부록E

실습문제 해답

부록E 실습문제 해답

실습문제 해답 2.1

1. 7
2. 10
3. 2.5000
4. 17
5. 7.8154
6. 4.1955
7. 12.9600
8. 5
9. 2.2361
10. −1

실습문제 해답 2.2

1. test is a valid name.
2. Test is a valid name, but is a different variable from test.
3. if is not allowed. It is a reserved keyword.
4. my−book is not allowed because it contains a hyphen.
5. my_book is a valid name
6. Thisisoneverylongnamebutisitstillallowed? is not allowed because it includes a question mark. Even without the question mark, it is not a good idea.
7. 1stgroup is not allowed because it starts with a number.

8. group_one is a valid name.
9. zzaAbc is a valid name, although it's not a very good one because it combines uppercase and lowercase letters and is not meaningful.
10. z34wAwy%12# is not valid because it includes the percent and pound signs.
11. sin is a valid name, but a poor choice since it is also a function name.
12. log is a valid name, but a poor choice since it is also a function name.

실습문제 해답 2.3

1. 6
2. 72
3. 16
4. 13
5. 48
6. 38.5
7. 4096
8. 2.4179×10^{24}
9. 245
10. 2187
11. 1
12. 7.5
13. 41.6667
14. 25.5
15. 135

실습문제 해답 2.4

1. a = [2.3 5.8 9]
2. sin(a)

   ans =

   0.7457 −0.4646 0.4121
3. a + 3

   ans =

   5.3000 8.8000 12.0000
4. b = [5.2 3.14 2]
5. a + b

```
    ans =
        7.5000 8.9400 11.0000
6. a .* b
    ans =
        11.9600 18.2120 18.0000
7. a.^2
    ans =
        5.2900 33.6400 81.0000
8. c = 0:10 or
    c = [0:10]
9. d = 0:2:10 or
    d = [0:2:10]
10. linspace(10,20, 6)
    ans =
10 12 14 16 18 20
11. logspace(1, 2, 5)
    ans =
        10.0000 17.7828 31.6228 56.2341 100.0000
```

실습문제 해답 3.1

1. In the command window, type
   help cos
   help sqrt
   help exp
2. Select Help MATLAB Help from the menu bar.
   Use the left−hand pane to navigate to either Functions − Categorical List or Functions −Alphabetical List
3. Select Help Web Resources The Mathworks Web Site

실습문제 해답 3.2

```
1. x = −2:1:2
    x =
    −2 −1 0 1 2
        abs(x)
    ans =
```

```
        2 1 0 1 2
    sqrt(x)
    ans =
        0 + 1.4142i 0 + 1.0000i 0 1.0000 1.4142
2. a. sqrt(-3)
    ans =
        0 + 1.7321i
    sqrt(3)
    ans =
        1.7321
    b. nthroot(-3,2)
        ??? Error using ==> nthroot at 33
        If X is negative, N must be an odd integer.
        nthroot(3,2)
        ans =
          1.7321
    c. -3^(1/2)
        ans =
          -1.7321
        3^(1/2)
        ans =
          1.7321
3. x = -9:3:12
    x =
        -9 -6 -3 0 3 6 9 12
    rem(x,2)
    ans =
        -1 0 -1 0 1 0 1 0
4. exp(x)
    ans =
        1.0e+005 *
    0.0000 0.0000 0.0000 0.0000 0.0002 0.0040 0.0810 1.6275
5. log(x)
    ans =
        Columns 1 through 4
        2.1972 + 3.1416i 1.7918 + 3.1416i 1.0986 + 3.1416i -Inf Columns 5
        through 8
        1.0986 1.7918 2.1972 2.4849
```

```
log10(x)
ans =
    Columns 1 through 4
    0.9542 + 1.3644i 0.7782 + 1.3644i 0.4771 + 1.3644i -Inf
    Columns 5 through 8
    0.4771 0.7782 0.9542 1.0792
6. sign(x)
ans =
    -1 -1 -1 0 1 1 1 1
7. format rat
x/2
ans =
    -9/2 -3 -3/2 0 3/2 3 9/2 6
```

실습문제 해답 3.3

```
1. factor(322)
ans =
    2 7 23
2. gcd(322,6)
ans =
    2
3. isprime(322)
ans =
    0 Because the result of isprime is the number 0, 322 is not a prime
    number.
4. length(primes(322))
ans =
    66
5. rats(pi)
ans =
    355/113
6. factorial(10)
ans =
    3628800
7. nchoosek(20,3)
ans =
    1140
```

실습문제 해답 3.4

1. theta = 3*pi;
   sin(2*theta)
   ans =
   −7.3479e−016
2. theta = 0:0.2*pi:2*pi;
   cos(theta)
   ans =
   Columns 1 through 7
   1.0000 0.8090 0.3090 −0.3090 −0.8090 −1.0000 −0.8090
   Columns 8 through 11
   −0.3090 0.3090 0.8090 1.0000
3. asin(1)
   ans =
   1.5708 This answer is in radians.
4. x = −1:0.2:1;
   acos(x)
   ans =
   Columns 1 through 7
   3.1416 2.4981 2.2143 1.9823 1.7722 1.5708 1.3694
   Columns 8 through 11
   1.1593 0.9273 0.6435 0
5. cos(45*pi/180)
   ans =
   0.7071
   cosd(45)
   ans =
   0.7071
6. asin(0.5)
   ans =
   0.5236 This answer is in radians. You could also find the result in degrees.
   asind(0.5)
   ans =
   30.0000
7. csc(60*pi/180)
   ans =
   1.1547

```
or
cscd(60)
ans =
    1.1547
```

