10



## 2.2 배정 [8/10]

### [콜론 연산자]



A screenshot of the MATLAB Command Window. The window has a blue title bar with the text 'Command Window' and standard window controls. Below the title bar is a menu bar with 'File', 'Edit', 'View', 'Web', 'Window', and 'Help'. The main area shows three MATLAB commands and their outputs. The first command is 't = 1:5', which outputs the vector [1, 2, 3, 4, 5]. The second command is 't = 1:0.5:3', which outputs the vector [1.0000, 1.5000, 2.0000, 2.5000, 3.0000]. The third command is 't = 10:-1:5', which outputs the vector [10, 9, 8, 7, 6, 5]. The status bar at the bottom left says 'Ready'.

```
>> t = 1:5
t =
     1     2     3     4     5

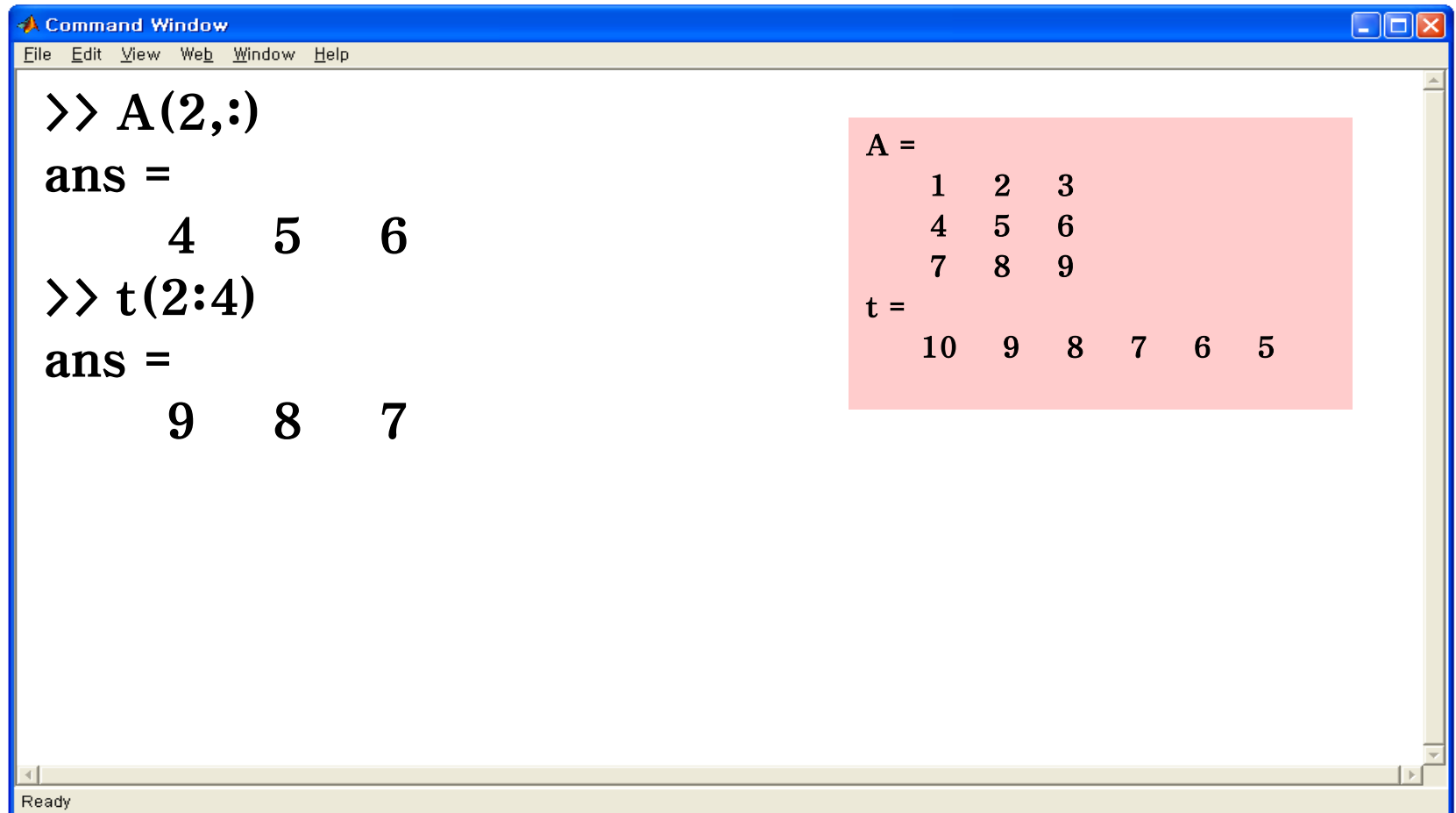
>> t = 1:0.5:3
t =
    1.0000    1.5000    2.0000    2.5000    3.0000

>> t = 10:-1:5
t =
    10     9     8     7     6     5
```



## 2.2 배정 [9/10]

### [콜론 연산자]



The screenshot shows a MATLAB Command Window with the following content:

```
>> A(2,:)
ans =
     4     5     6

>> t(2:4)
ans =
     9     8     7
```

To the right of the command window, a pink box displays the matrices A and t:

A =

1	2	3
4	5	6
7	8	9

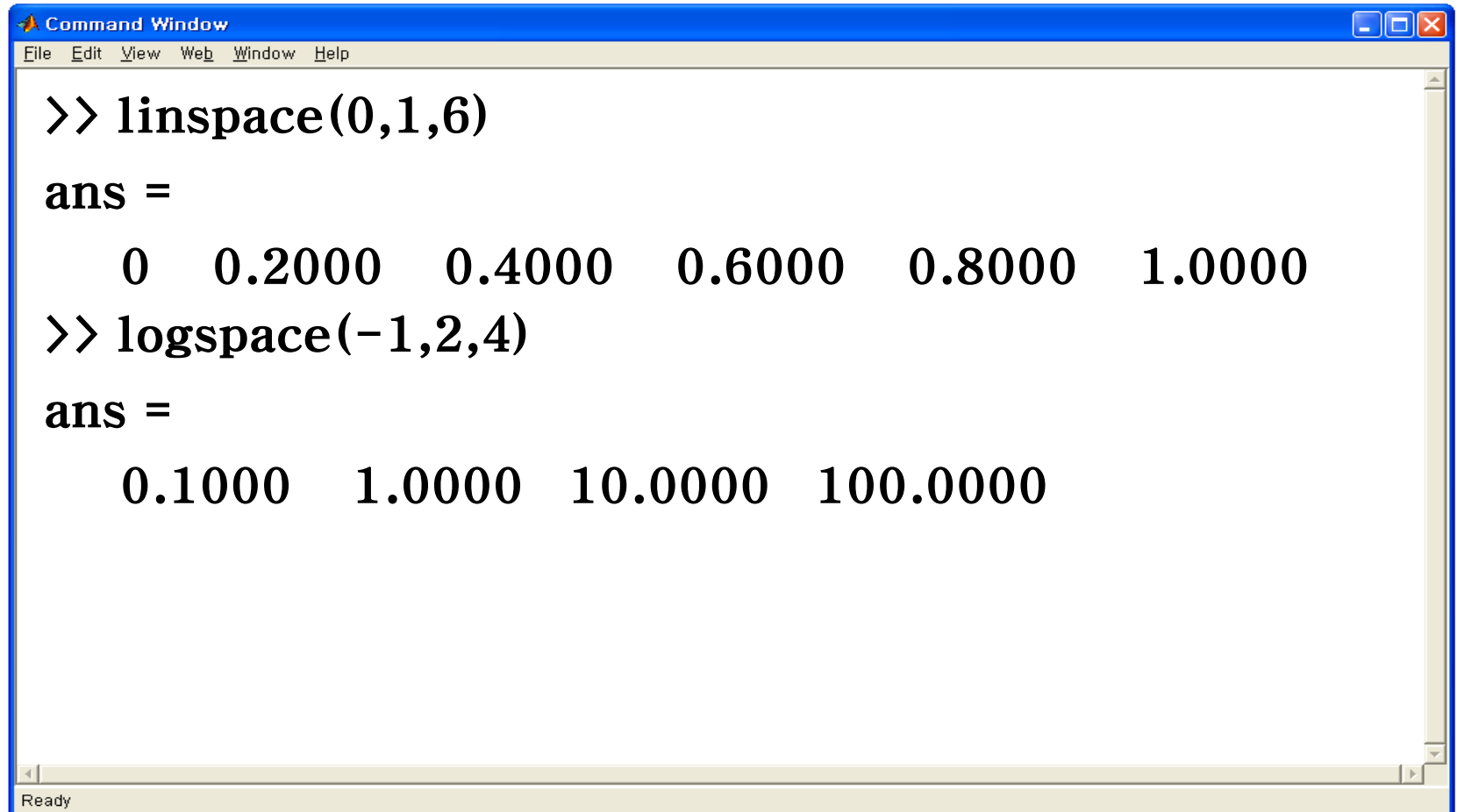
t =

10	9	8	7	6	5
----	---	---	---	---	---



## 2.2 배정 [10/10]

### [linspace와 logspace 함수]



A screenshot of the MATLAB Command Window. The window has a blue title bar with the text "Command Window" and standard window controls. Below the title bar is a menu bar with "File", "Edit", "View", "Web", "Window", and "Help". The main area of the window contains the following text:

```
>> linspace(0,1,6)
ans =
    0    0.2000    0.4000    0.6000    0.8000    1.0000
>> logspace(-1,2,4)
ans =
    0.1000    1.0000   10.0000  100.0000
```

At the bottom of the window, there is a status bar that says "Ready".