실습문제 해답 3.5

```
x = [4 90 85 75; 2 55 65 75; 3 78 82 79;1 84 92 93];
1. max(x)
   ans =
       4 90 92 93
2. [maximum, row]=max(x)
   maximum =
       4 90 92 93
   row =
       1 1 4 4
3. max(x')
   ans =
       90 75 82 93
4. [maximum, column]=max(x')
   maximum =
       90 75 82 93
   column =
       2 4 3 4
5. max(max(x))
   ans =
       10
       93
```

실습문제 해답 3.6

```
x = [4 90 85 75; 2 55 65 75; 3 78 82 79;1 84 92 93];
1. mean(x)
   ans =
       2.5000 76.7500 81.0000 80.5000
2. median(x)
   ans =
```

```
        2.5000 81.0000 83.5000 77.0000
3. mean(x')
   ans =
        63.5000 49.2500 60.5000 67.5000
4. median(x')
   ans =
        80.0000 60.0000 78.5000 88.0000
5. mode(x)
   ans =
        1 55 65 75
6. mean(mean(x))
   ans =
        60.1875
   or
   mean(x(:))
   ans =
        60.1875
```

실습문제 해답 3.7

```
x = [4 90 85 75; 2 55 65 75; 3 78 82 79;1 84 92 93];
1. size(x)
   ans =
        4 4
2. sort(x)
   ans =
        1 55 65 75
        2 78 82 75
        3 84 85 79
        4 90 92 93
3. sort(x,'descend')
   ans =
        4 90 92 93
        3 84 85 79
        2 78 82 75
        1 55 65 75
4. sortrows(x)
   ans =
```

```
        1 84 92 93
        2 55 65 75
        3 78 82 79
        4 90 85 75
5. sortrows(x,-3)
   ans =
        12
        1 84 92 93
        4 90 85 75
        3 78 82 79
        2 55 65 75
```

실습문제 해답 3.8

```
x = [4 90 85 75; 2 55 65 75; 3 78 82 79;1 84 92 93];
1. std(x)
   ans =
        1.2910 15.3052 11.4601 8.5440
2. var(x)
   ans =
        1.6667 234.2500 131.3333 73.0000
3. sqrt(var(x))
   ans =
        1.2910 15.3052 11.4601 8.5440
4. The square root of the variance is equal to the standard deviation.
```

실습문제 해답 3.9

```
1. rand(3)
   ans =
        0.9501 0.4860 0.4565
        0.2311 0.8913 0.0185
        0.6068 0.7621 0.8214
2. randn(3)
   ans =
        -0.4326 0.2877 1.1892
        -1.6656 -1.1465 -0.0376
```

```
        0.1253 1.1909 0.3273
3. x = rand(100,5);
4. max(x)
   ans =
        0.9811 0.9785 0.9981 0.9948 0.9962
   std(x)
   ans =
        0.2821 0.2796 0.3018 0.2997 0.2942
   var(x)
   ans =
        0.0796 0.0782 0.0911 0.0898 0.0865
   mean(x)
   ans =
        0.4823 0.5026 0.5401 0.4948 0.5111
5. x = randn(100,5);
6. max(x)
   ans =
        2.6903 2.6289 2.7316 2.4953 1.7621
   std(x)
   ans =
        0.9725 0.9201 0.9603 0.9367 0.9130
   var(x)
   ans =
        0.9458 0.8465 0.9221 0.8774 0.8335
   mean(x)
   ans =
       -0.0277 0.0117 -0.0822 0.0974 -0.1337
```

실습문제 해답 3.10

```
1. A = 1+i
   A =
        1.0000 + 1.0000i
   B = 2-3i
   B =
        2.0000 - 3.0000i
   C = 8+2i
   C =
```

```
        8.0000 + 2.0000i
2. imagD = [-3,8,-16];
   realD = [2,4,6];
   D = complex(realD,imagD)
   ans =
        2.0000 - 3.0000i 4.0000 + 8.0000i 6.0000 -16.0000i
3. abs(A)
   ans =
        1.4142
   abs(B)
   ans =
        3.6056
   abs(C)
   ans =
        8.2462
   abs(D)
   ans =
        3.6056 8.9443 17.0880
4. angle(A)
   ans =
        0.7854
   angle(B)
   ans =
        -0.9828
   angle(C)
   ans =
        0.2450
   angle(D)
   ans =
        -0.9828 1.1071 -1.2120
5. conj(D)
   ans =
        2.0000 + 3.0000i 4.0000 - 8.0000i 6.0000 +16.0000i
6. D'
   ans =
        2.0000 + 3.0000i
        4.0000 - 8.0000i
        6.0000 +16.0000i
```

```
7. sqrt(A.*A')
   ans =
        1.4142
```

실습문제 해답 3.11

```
1. clock
   ans =
        1.0e+003 *
        2.0080 0.0050 0.0270 0.0160 0.0010 0.0220
2. date
   ans =
        27-May-2008
3. a. factorial(322)
        ans =
        Inf
   b. 5*10^500
        ans =
        Inf
   c. 1/5*10^500
        ans =
        Inf
   d. 0/0
        Warning: Divide by zero.
        ans =
        NaN
```