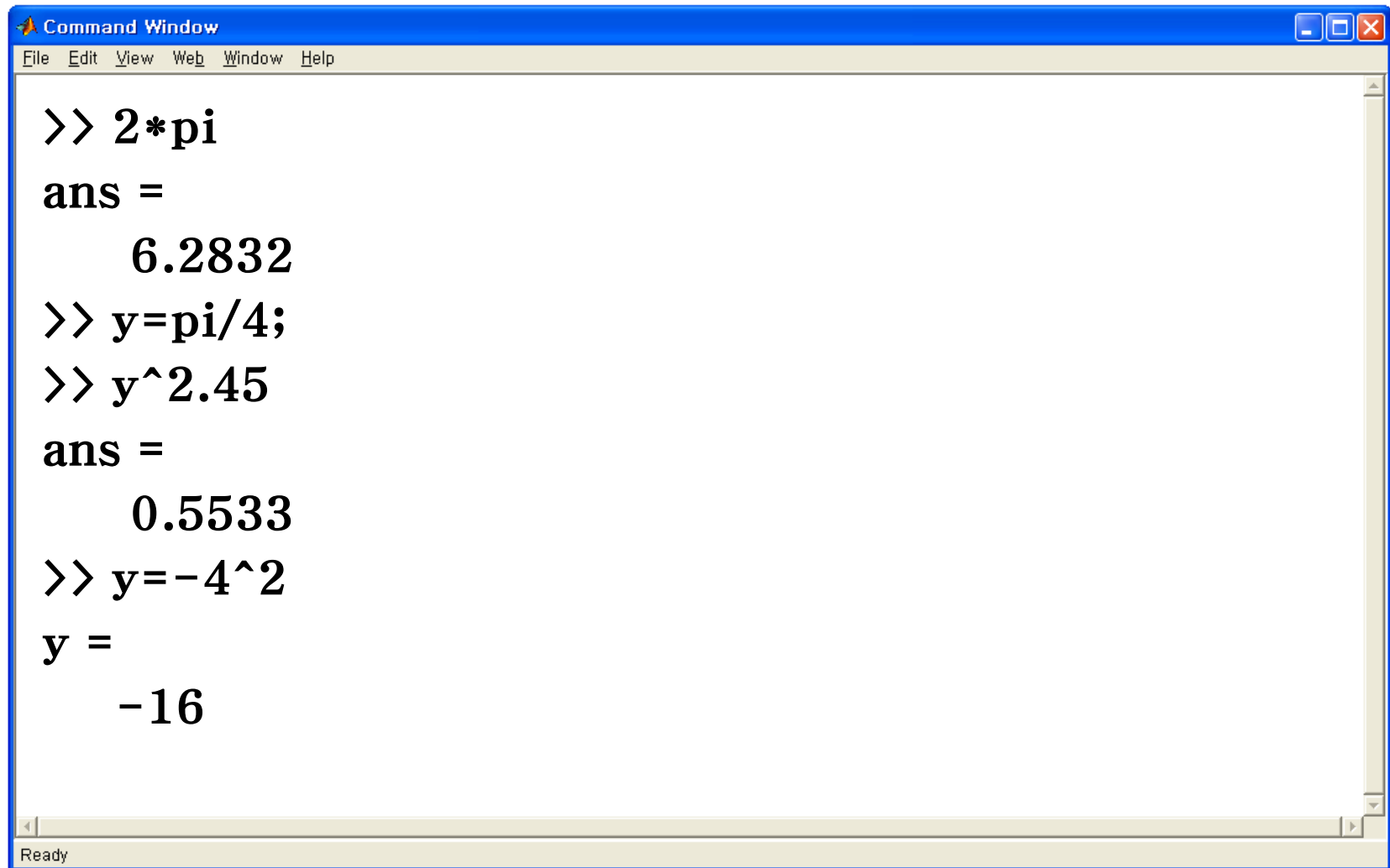
## 2.3 수학적 연산 (1/7)

### [계산순서]

- 지수계산 (^)
- 음부호 (-)
- 곱셈과 나눗셈 (\*, /)
- 왼쪽 나눗셈 (\)
- 덧셈과 뺄셈 (+, -)



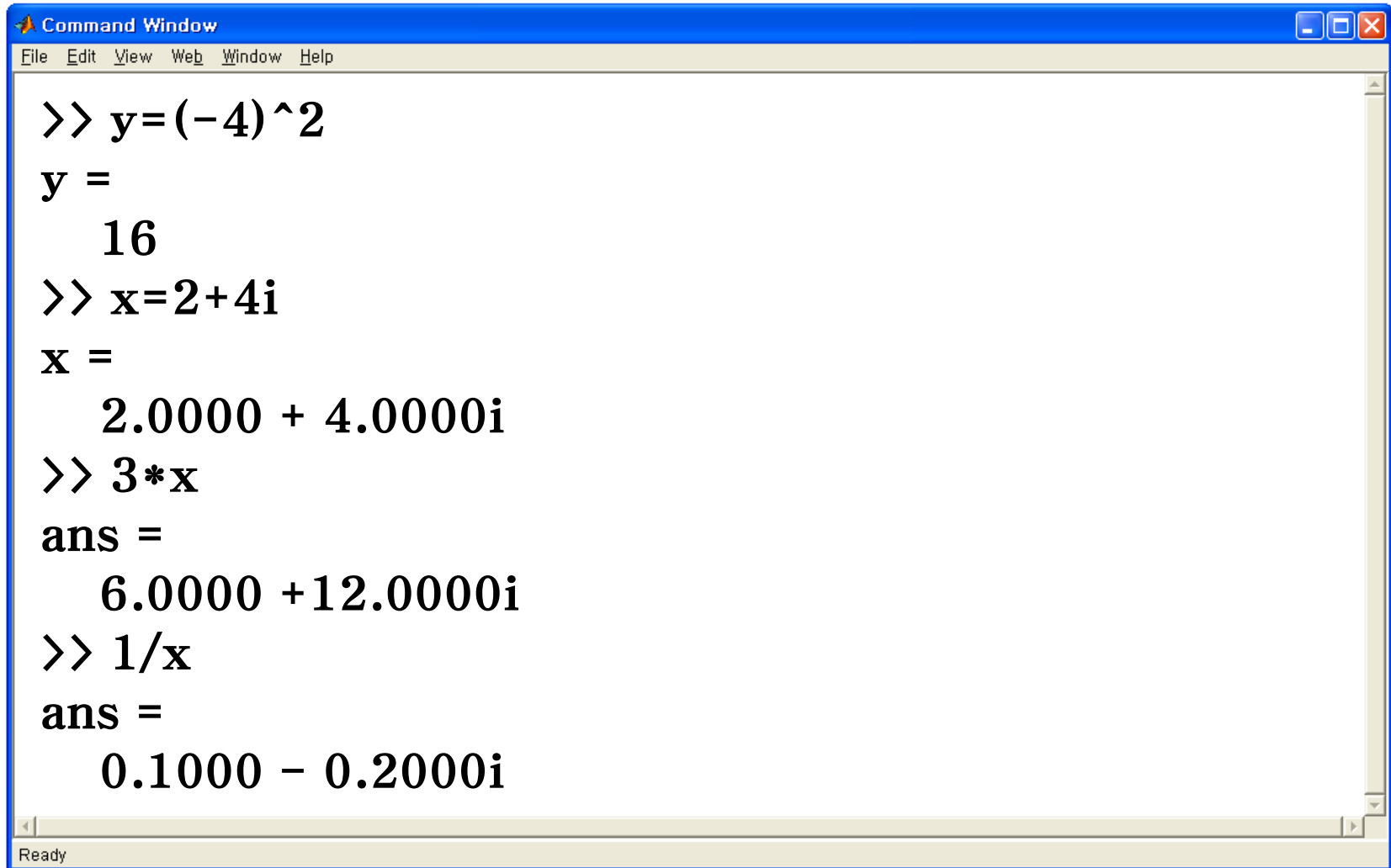
## 2.3 수학적 연산 (2/7)

A screenshot of the MATLAB Command Window. The window has a blue title bar with the text "Command Window" and standard window control buttons (minimize, maximize, close). Below the title bar is a menu bar with "File", "Edit", "View", "Web", "Window", and "Help". The main area of the window is white and contains the following text:

```
>> 2*pi  
ans =  
    6.2832  
>> y=pi/4;  
>> y^2.45  
ans =  
    0.5533  
>> y=-4^2  
y =  
   -16
```

At the bottom of the window, there is a status bar with the text "Ready".

## 2.3 수학적 연산 (3/7)

A screenshot of the MATLAB Command Window. The window has a blue title bar with the text "Command Window" and standard window control buttons (minimize, maximize, close). Below the title bar is a menu bar with "File", "Edit", "View", "Web", "Window", and "Help". The main area of the window contains MATLAB commands and their outputs. The commands are: `>> y=(-4)^2`, `>> x=2+4i`, `>> 3*x`, and `>> 1/x`. The outputs are: `y = 16`, `x = 2.0000 + 4.0000i`, `ans = 6.0000 + 12.0000i`, and `ans = 0.1000 - 0.2000i`. At the bottom of the window, there is a status bar that says "Ready".

```
Command Window
File Edit View Web Window Help

>> y=(-4)^2
y =
    16

>> x=2+4i
x =
    2.0000 + 4.0000i

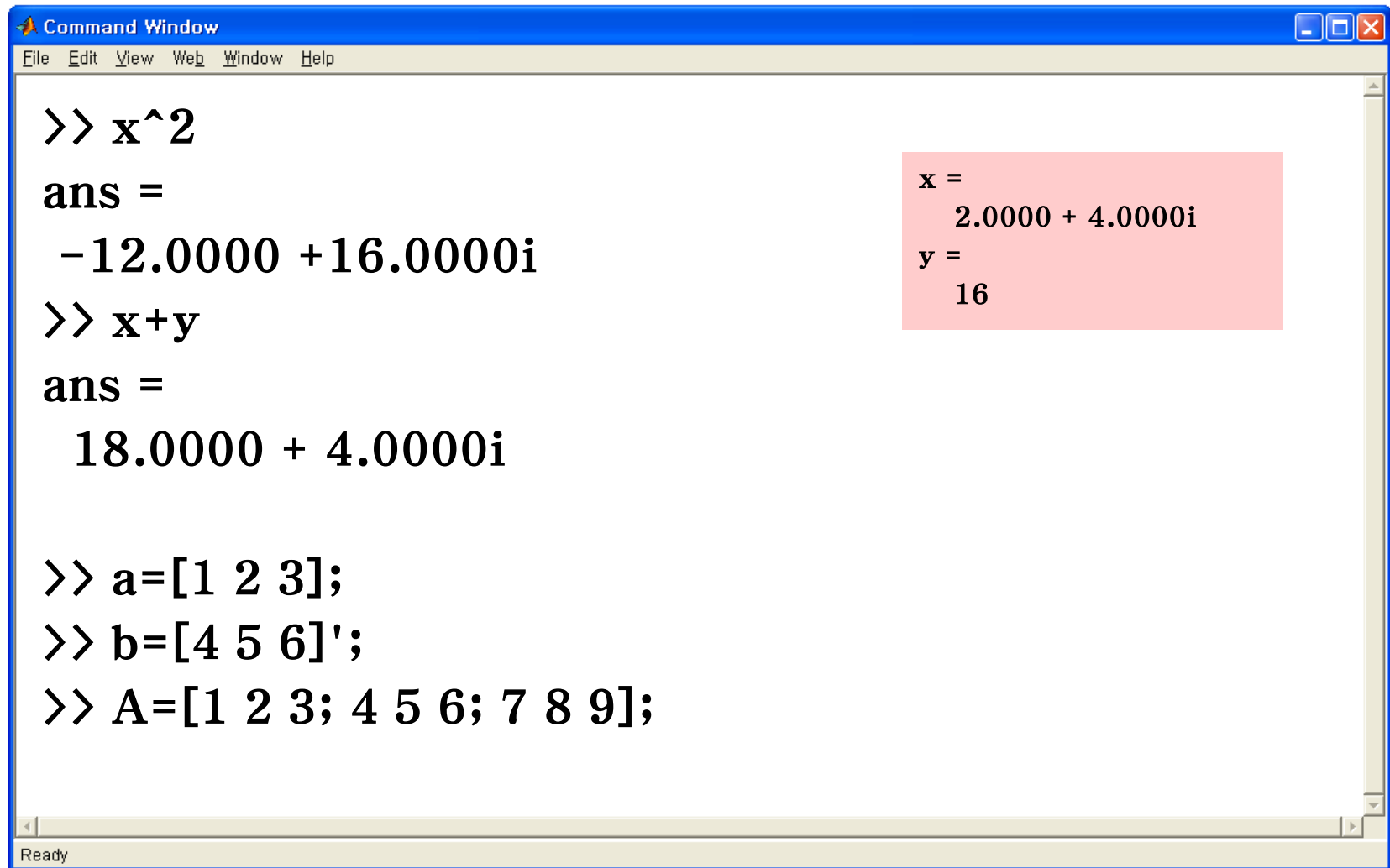
>> 3*x
ans =
    6.0000 + 12.0000i

>> 1/x
ans =
    0.1000 - 0.2000i

Ready
```



## 2.3 수학적 연산 (4/7)



A screenshot of the MATLAB Command Window interface. The window has a blue title bar with the text 'Command Window' and standard window control buttons. Below the title bar is a menu bar with 'File', 'Edit', 'View', 'Web', 'Window', and 'Help'. The main area contains MATLAB commands and their outputs. The commands are: `>> x^2`, `>> x+y`, `>> a=[1 2 3];`, `>> b=[4 5 6]';`, and `>> A=[1 2 3; 4 5 6; 7 8 9];`. The outputs are: `ans = -12.0000 + 16.0000i` for `x^2`, `ans = 18.0000 + 4.0000i` for `x+y`, and no output for the matrix assignments. A red rectangular box on the right side of the window contains the text: `x = 2.0000 + 4.0000i` and `y = 16`. The status bar at the bottom left shows 'Ready'.

```
Command Window
File Edit View Web Window Help

>> x^2
ans =
-12.0000 + 16.0000i

>> x+y
ans =
18.0000 + 4.0000i

>> a=[1 2 3];
>> b=[4 5 6]';
>> A=[1 2 3; 4 5 6; 7 8 9];

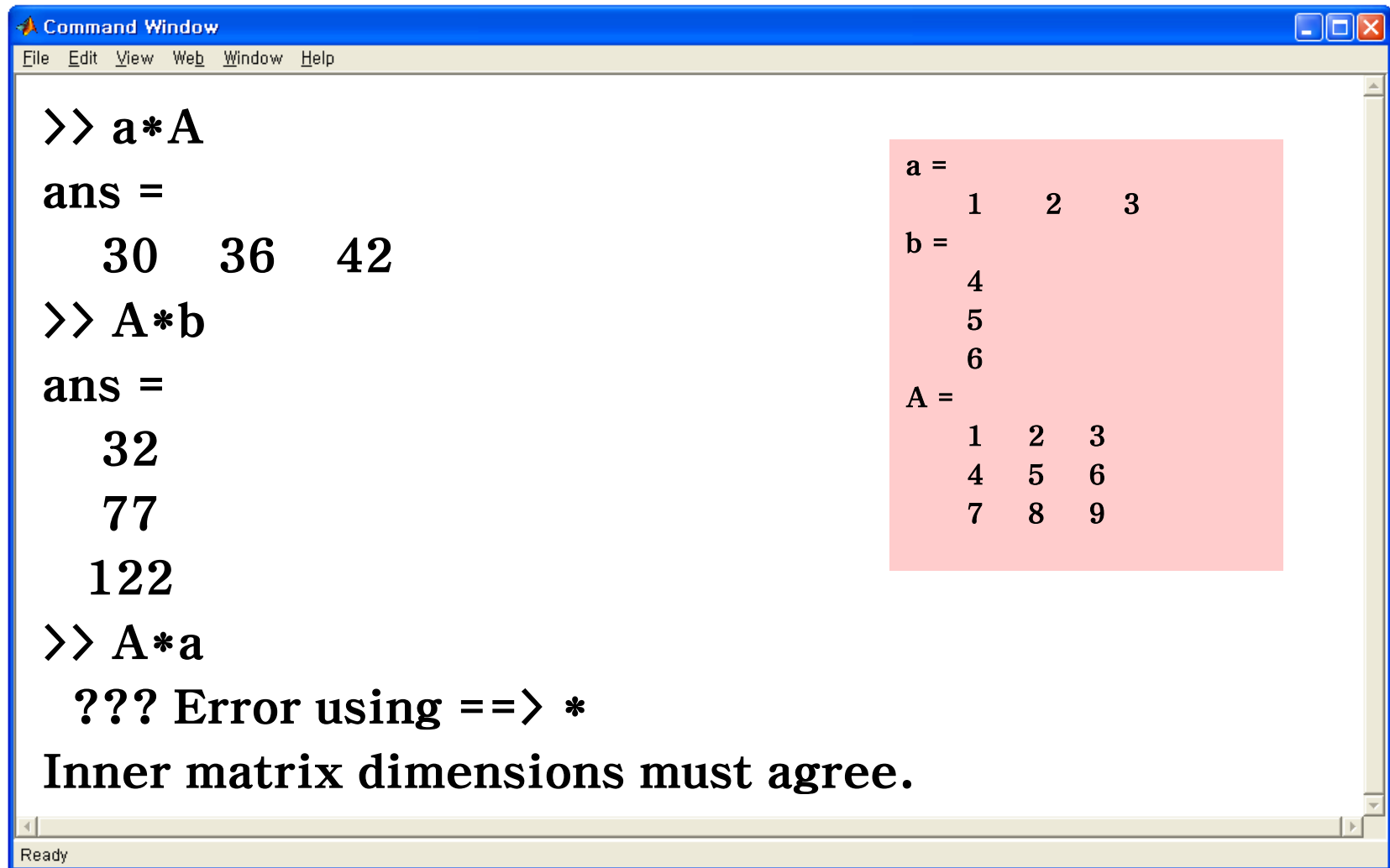
x =
2.0000 + 4.0000i
y =
16

Ready
```





## 2.3 수학적 연산 (5/7)



The screenshot shows a MATLAB Command Window with the following content:

```
>> a*A
ans =
    30    36    42
>> A*b
ans =
    32
    77
   122
>> A*a
??? Error using ==> *
Inner matrix dimensions must agree.
```

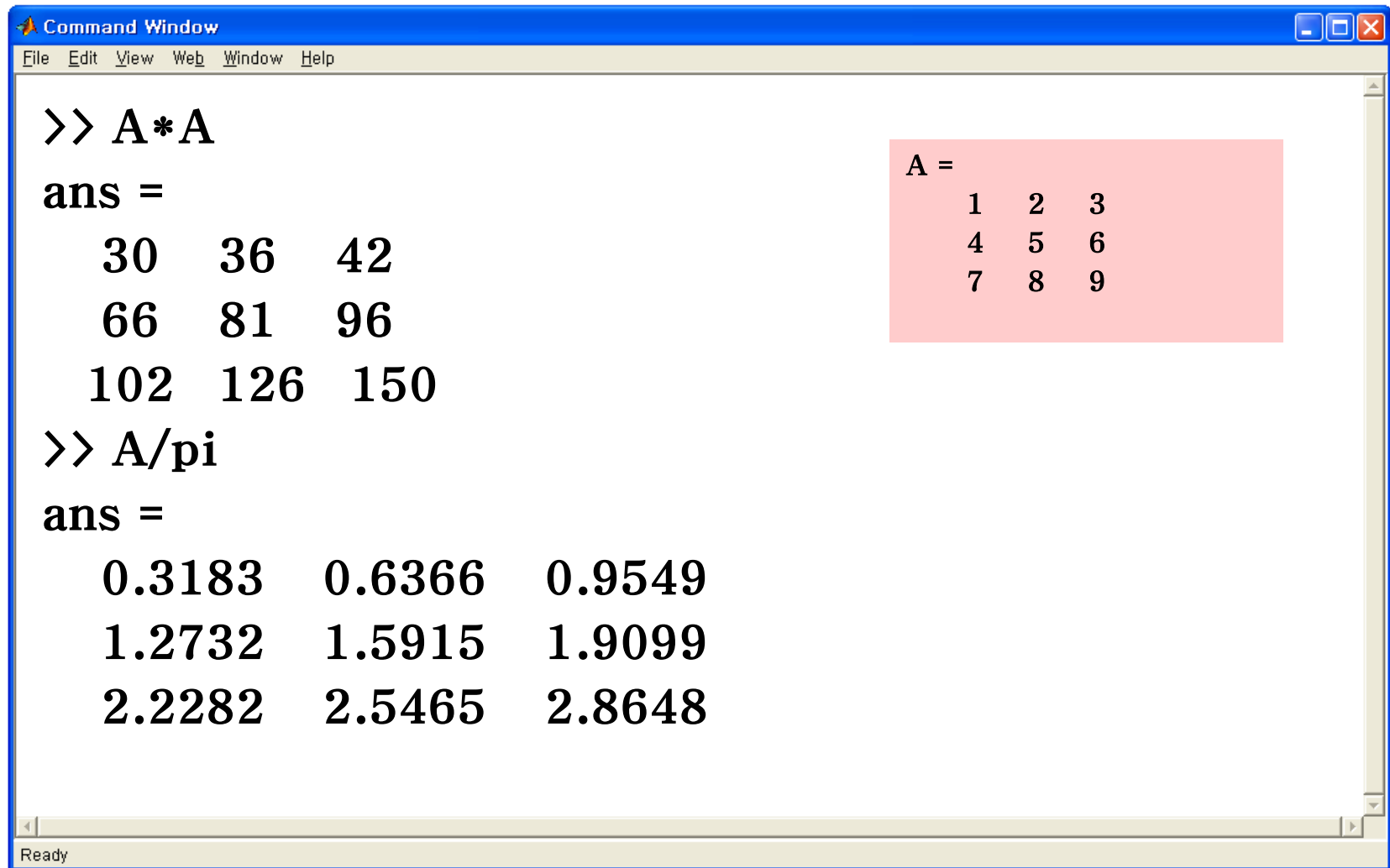
On the right side of the window, a pink box contains the definitions of the variables:

```
a =
     1     2     3
b =
     4
     5
     6
A =
     1     2     3
     4     5     6
     7     8     9
```

The status bar at the bottom left of the window displays "Ready".