실습문제 해답 4.1

```
a = [12 17 3 6]
a =
   12 17 3 6
b = [5 8 3; 1 2 3; 2 4 6]
b =
   5 8 3
   1 2 3
   2 4 6
```

```
c = [22;17;4]
c =
   22
   17
   4
1. x1 = a(1,2)
   x1 =
        17
2. x2 = b(:,3)
   x2 =
        3
        3
        6
3. x3 = b(3,:)
   x3 =
        2 4 6
4. x4 = [b(1,1), b(2,2), b(3,3)]
   x4 =
        5 2 6
5. x5 = [a(1:3);b]
   x5 =
        12 17 3
        5 8 3
        1 2 3
        2 4 6
6. x6 = [c,b;a]
   x6 =
        22 5 8 3
        17 1 2 3
        4 2 4 6
        12 17 3 6
7. x7 = b(8)
   x7 =
        3
8. x8 = b(:)
   x8 =
        5
        1
```

```
2
8
2
4
19
3
3
6
```

실습문제 해답 4.2

```
1. length = [1, 3, 5];
   width = [2,4,6,8];
   [L,W] = meshgrid(length,width);
   area = L.*W
   area =
       2 6 10
       4 12 20
       6 18 30
       8 24 40
2. radius = 0:3:12;
   height = 10:2:20;
   [R,H] = meshgrid(radius,height);
   volume = pi*R.^2.*H
   volume =
   1.0e+003 *
       0 0.2827 1.1310 2.5447 4.5239
       0 0.3393 1.3572 3.0536 5.4287
       0 0.3958 1.5834 3.5626 6.3335
       0 0.4524 1.8096 4.0715 7.2382
       0 0.5089 2.0358 4.5804 8.1430
       0 0.5655 2.2619 5.0894 9.0478
```

실습문제 해답 4.3

1. zeros(3)

```
ans =
     0 0 0
     0 0 0
     0 0 0
```

2. zeros(3,4)

```
ans =
     0 0 0 0
     0 0 0 0
     0 0 0 0
```

3. ones(3)

```
ans =
     1 1 1
     1 1 1
     1 1 1
```

4. ones(5,3)

```
ans =
     1 1 1
     1 1 1
     1 1 1
     1 1 1
     1 1 1
```

5. ones(4,6)*pi

```
ans =
     3.1416 3.1416 3.1416 3.1416 3.1416 3.1416
     3.1416 3.1416 3.1416 3.1416 3.1416 3.1416
     3.1416 3.1416 3.1416 3.1416 3.1416 3.1416
     3.1416 3.1416 3.1416 3.1416 3.1416 3.1416
```

6. x = [1,2,3];
   diag(x)

```
ans =
     1 0 0
     0 2 0
     0 0 3
```

7. x = magic(10)

```
x =
     92 99 1 8 15 67 74 51 58 40
```

```
        98 80 7 14 16 73 55 57 64 41
        4 81 88 20 22 54 56 63 70 47
        85 87 19 21 3 60 62 69 71 28
        86 93 25 29 61 68 75 52 34
        17 24 76 83 90 42 49 26 33 65
        23 5 82 89 91 48 30 32 39 66
        79 6 13 95 97 29 31 38 45 72
        10 12 94 96 78 35 37 44 46 53
        11 18 100 77 84 36 43 50 27 59
    a. diag(x)
        ans =
          92 80 88 21 9 42 30 38 46 59
    b. diag(fliplr(x))
        ans =
          40 64 63 62 61 90 89 13 12 11
    c. sum(x)
        ans =
          505 505 505 505 505 505 505 505 505 505
        sum(x')
        ans =
          505 505 505 505 505 505 505 505 505 505
        sum(diag(x))
        ans =
          505
        sum(diag(fliplr(x)))
        ans =
```

실습문제 해답 5.1

```
1. clear,clc
   x = 0:0.1*pi:2*pi;
   y = sin(x);
   plot(x,y)
2. title('Sinusoidal Curve')
   xlabel('x values')
   ylabel('sin(x)')
3. figure(2)
```

```
3. figure(2)
   y1 = sin(x);
   y2 = cos(x);
   plot(x,y1,x,y2)
   title('Sine and
   Cosine Plots')
   xlabel('x values')
   ylabel('y values')
4. figure(3)
   plot(x,y1,'-- r',
   x,y2,': g')
   title('Sine and Cosine
   Plots')
   xlabel('x values')
   ylabel('y values')
5. legend('sin(x)','cos(x)')
6. axis([-1,2*pi+1,
   -1.5,1.5])
7. figure(4)
   a = cos(x);
   plot(a)
   A line graph is created, with a plotted against the vector index number.
```

실습문제 해답 5.2

```
1. subplot(2,1,1)
2. x = -1.5:0.1:1.5;
   y = tan(x);
   plot(x,y)
3. title('Tangent(x)')
   xlabel('x value')
   ylabel('y value')
4. subplot(2,1,2)
   y = sinh(x);
   plot(x,y)
5. title('Hyperbolic
   sine of x')
   xlabel('x value')
```

```
    ylabel('y value')
6. figure(2)
    subplot(1,2,1)
    plot(x,y)
    title('Tangent(x)')
    xlabel('x value')
    ylabel('y value')
    subplot(1,2,2)
    y = sinh(x);
    plot(x,y)
    title('Hyperbolic
    sine of x')
    xlabel('x value')
    ylabel('y value')
```

실습문제 해답 5.3

```
1. theta = 0:0.01*pi:2*pi;
    r = 5*cos(4*theta);
    polar(theta,r)
2. hold on
    r = 4*cos(6*theta);
    polar(theta,r)
    title('Flower Power')
3. figure(2)
    r = 5-5*sin(theta);
    polar(theta,r)
4. figure(3)
    r = sqrt(5^2*cos(2*theta));
    polar(theta3,r)
5. figure(4)
    theta = pi/2:4/5*pi:4.8*pi;
    r = ones(1,6);
    polar(theta,r)
```