## 2.3 수학적 연산 (6/7)



The image shows a MATLAB Command Window interface. The title bar reads "Command Window" with standard window controls. The menu bar includes "File", "Edit", "View", "Web", "Window", and "Help". The command history shows two operations: `>> A*A` and `>> A/pi`. The results are displayed as matrices. To the right of the command window, a pink box displays the matrix `A`.

```
>> A*A
ans =
    30    36    42
    66    81    96
   102   126   150

>> A/pi
ans =
    0.3183    0.6366    0.9549
    1.2732    1.5915    1.9099
    2.2282    2.5465    2.8648
```

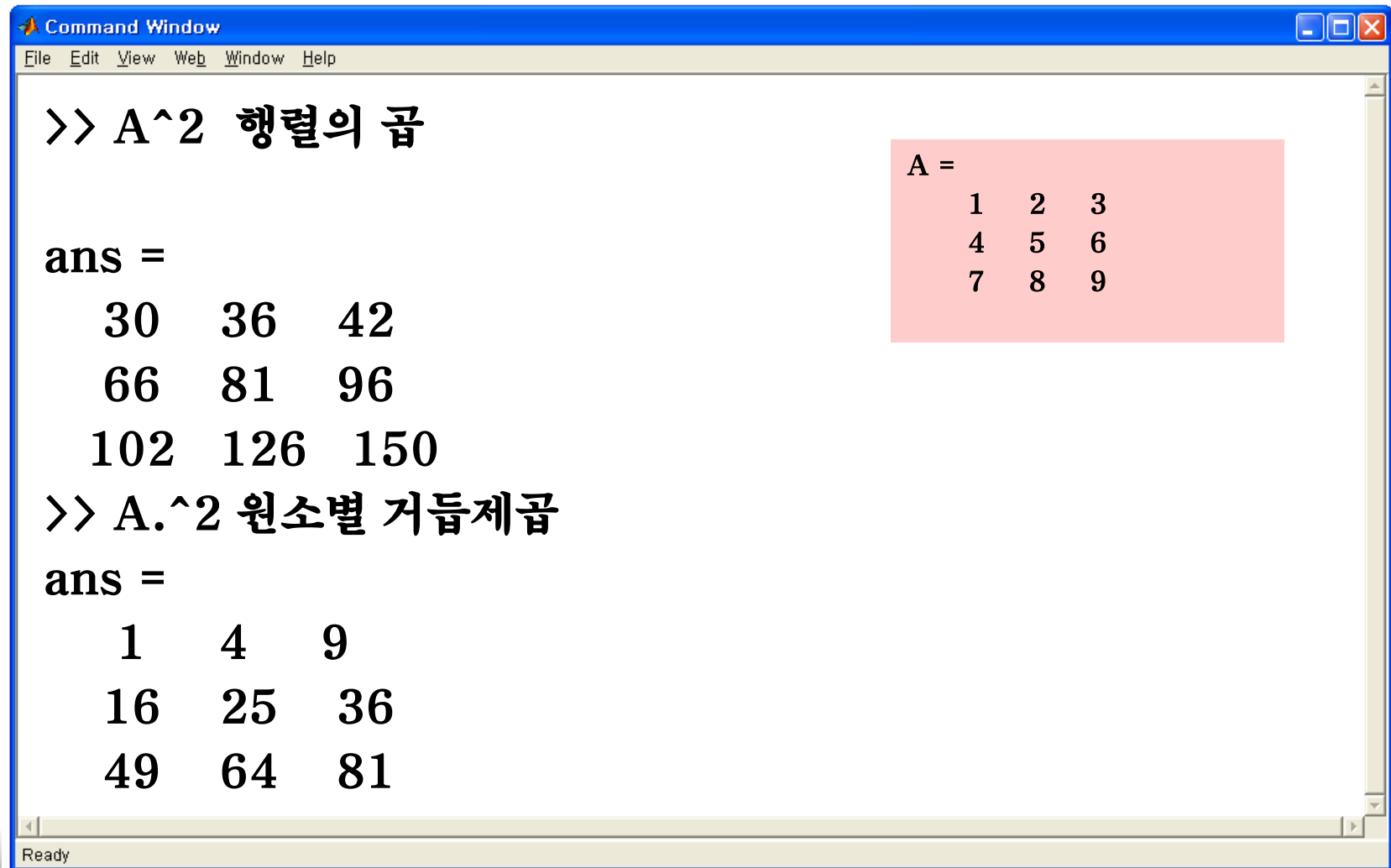
A =

1	2	3
4	5	6
7	8	9

Ready



## 2.3 수학적 연산 (7/7)



The screenshot shows a MATLAB Command Window with a blue title bar and menu bar. The command prompt shows two operations: `>> A^2` and `>> A.^2`. The results are displayed in the command window and also shown in a separate pink box for the matrix A.

```
>> A^2 행렬의 곱

ans =
    30    36    42
    66    81    96
   102   126   150

>> A.^2 원소별 거듭제곱

ans =
     1     4     9
    16    25    36
    49    64    81
```

Matrix A (shown in pink box):