실습문제 해답 5.4

1. figure(1)

```
x = −1:0.1:1;
y = 5*x+3;
subplot(2,2,1)
plot(x,y)
title('Rectangular Coordinates')
ylabel('y−axis')
grid on
subplot(2,2,2)
semilogx(x,y)
title('Semilog x Coordinate System')
grid on
subplot(2,2,3)
semilogy(x,y)
title('Semilog y Coordinate System')
ylabel('y−axis')
xlabel('x−axis')
grid on
subplot(2,2,4)
loglog(x,y)
title('Log Plot')
xlabel('x−axis')
grid on
```

2. figure(2)

```
x = −1:0.1:1;
y = 3*x.^2;
subplot(2,2,1)
plot(x,y)
title('Rectangular Coordinates')
ylabel('y−axis')
grid on
subplot(2,2,2)
semilogx(x,y)
title('Semilog x Coordinate System')
grid on
subplot(2,2,3)
semilogy(x,y)
```

```
    title('Semilog y Coordinate System')
    ylabel('y−axis')
    xlabel('x−axis')
    grid on
    subplot(2,2,4)
    loglog(x,y)
    title('Log Plot')
    xlabel('x−axis')
    grid on
3. figure(3)
    x = −1:0.1:1;
    y = 12*exp(x+2);
    subplot(2,2,1)
    plot(x,y)
    title('Rectangular Coordinates')
    ylabel('y−axis')
    grid on
    subplot(2,2,2)
    semilogx(x,y)
    title('Semilog x Coordinate System')
    grid on
    subplot(2,2,3)
    semilogy(x,y)
    title('Semilog y Coordinate System')
    ylabel('y−axis')
    xlabel('x−axis')
    grid on
    subplot(2,2,4)
    loglog(x,y)
    title('Log Plot')
    xlabel('x−axis')
    grid on
4. figure(4)
    x = −1:0.01:1;
    y = 1./x;
    subplot(2,2,1)
    plot(x,y)
    title('Rectangular Coordinates')
```

```
ylabel('y−axis')
grid on
subplot(2,2,2)
semilogx(x,y)
title('Semilog x Coordinate System')
grid on
subplot(2,2,3)
semilogy(x,y)
title('Semilog y Coordinate System')
ylabel('y−axis')
xlabel('x−axis')
grid on
subplot(2,2,4)
loglog(x,y)
title('Log Plot')
xlabel('x−axis')
grid on
```

실습문제 해답 5.5

1.
```
fplot('5*t^2',[−3,+3])
title('5*t^2')
xlabel('x−axis')
ylabel('y−axis')
```
2.
```
fplot('5*sin(t)^2 + t*cos(t)^2',[−2*pi,2*pi])
title('5*sin(t)^2 +
t*cos(t)^2')
xlabel('x−axis')
ylabel('y−axis')
```
3.
```
fplot('t*exp(t)',[0,10])
title('t*exp(t)')
xlabel('x−axis')
ylabel('y−axis')
```
4.
```
fplot('log(t)+ sin(t)',[0,pi])
title('log(t)+sin(t)')
xlabel('x−axis')
ylabel('y−axis')
```

실습문제 해답 6.1

Store these functions as separate M-files. The name of the function must be the same as the name of the M-file. You'll need to call these functions either from the command window or from a script M-file. You can't run a function M-file by itself.

1. function output = quadratic(x)
   output = x.^2;
2. function output = one_over(x)
   output = exp(1./x);
3. function output = sin_x_squared(x)
   output = sin(x.^2);
4. function result = in_to_ft(x)
   result = x./12;
5. function result = cal_to_joules(x)
   result = 4.2.*x;
6. function output = Watts_to_Btu_per_hour(x)
   output = x.*3.412;
7. function output = meters_to_miles(x)
   output = x./1000.*.6214;
8. function output = mph_to_fps(x)
   output = x.*5280/3600;

실습문제 해답 6.2

Store these functions as separate M-files. The name of the function must be the same as the name of the M-file.

1. function output = z1(x,y)
   % summation of x and y
   % the matrix dimensions must agree
   output = x+y;
2. function output = z2(a,b,c)
   % finds a.*b.^c
   % the matrix dimensions must agree
   output = a.*b.^c;
3. function output = z3(w,x,y)
   % finds w.*exp(x./y)
   % the matrix dimensions must agree

```
    output = w.*exp(x./y);
4. function output = z4(p,t)
    % finds p./sin(t)
    % the matrix dimensions must agree
    output = p./sin(t);
5. function [a,b]=f5(x)
    a = cos(x);
    b = sin(x);
6. function [a,b] = f6(x)
    a = 5.*x.^2 + 2;
    b = sqrt(5.*x.^2 + 2);
7. function [a,b] = f7(x)
    a = exp(x);
    b = log(x);
8. function [a,b] = f8(x,y)
    a = x+y;
    b = x-y;
9. function [a,b] = f9(x,y)
    a = y.*exp(x);
    b = x.*exp(y);
```

실습문제 해답 7.1

```
1. b = input('Enter the length of the base of the triangle: ');
    h = input('Enter the height of the triangle: ');
    Area = 1/2*b*h
    When this file runs, it generates the following interaction in the command
    window:
    Enter the length of the base of the triangle: 5
    Enter the height of the triangle: 4
    Area =
        10
2. r = input('Enter the radius of the cylinder: ');
    h = input('Enter the height of the cylinder: ');
    Volume = pi*r.^2*h
    When this file runs, it generates the following interaction in the command
    window:
    Enter the radius of the cylinder: 2
```

Enter the height of the cylinder: 3
Volume =
37.6991

3. n = input('Enter a value of n: ')
vector = 0:n
When this file runs, it generates the following interaction in the command window:
Enter a value of n: 3
n =
3
vector =
0 1 2 3

4. a = input('Enter the starting value: ');
b = input('Enter the ending value: ');
c = input('Enter the vector spacing: ');
vector = a:c:b
When this file runs, it generates the following interaction in the command window:
Enter the starting value: 0
Enter the ending value: 6
Enter the vector spacing: 2
vector =
0 2 4 6

실습문제 해답 7.2

1. disp('Inches to Feet Conversion Table')
2. disp(' Inches Feet')
3. inches = 0:10:120;
feet = inches./12;
table = [inches; feet];
fprintf(' %8.0f %8.2f ₩n',table)
The resulting display in the command window is
Inches to Feet Conversion Table

Inches	Feet
0	0.00
10	0.83
20	1.67

```
...        ...
...        ...
...        ...
100        8.33
110        9.17
120        10.00
```

실습문제 해답 8.1

Use these arrays in the exercises.

```
x = [1 10 42 6
     5 8 78 23
     56 45 9 13
     23 22 8 9];
y = [1 2 3; 4 10 12; 7 21 27];
z = [10 22 5 13];
```

1. elements_x = find(x>10)
   elements_y = find(y>10)
   elements_z = find(z>10)
2. [rows_x, cols_x] = find(x>10)
   [rows_y, cols_y] = find(y>10)
   [rows_z, cols_z] = find(z>10)
3. x(elements_x)
   y(elements_y)
   z(elements_z)
4. elements_x = find(x>10 & x< 40)
   elements_y = find(y>10 & y< 40)
   elements_z = find(z>10 & z< 40)
5. [rows_x, cols_x] = find(x>10 & x<40)
   [rows_y, cols_y] = find(y>10 & y<40)
   [rows_z, cols_z] = find(z>10 & z<40)
6. x(elements_x)
   y(elements_y)
   z(elements_z)
7. elements_x = find((x>0 & x<10) | (x>70 & x<80))
   elements_y = find((y>0 & y<10) | (y>70 & y<80))
   elements_z = find((z>0 & z<10) | (z>70 & z<80))
8. length_x = length(find((x>0 & x<10) | (x>70 & x<80)))

8. length_x = length(find((x>0 & x<10) | (x>70 & x<80)))
   length_y = length(find((y>0 & y<10) | (y>70 & y<80)))
   length_z = length(find((z>0 & z<10) | (z>70 & z<80)))

실습문제 해답 8.2

1. function output = drink(x)
   if x> = 21
   output = 'You can drink';
   else
   output = 'Wait "till you"re older';
   end
   Test your function with the following from the command window or a script M-file:
   drink(22)
   drink(18)
2. function output = tall(x)
   if x> = 48
   output = 'You may ride';
   else
   output = 'You"re too short';
   end
   Test your function with the following:
   tall(50)
   tall(46)
3. function output = spec(x)
   if x> = 5.3 & x< = 5.5
   output = ' in spec';
   else
   output = ' out of spec';
   end
   Test your function with the following
   spec(5.6)
   spec(5.45)
   spec(5.2)
4. function output = metric_spec(x)
   if x> = 5.3/2.54 & x< = 5.5/2.54
   output = ' in spec';

```
else
    output = ' out of spec';
end
Test your function with the following:
metric_spec(2)
metric_spec(2.2)
metric_spec(2.4)
```

5.
```
function output = flight(x)
if x> = 0 & x< = 100
    output = 'first stage';
elseif x< = 170
    output = 'second stage';
elseif x<260
    output = 'third stage';
else
    output = 'free flight';
end
Test your function with the following:
flight(50)
flight(110)
flight(200)
flight(300)
```

실습문제 해답 8.3

1.
```
year = input('Enter the name of your year in school: ','s');
switch year
    case 'freshman'
      day = 'Monday';
    case 'sophomore'
      day = 'Tuesday';
    case 'junior'
      day = 'Wednesday';
    case 'senior'
      day = 'Thursday';
    otherwise
      day = 'I don''t know that year';
end
```

```
    disp(['Your finals are on ',day])
2. disp('What year are you in school?')
    disp('Use the menu box to make your selection ')
        choice = menu('Year in School', 'freshman', 'sophomore', 'junior',
        'senior');
        switch choice
          case 1
                day = 'Monday';
          case 2
                day = 'Tuesday';
          case 3
                day = 'Wednesday';
          case 4
                day = 'Thursday';
    end
    disp(['Your finals are on ',day])
3. num = input('How many candy bars would you like? ');
    switch num
        case 1
          bill = 0.75;
        case 2
          bill = 1.25;
        case 3
          bill = 1.65;
        otherwise
          bill = 1.65 + (num-3)*0.30;
    end
    fprintf('Your bill is %5.2f ₩n',bill)
```

실습문제 해답 9.1

```
1. inches = 0:3:24;
    for k = 1:length(inches)
        feet(k) = inches(k)/12;
    end
    table = [inches',feet']
2. x = [ 45,23,17,34,85,33];
    count = 0;
```

```
    for k = 1:length(x)
        if x(k)>30
          count = count+1;
        end
    end
    fprintf('There are %4.0f values greater than 30 ₩n',count)
3. num = length(find(x>30));
    fprintf('There are %4.0f values greater than 30 ₩n',num)
4. total = 0;
    for k = 1:length(x)
        total = total + x(k);
    end
    disp('The total is: ')
    disp(total)
    sum(x)
5. for k = 1:10
    x(k) = 1/k
    end
6. for k = 1:10
    x(k)=(-1)^(k+1)/k
    end
```