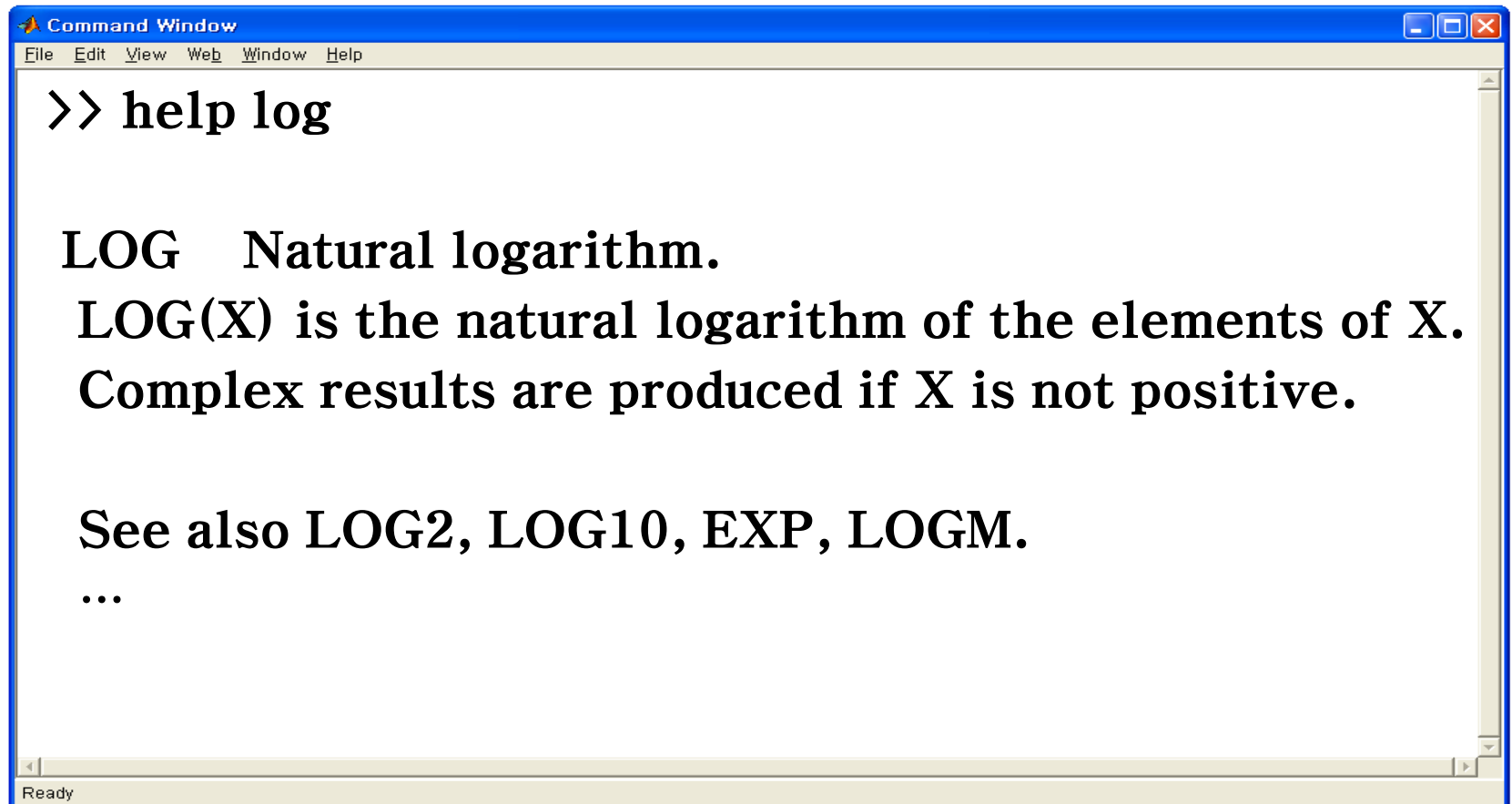
A =	1	2	3
	4	5	6
	7	8	9

Ready



## 2.4 내장함수의 사용 (1/9)

- Help 명령어를 사용하여 온라인 도움을 얻음

A screenshot of the MATLAB Command Window. The title bar says "Command Window". The menu bar includes "File", "Edit", "View", "Web", "Window", and "Help". The command prompt shows ">> help log". The output text reads: "LOG Natural logarithm. LOG(X) is the natural logarithm of the elements of X. Complex results are produced if X is not positive. See also LOG2, LOG10, EXP, LOGM. ...". The status bar at the bottom says "Ready".

```
Command Window
File Edit View Web Window Help
>> help log

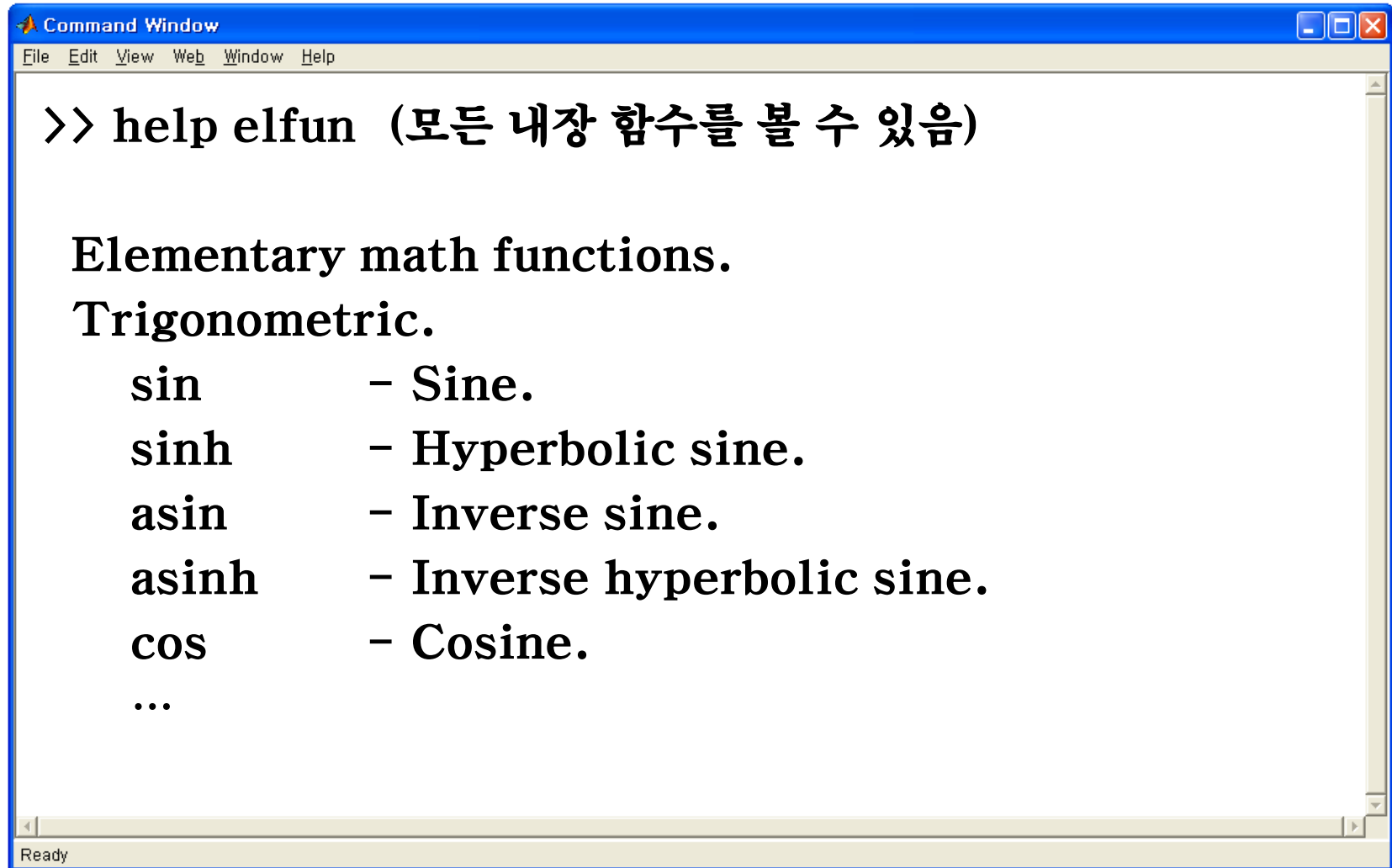
LOG Natural logarithm.
LOG(X) is the natural logarithm of the elements of X.
Complex results are produced if X is not positive.

See also LOG2, LOG10, EXP, LOGM.
...

Ready
```



## 2.4 내장함수의 사용 (2/9)

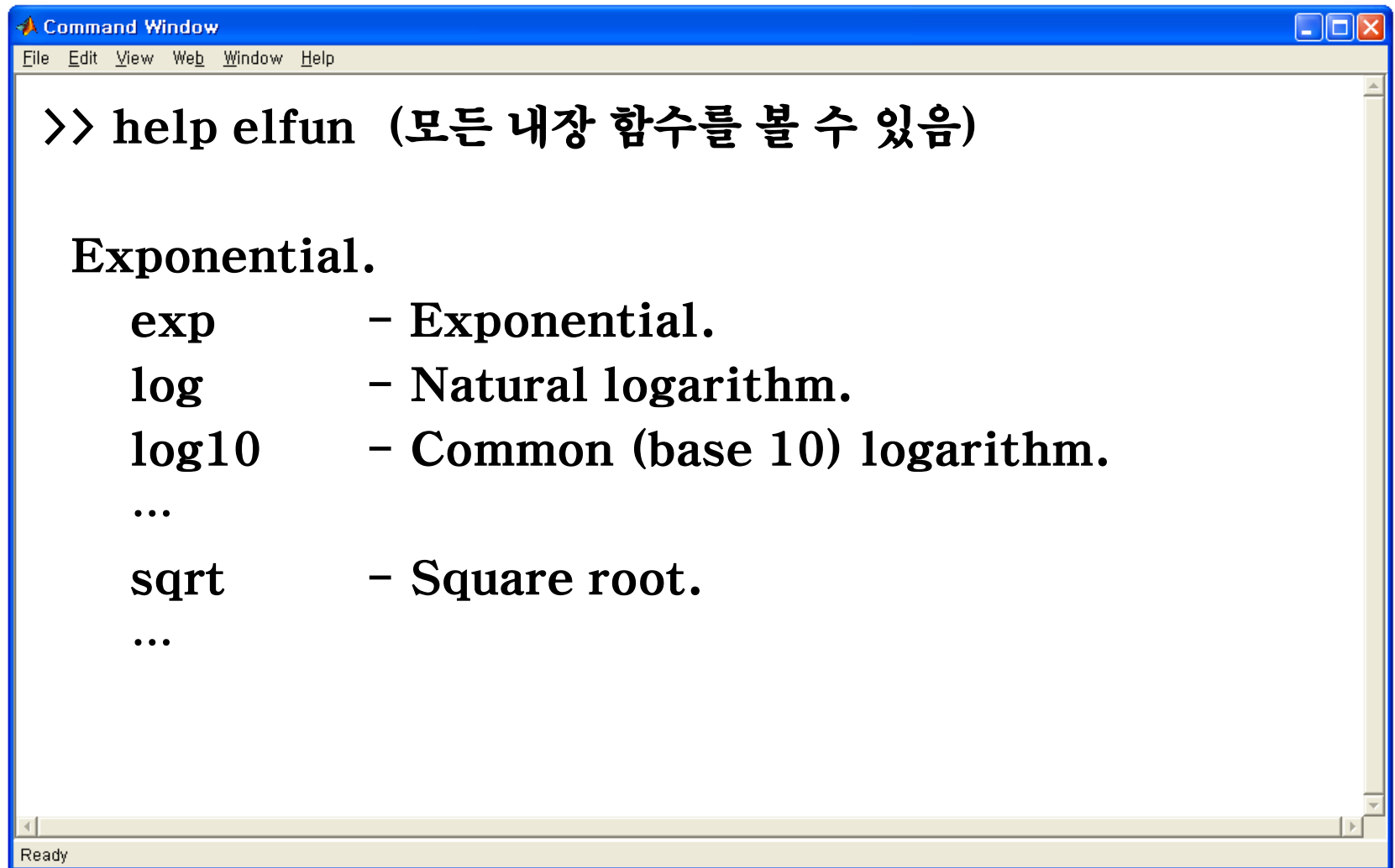
A screenshot of the MATLAB Command Window. The window has a blue title bar with the text 'Command Window' and standard window control buttons (minimize, maximize, close). Below the title bar is a menu bar with 'File', 'Edit', 'View', 'Web', 'Window', and 'Help'. The main area of the window contains the following text: '>> help elfun (모든 내장 함수를 볼 수 있음)' followed by 'Elementary math functions.' and 'Trigonometric.' Then, a list of functions is shown: 'sin - Sine.', 'sinh - Hyperbolic sine.', 'asin - Inverse sine.', 'asinh - Inverse hyperbolic sine.', 'cos - Cosine.', and '...'. At the bottom of the window, there is a status bar that says 'Ready'.

```
>> help elfun (모든 내장 함수를 볼 수 있음)

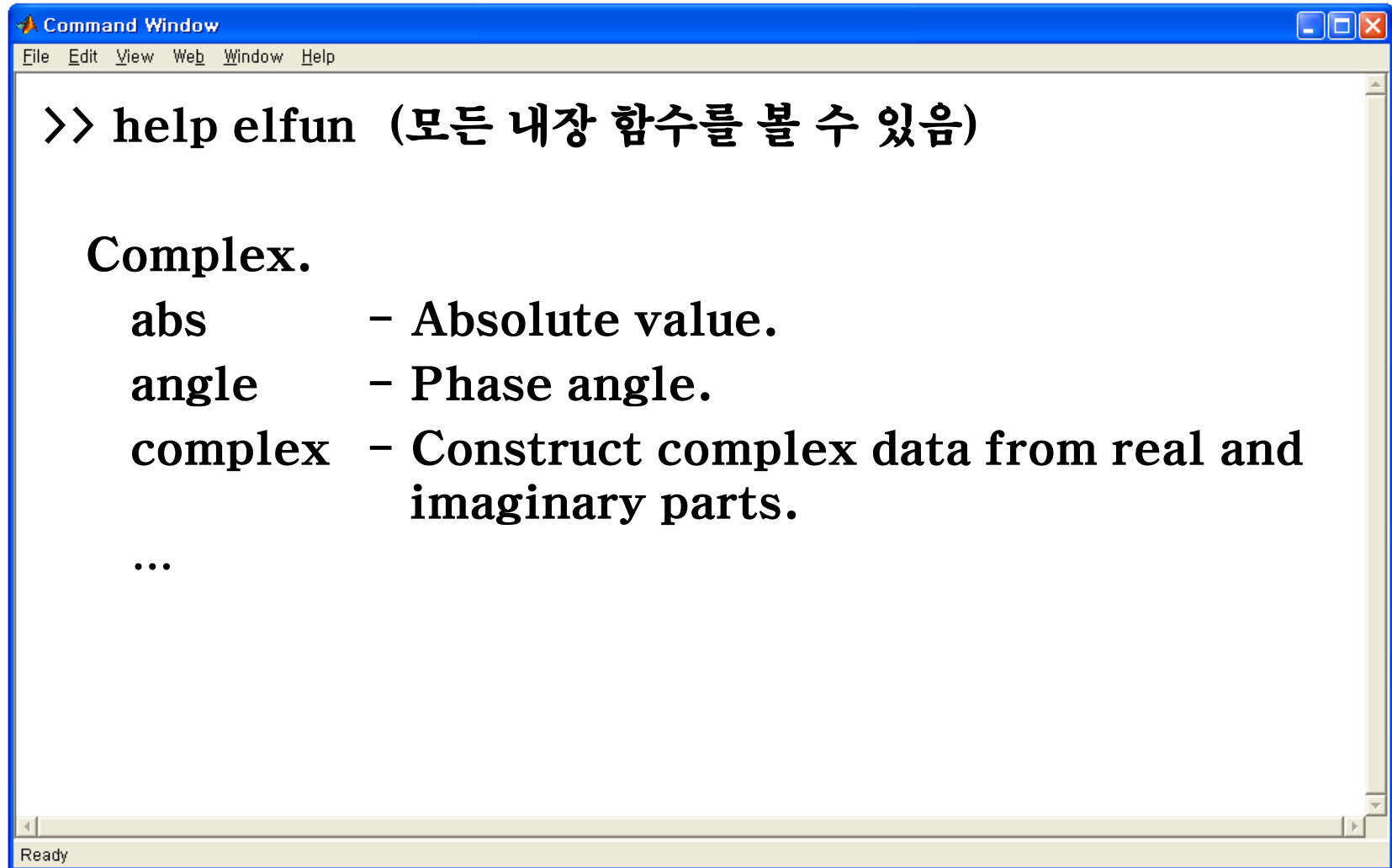
Elementary math functions.
Trigonometric.
    sin      - Sine.
    sinh     - Hyperbolic sine.
    asin     - Inverse sine.
    asinh    - Inverse hyperbolic sine.
    cos      - Cosine.
    ...
```