실습문제 해답 9.2

```
1. inches = 0:3:24;
    k = 1;
    while k<=length(inches)
        feet(k) = inches(k)/12;
        k = k+1;
    end
    disp(' Inches Feet');
    fprintf(' %8.0f %8.2f ₩n',[inches;feet])
2. x = [ 45,23,17,34,85,33];
    k = 1;
    count = 0;
    while k< = length(x)
    if x(k)> = 30;
        count = count +1;
```

```
    end
        k=k+1;
    end
    fprintf('There are %4.0f values greater than 30 ₩n',count)
3. count = length(find(x>30))
4. k = 1;
   total = 0;
   while k< = length(x)
        total = total + x(k);
        k = k+1;
   end
   disp(total)
   sum(x)
5. k = 1;
   while(k< = 10)
        x(k) = 1/k;
        k = k+1;
   end
   x
6. k = 1;
   while(k< = 10)
        x(k)=(-1)^(k+1)/k
        k = k+1;
   end
   x
```

실습문제 해답 10.1

```
1. A = [ 1 2 3 4]
   B = [ 12 20 15 7]
   dot(A,B)
2. sum(A.*B)
3. price = [0.99, 1.49, 2.50, 0.99, 1.29];
   num = [4, 3, 1, 2, 2];
   total = dot(price,num)
```

실습문제 해답 10.2

1. A = [2 5; 2 9; 6 5];
   B = [2 5; 2 9; 6 5];
   % These cannot be multiplied because the number of
   % columns in A does not equal
   % the number of rows in B
2. A = [2 5; 2 9; 6 5];
   B = [1 3 12; 5 2 9];
   % Since A is a 3 × 2 matrix and B is a 2 × 3 matrix,
   % they can be multiplied
   A*B
   %However, A*B does not equal B*A
   B*A
3. A = [5 1 9; 7 2 2];
   B = [8 5; 4 2; 8 9];
   % Since A is a 2 × 3 matrix and B is a 3 × 2 matrix,
   % they can be multiplied
   A*B
   %However, A*B does not equal B*A
   B*A
4. A = [1 9 8; 8 4 7; 2 5 3];
   B = [7;1;5]
   % Since A is a 3 × 3 matrix and B is a 3 × 1 matrix,
   % they can be multiplied
   A*B
   % However, B*A won't work

실습문제 해답 10.3

1. a. a = magic(3)
      inv(magic(3))
      magic(3)^−1
   b. b = magic(4)
      inv(b)
      b^−1
   c. c = magic(5)
      inv(magic(5))

```
    magic(5)^−1
2. det(a)
   det(b)
   det(c)
3. A = [1 2 3;2 4 6;3 6 9]
   det(A)
   inv(A)
   %Notice that the three lines are just multiples of
   %each other and therefore do not represent %independent equations
```

실습문제 해답 11.1

```
1. A = [1,4,6; 3, 15, 24; 2, 3,4];
   B = single(A)
   C = int8(A)
   D = uint8(A)
2. E = A+B
   % The result is a single−precision array
3. x = int8(1)
   y = int8(3)
   result1 = x./y
   % This calculation returns the integer 0
   x = int8(2)
   result2 = x./y
   % This calculation returns the integer 1; it appears
   % that MATLAB rounds the answer
4. intmax('int8')
   intmax('int16')
   intmax('int32')
   intmax('int64')
   intmax('uint8')
   intmax('uint16')
   intmax('uint32')
   intmax('uint64')
5. intmin('int8')
   intmin('int16')
   intmin('int32')
   intmin('int64')
```

```
intmin('uint8')
intmin('uint16')
intmin('uint32')
intmin('uint64')
```

실습문제 해답 11.2

1. name ='Holly'
2. G = double('g')
   fprintf('The decimal equivalent of the letter g is %5.0f ₩n',G)
3. m = 'MATLAB'
   M = char(double(m)−32)

실습문제 해답 11.3

1. a = magic(3)
   b = zeros(3)
   c = ones(3)
   x(:,:,1) = a
   x(:,:,2) = b
   x(:,:,3) = c
2. x(3,2,1)
3. x(2,3,:)
4. x(:,3,:)

실습문제 해답 11.4

1. names = char('Mercury','Venus','Earth','Mars','Jupiter',
   'Saturn','Uranus','Neptune','Pluto')
2. R = 'rocky';
   G = 'gas giants';
   type = char(R,R,R,R,G,G,G,G,R)
3. space =[' ';' ';' ';' ';' ';' ';' ';' ';' '];
4. table =[names,space,type]
5. %These data were found at
   %http://sciencepark.etacude.com/astronomy/pluto.php
   %Similar data are found at many websites

```
mercury = 3.303e23; % kg
venus = 4.869e24; % kg
earth = 5.976e24; % kg
mars = 6.421e23; % kg
jupiter = 1.9e27; % kg
saturn = 5.69e26; % kg
uranus = 8.686e25; % kg
neptune = 1.024e26; % kg
pluto = 1.27e22 % kg
mass = [mercury,venus,earth,mars,jupiter, saturn,uranus,neptune,pluto]';
newtable = [table,space,num2str(mass)]
```

실습문제 해답 12.1

```
1. syms x a b c d
   %or
   d = sym('d') %etc
   d =
   d
2. ex1 = x^2-1
   ex1 =
   x^2-1
   ex2 = (x+1)^2
   ex2 =
   (x+1)^2
   ex3 = a*x^2-1
   ex3 =
   a*x^2-1
   ex4 = a*x^2 + b*x + c
   ex4 =
   a*x^2+b*x+c
   ex5 = a*x^3 + b*x^2 + c*x + d
   ex5 =
   a*x^3+b*x^2+c*x+d
   ex6 = sin(x)
   ex6 =
   sin(x)
3. EX1 = sym('X^2 - 1 ')
```

```
EX1 =
X^2 - 1
EX2 = sym(' (X +1)^2 ')
EX2 =
(X +1)^2
EX3 = sym('A*X ^2 - 1 ')
EX3 =
A*X ^2 - 1
EX4 = sym('A*X ^2 + B*X + C ')
EX4 =
A*X ^2 + B*X + C
EX5 = sym('A*X ^3 + B*X ^2 + C*X + F ')
EX5 =
A*X ^3 + B*X ^2 + C*X + F
EX6 = sym(' sin(X) ')
EX6 =
sin(X)
```

4.
```
eq1 = sym(' x^2=1 ')
eq1 =
x^2 = 1
eq2 = sym(' (x+1)^2=0 ')
eq2 =
(x+1)^2=0
eq3 = sym(' a*x^2=1 ')
eq3 =
a*x^2=1
eq4 = sym('a*x^2 + b*x + c = 0 ')
eq4 =
a*x^2 + b*x + c = 0
eq5 = sym('a*x^3 + b*x^2 + c*x + d = 0 ')
eq5 =
a*x^3 + b*x^2 + c*x + d = 0
eq6 = sym('sin(x) = 0 ')
eq6 =
sin(x) = 0
```

5.
```
EQ1 = sym('X^2 = 1 ')
EQ1 =
X^2 = 1
```

```
EQ2 = sym(' (X +1)^2 = 0 ')
EQ2 =
(X +1)^2 = 0
EQ3 = sym('A*X ^2 = 1 ')
EQ3 =
A*X ^2 = 1
EQ4 = sym('A*X ^2 + B*X + C = 0 ')
EQ4 =
A*X ^2 + B*X + C = 0
EQ5 = sym('A*X ^3 + B*X ^2 + C*X + F = 0 ')
EQ5 =
A*X ^3 + B*X ^2 + C*X + F = 0
EQ6 = sym(' sin(X) = 0 ')
EQ6 =
sin(X) = 0
```

실습문제 해답 12.2

1.
```
y1 = ex1*ex2
y1 =
(x^2−1)*(x+1)^2
```
2.
```
y2 = ex1/ex2
y2 =
(x^2−1)/(x+1)^2
```
3.
```
[num1,den1] = numden(y1)
num1 =
(x^2−1)*(x+1)^2
den1 =
1
[num2,den2] = numden(y2)
num2 =
x−1
den2 =
(x+1)
```
4.
```
Y1 = EX1*EX2
Y1 =
(X^2−1)*(X+1)^2
```
5.
```
Y2=EX1/EX2
```

```
Y2 =
(X^2-1)/(X+1)^2
6. [NUM1,DEN1] = numden(Y1)
NUM1 =
(X^2-1)*(X+1)^2
DEN1 =
1
[NUM2,DEN2] = numden(Y2)
NUM2 =
X-1
DEN2 =
(X+1)
7. %numden(EQ4)
%The numden function does not apply to equations,
%only to expressions
8. a. factor(y1)
   ans =
   (x-1)*(x+1)^3
   expand(y1)
   ans =
   x^4+2*x^3-2*x-1
   collect(y1)
   ans =
   x^4+2*x^3-2*x-1
   simplify(y1)
   ans =
   (x^2 - 1)*(x + 1)^2
  b. factor(y2)
   ans =
   (x-1)/(x+1)
   expand(y2)
   ans =
   x^2/(x^2 + 2*x + 1) - 1/(x^2 + 2*x + 1)
   collect(y2)
   ans =
   (x - 1)/(x + 1)
   simplify(y2)
   ans =
```

```
    (x - 1)/(x + 1)
  c. factor(Y1)
    ans =
    (X-1)*(X+1)^3
    expand(Y1)
    ans =
    X^4+2*X^3-2*X-1
    collect(Y1)
    ans =
    X^4+2*X^3-2*X-1
    simplify(Y1)
    ans =
    (X^2 - 1)*(X + 1)^2
  d. factor(Y2)
    ans =
    (X-1)/(X+1)
    expand(Y2)
    ans =
    X^2/(X^2 + 2*X + 1) - 1/(X^2 + 2*X + 1)
    collect(Y2)
    ans =
    (X - 1)/(X + 1)
    simplify(Y2)
    ans =
    (X - 1)/(X + 1)
9. factor(EX1)
  ans =
  (X-1)*(X+1)
  expand(EX1)
  ans =
  X^2-1
  collect(EX1)
  ans =
  X^2-1
  simplify(EX1)
  ans =
  X^2 - 1
  factor(EQ1)
```

```
ans =
X^2 == 1
expand(EQ1)
ans =
X^2 == 1
collect(EQ1)
ans =
X^2 == 1
simplify(EQ1)
ans =
X^2 == 1
%
factor(EX2)
ans =
(X+1)^2
expand(EX2)
ans =
X^2+2*X+1
collect(EX2)
ans =
X^2+2*X+1
simplify(EX2)
ans =
(X + 1)^2
factor(EQ2)
ans =
(X+1)^2 == 0
expand(EQ2)
ans =
X^2+2*X+1 == 0
collect(EQ2)
ans =
X^2+2*X+1 = 0
simplify(EQ2)
ans =
X == -1
```

실습문제 해답 12.3

1. solve(ex1)

```
ans =
1
-1
solve(EX1)
ans =
1
-1
solve(eq1)
ans =
1
-1
solve(EQ1)
ans =
1
-1
```

2. solve(ex2)

```
ans =
-1
-1
solve(EX2)
ans =
-1
-1
solve(eq2)
ans =
-1
-1
solve(EQ2)
ans =
-1
-1
```