## 2.4 내장함수의 사용 (3/9)

A screenshot of the MATLAB Command Window. The window has a blue title bar with the text 'Command Window' and standard window control buttons (minimize, maximize, close). Below the title bar is a menu bar with 'File', 'Edit', 'View', 'Web', 'Window', and 'Help'. The main area of the window contains the text: '>> help elfun (모든 내장 함수를 볼 수 있음)' followed by a list of functions under the heading 'Exponential.'. The list includes 'exp - Exponential.', 'log - Natural logarithm.', 'log10 - Common (base 10) logarithm.', '...', 'sqrt - Square root.', and '...'. At the bottom of the window, there is a status bar that says 'Ready'.

## 2.4 내장함수의 사용 (4/9)

A screenshot of the MATLAB Command Window. The window has a blue title bar with the text 'Command Window' and standard window control buttons. Below the title bar is a menu bar with 'File', 'Edit', 'View', 'Web', 'Window', and 'Help'. The main area of the window contains the text '>> help elfun (모든 내장 함수를 볼 수 있음)' followed by a list of functions under the heading 'Complex.'. The functions listed are 'abs' (Absolute value), 'angle' (Phase angle), and 'complex' (Construct complex data from real and imaginary parts), followed by an ellipsis '...'. The status bar at the bottom left shows 'Ready'.

```
Command Window
File Edit View Web Window Help

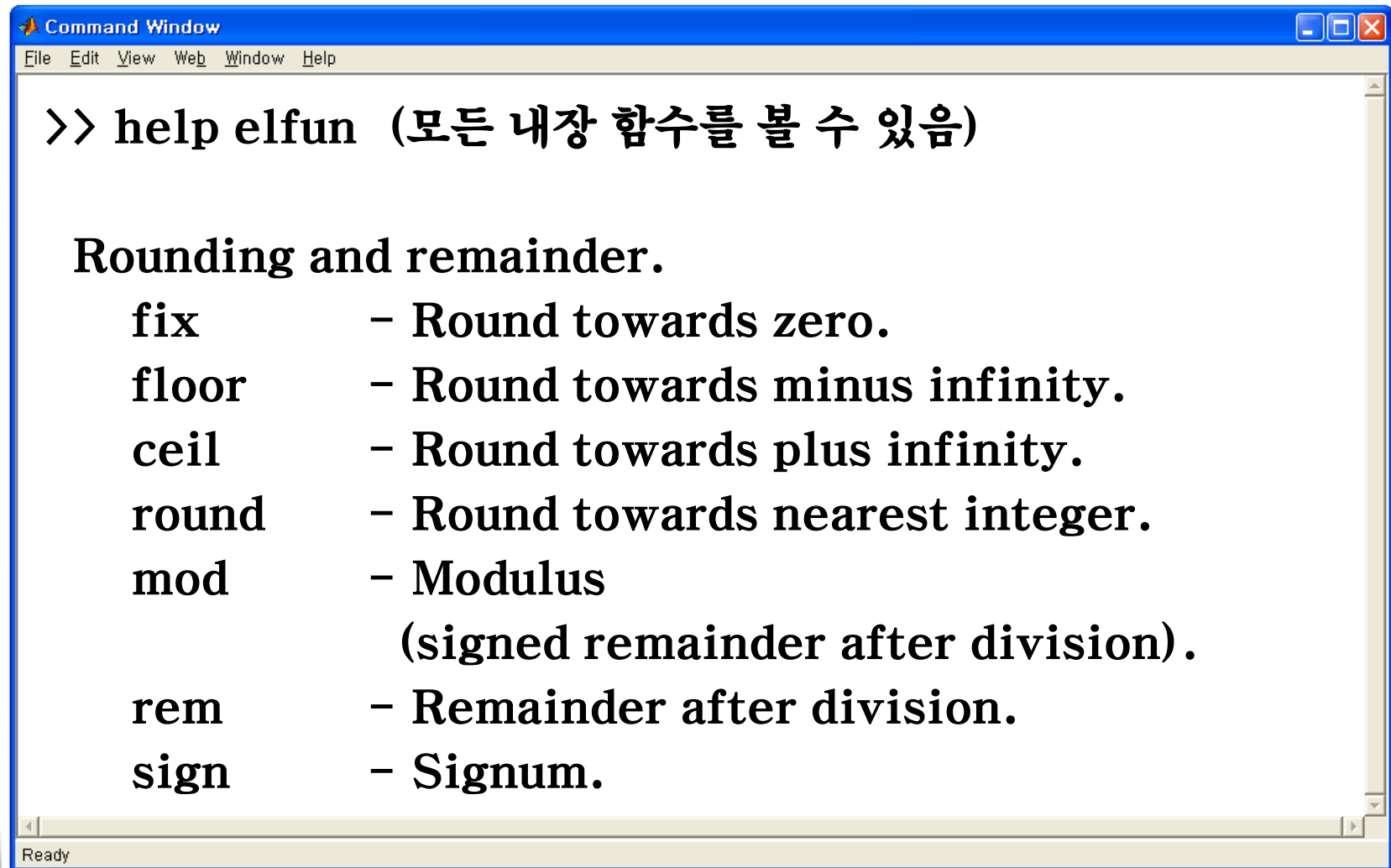
>> help elfun (모든 내장 함수를 볼 수 있음)

Complex.
abs      - Absolute value.
angle    - Phase angle.
complex  - Construct complex data from real and
           imaginary parts.
...

Ready
```

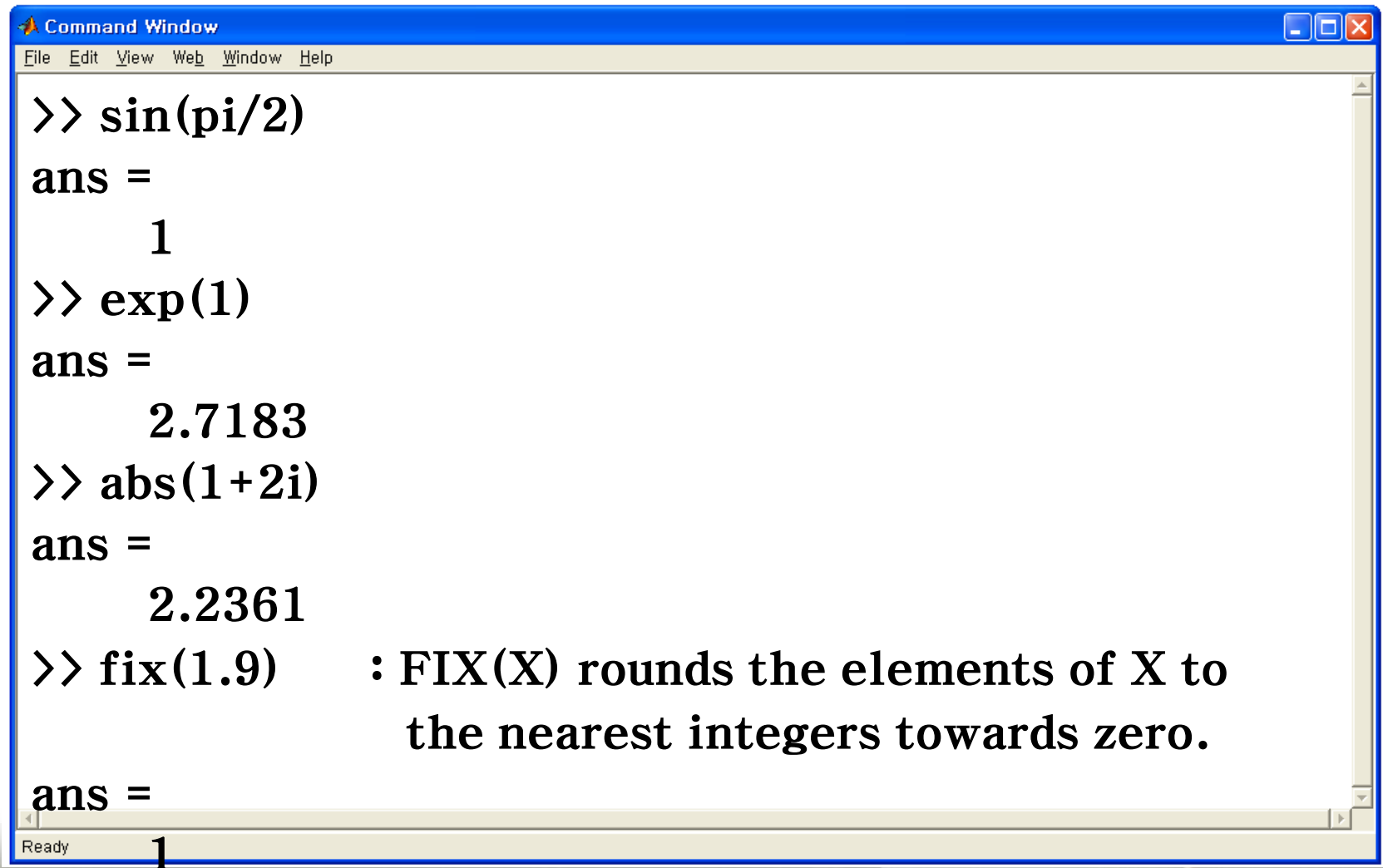


## 2.4 내장함수의 사용 (5/9)

A screenshot of the MATLAB Command Window. The title bar is blue with the text 'Command Window' and standard window control buttons. The menu bar includes 'File', 'Edit', 'View', 'Web', 'Window', and 'Help'. The main text area shows the command '>> help elfun (모든 내장 함수를 볼 수 있음)' followed by a list of rounding and remainder functions: 'fix - Round towards zero.', 'floor - Round towards minus infinity.', 'ceil - Round towards plus infinity.', 'round - Round towards nearest integer.', 'mod - Modulus (signed remainder after division).', 'rem - Remainder after division.', and 'sign - Signum.'. The status bar at the bottom left says 'Ready'.



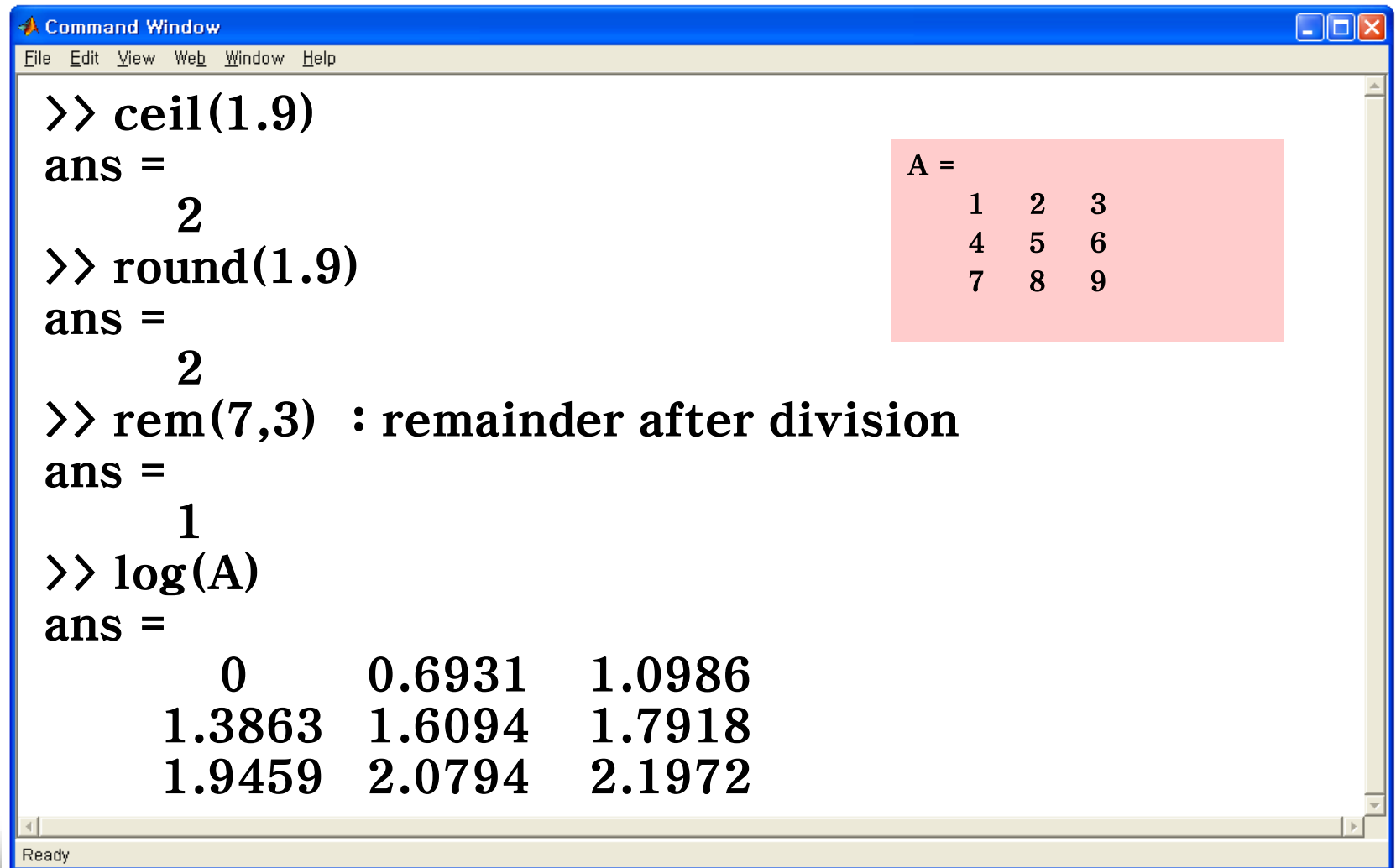
## 2.4 내장함수의 사용 [6/9]

A screenshot of the MATLAB Command Window. The window has a blue title bar with the text 'Command Window' and standard window control buttons. Below the title bar is a menu bar with 'File', 'Edit', 'View', 'Web', 'Window', and 'Help'. The main area contains MATLAB commands and their outputs. The commands are: 'sin(pi/2)', 'exp(1)', 'abs(1+2i)', and 'fix(1.9)'. The outputs are: 'ans = 1', 'ans = 2.7183', 'ans = 2.2361', and 'ans = 1'. A text annotation ': FIX(X) rounds the elements of X to the nearest integers towards zero.' is placed next to the 'fix(1.9)' command. The status bar at the bottom shows 'Ready' and a cursor icon.

```
>> sin(pi/2)
ans =
    1
>> exp(1)
ans =
    2.7183
>> abs(1+2i)
ans =
    2.2361
>> fix(1.9)      : FIX(X) rounds the elements of X to
                  the nearest integers towards zero.
ans =
    1
```



## 2.4 내장함수의 사용 [7/9]



The screenshot shows a MATLAB Command Window with a blue title bar and menu bar. The command history includes: `>> ceil(1.9)` resulting in `ans = 2`; `>> round(1.9)` resulting in `ans = 2`; `>> rem(7,3) : remainder after division` resulting in `ans = 1`; and `>> log(A)` resulting in a 3x3 matrix of logarithmic values. To the right of the window, a pink box displays the matrix `A` with values 1 through 9 arranged in a 3x3 grid.

```
>> ceil(1.9)
ans =
    2

>> round(1.9)
ans =
    2

>> rem(7,3) : remainder after division
ans =
    1

>> log(A)
ans =
    0    0.6931    1.0986
  1.3863    1.6094    1.7918
  1.9459    2.0794    2.1972
```

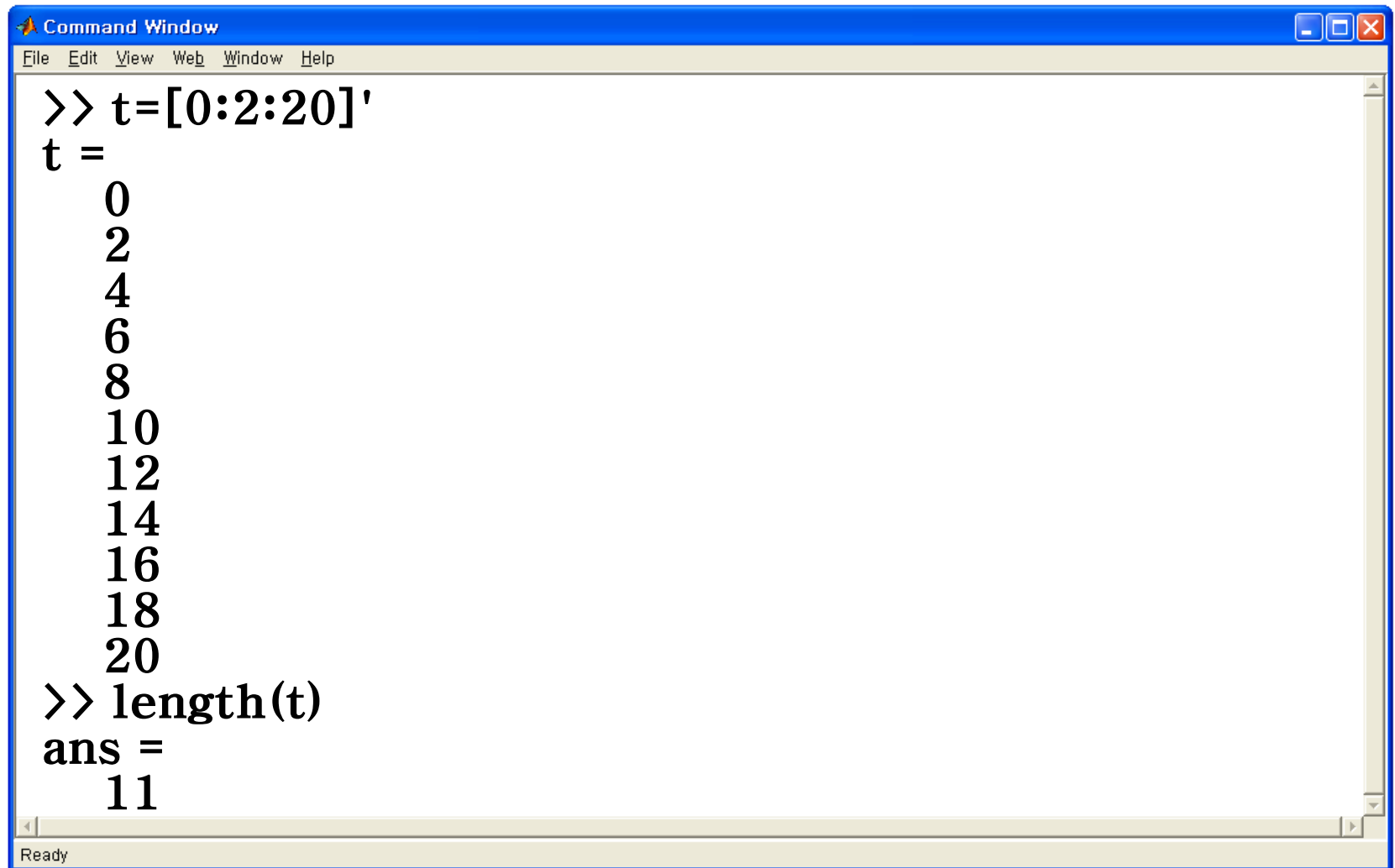
A =

1	2	3
4	5	6
7	8	9

Ready



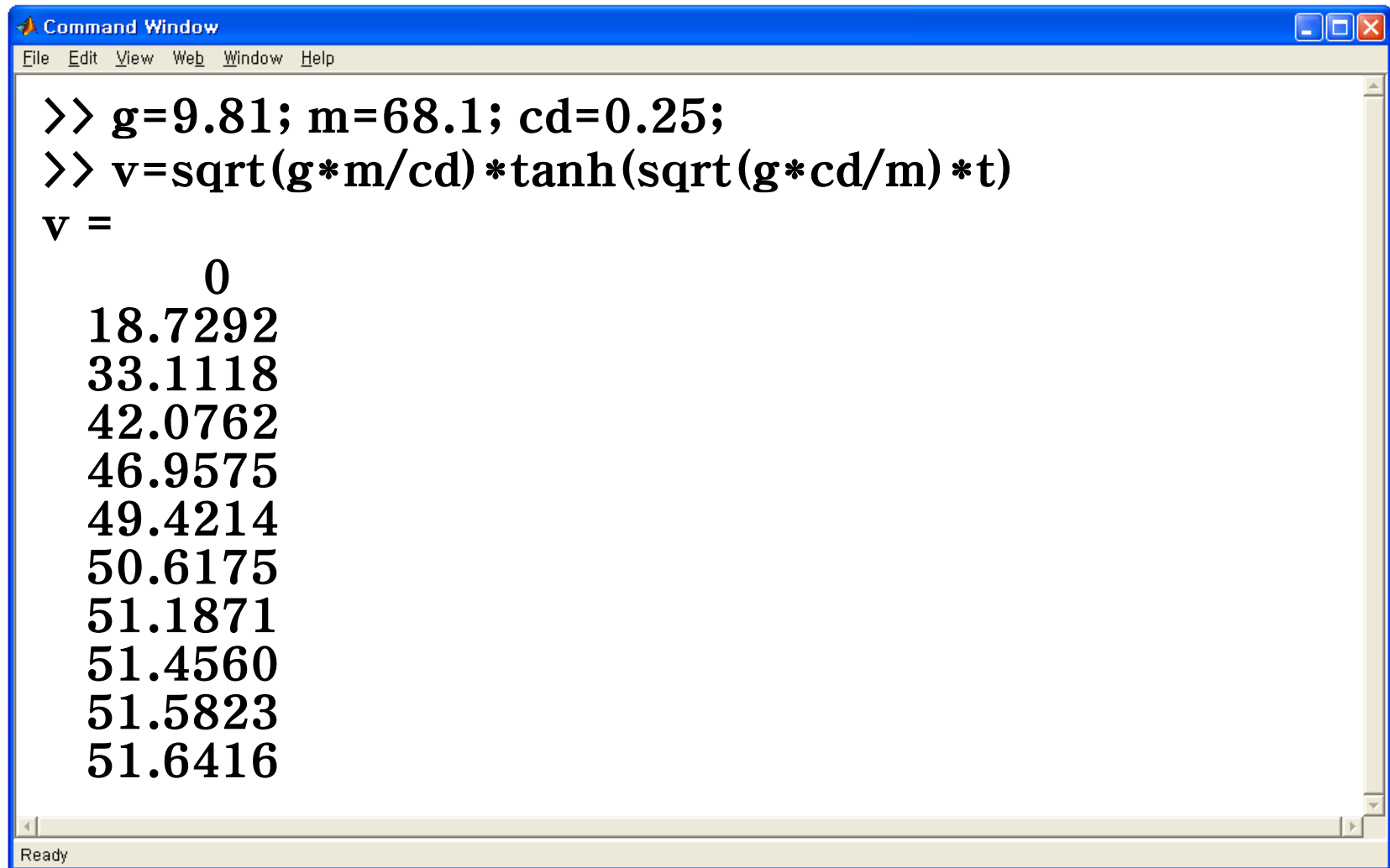
## 2.4 내장함수의 사용 (8/9)

A screenshot of the MATLAB Command Window. The window has a blue title bar with the text 'Command Window' and standard window control buttons. Below the title bar is a menu bar with 'File', 'Edit', 'View', 'Web', 'Window', and 'Help'. The main area of the window contains the following text:

```
>> t=[0:2:20]'  
t =  
    0  
    2  
    4  
    6  
    8  
   10  
   12  
   14  
   16  
   18  
   20  
>> length(t)  
ans =  
    11
```

At the bottom of the window, there is a status bar that says 'Ready'.

## 2.4 내장함수의 사용 (9/9)

A screenshot of the MATLAB Command Window. The window has a blue title bar with the text "Command Window" and standard window control buttons (minimize, maximize, close). Below the title bar is a menu bar with "File", "Edit", "View", "Web", "Window", and "Help". The main area of the window contains MATLAB code and its output. The code consists of two lines: ">> g=9.81; m=68.1; cd=0.25;" and ">> v=sqrt(g\*m/cd)\*tanh(sqrt(g\*cd/m)\*t)". The output shows "v =" followed by a column of ten numerical values: 0, 18.7292, 33.1118, 42.0762, 46.9575, 49.4214, 50.6175, 51.1871, 51.4560, 51.5823, and 51.6416. At the bottom left of the window, the status bar says "Ready".

```
Command Window
File Edit View Web Window Help

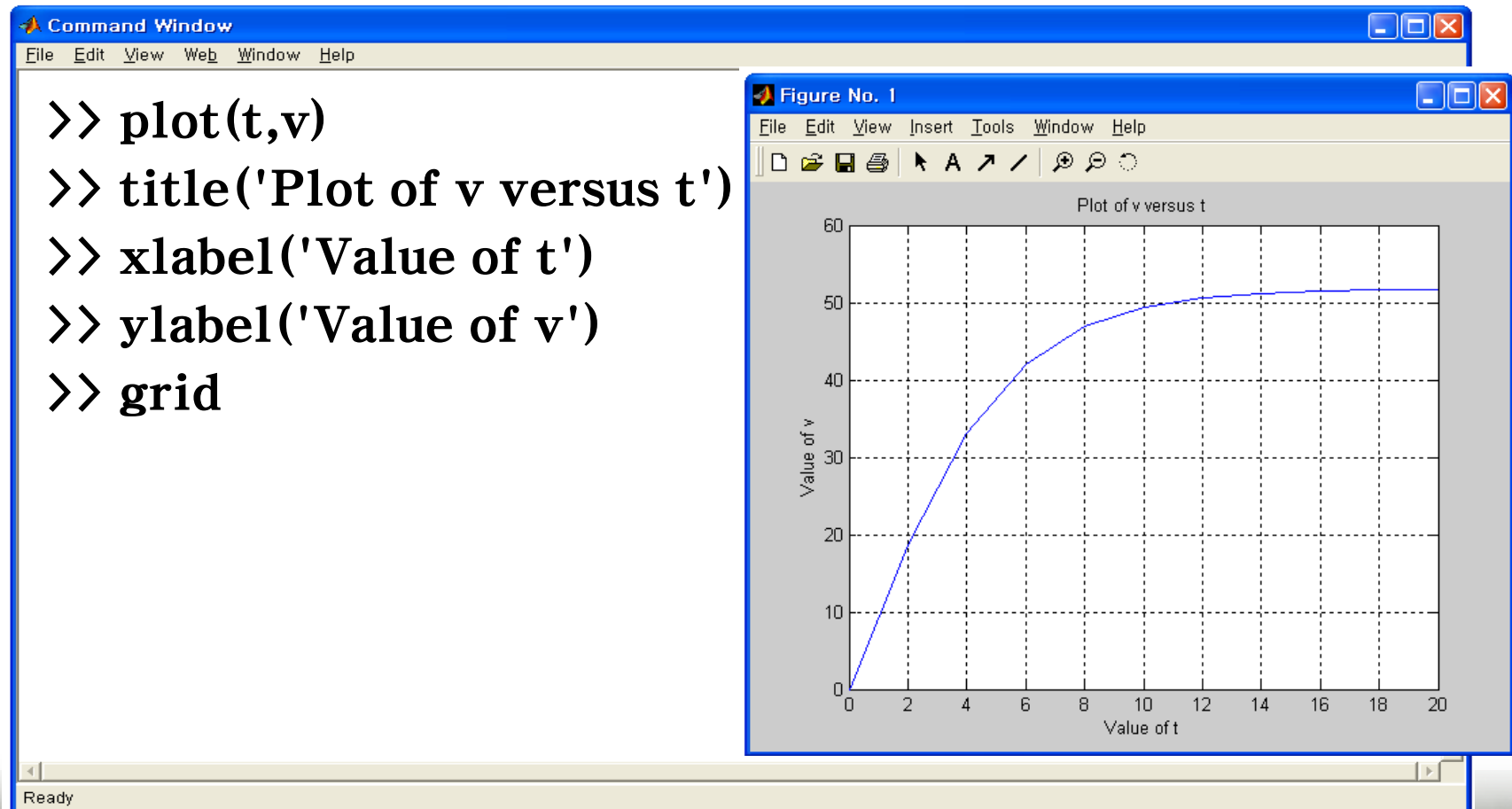
>> g=9.81; m=68.1; cd=0.25;
>> v=sqrt(g*m/cd)*tanh(sqrt(g*cd/m)*t)
v =
    0
 18.7292
 33.1118
 42.0762
 46.9575
 49.4214
 50.6175
 51.1871
 51.4560
 51.5823
 51.6416

Ready
```



## 2.5 그래픽 (1/2)

- 그래프를 빠르고 편리하게 그릴 수 있음



## 2.5 그래픽 (2/2)

- 그래프를 빠르고 편리하게 그릴 수 있음