3. a. solve(ex3,x)

```
ans =
1/a^(1/2)
-1/a^(1/2)
solve(eq3,a)
```

```
    ans =
    1/x^2
  b. solve(eq3,x)
    ans =
    1/a^(1/2)
    -1/a^(1/2)
    solve(ex3,a)
    ans =
    1/x^2
4. a. solve(EX3,'X')
    ans =
    1/A^(1/2)
    -1/A^(1/2)
    solve(EX3,'A')
    ans =
    1/X^2
  b. solve(EQ3,'X')
    ans =
    1/A^(1/2)
    -1/A^(1/2)
    solve(EQ3,'A')
    ans =
    1/X^2
5. a. solve(ex4,x)
    ans =
    -(b + (b^2 - 4*a*c)^(1/2))/(2*a)
    -(b - (b^2 - 4*a*c)^(1/2))/(2*a)
    solve(ex4,a)
    ans =
    -(c + b*x)/x^2
      a. solve(eq4,x)
    ans =
    -(b + (b^2 - 4*a*c)^(1/2))/(2*a)
    -(b - (b^2 - 4*a*c)^(1/2))/(2*a)
    solve(eq4,a)
    ans =
    -(c + b*x)/x^2
6. a. solve(EX4,'X')
```

```
    ans =
    -(B + (B^2 - 4*A*C)^(1/2))/(2*A)
    -(B - (B^2 - 4*A*C)^(1/2))/(2*A)
    solve(EX4,'A')
    ans =
    -(C + B*X)/X^2
  b. . solve(EQ4,'X')
    ans =
    -(B + (B^2 - 4*A*C)^(1/2))/(2*A)
    -(B - (B^2 - 4*A*C)^(1/2))/(2*A)
    solve(EQ4,'A')
    ans =
    -(C + B*X)/X^2
7. solve(ex5,x)
  ans =
  1/6/a*(36*c*b*a-108*d*a^2-8*b^3+12*3^(1/2)*(4*c^3*a-c^2*b^2-
  18*c*b*a*d+27*d^2*a^2+4*d*b^3)^(1/2)*a)^(1/3)-2/3*(3*c*a-b^2)/a/
  (36*c*b*a-
  108*d*a^2-8*b^3+12*3^(1/2)*(4*c^3*a-c^2*b^2-
  18*c*b*a*d+27*d^2*a^2+4*d*b^3)^(1/2)*a)^(1/3)-1/3*b/a  -1/12/
  a*(36*c*b*a-
  108*d*a^2-8*b^3+12*3^(1/2)*(4*c^3*a-c^2*b^2-
  18*c*b*a*d+27*d^2*a^2+4*d*b^3)^(1/2)*a)^(1/3)+1/3*(3*c*a-b^2)/a/
  (36*c*b*a-
  108*d*a^2-8*b^3+12*3^(1/2)*(4*c^3*a-c^2*b^2-
  18*c*b*a*d+27*d^2*a^2+4*d*b^3)^(1/2)*a)^(1/3)-
  1/3*b/a+1/2*i*3^(1/2)*(1/6/a*(36*c*b*a-108*d*a^2-
  8*b^3+12*3^(1/2)*(4*c^3*ac^
  2*b^2-18*c*b*a*d+27*d^2*a^2+4*d*b^3)^(1/2)*a)^(1/3)+2/3*(3*c*ab^
  2)/a/(36*c*b*a-108*d*a^2-8*b^3+12*3^(1/2)*(4*c^3*a-c^2*b^2-
  18*c*b*a*d+27*d^2*a^2+4*d*b^3)^(1/2)*a)^(1/3))-1/12/a*(36*c*b*a-
  108*d*a^2-
  8*b^3+12*3^(1/2)*(4*c^3*a-c^2*b^2-
  18*c*b*a*d+27*d^2*a^2+4*d*b^3)^(1/2)*a)^(1/3)+1/3*(3*c*a-b^2)/a/
  (36*c*b*a-
  108*d*a^2-8*b^3+12*3^(1/2)*(4*c^3*a-c^2*b^2-
  18*c*b*a*d+27*d^2*a^2+4*d*b^3)^(1/2)*a)^(1/3)-1/3*b/a-
  1/2*i*3^(1/2)*(1/6/a*(36*c*b*a-108*d*a^2-8*b^3+12*3^(1/2)*(4*c^3*a-
```

```
c^2*b^2-
18*c*b*a*d+27*d^2*a^2+4*d*b^3)^(1/2)*a)^(1/3)+2/3*(3*c*a-b^2)/a/
(36*c*b*a60
108*d*a^2-8*b^3+12*3^(1/2)*(4*c^3*a-c^2*b^2-
18*c*b*a*d+27*d^2*a^2+4*d*b^3)^(1/2)*a)^(1/3))
% Clearly this is too complicated to memorize
```

8. solve(ex6)

```
ans =
0
solve(EX6)
ans =
0
solve(eq6)
ans =
0
solve(EQ6)
ans =
0
```

실습문제 해답 12.4

1. coef = [5 6 −3; 3 −3 2; 2 −4 −12];

```
result =[10; 14; 24];
x = inv(coef)*result
% or
x = coef₩result
x =
    3.5314
   −1.6987
   −0.8452
```

2. A1 = sym('5*x + 6*y − 3*z = 10');

```
A2 = sym('3*x − 3*y + 2*z = 14');
A3 = sym('2*x − 4*y −12*z = 24');
A = solve(A1,A2,A3)
A =
    x: [1x1 sym]
    y: [1x1 sym]
    z: [1x1 sym]
```

```
3. A.x
   ans =
   844/239
   A.y
   ans =
   -406/239
   A.z
   ans =
   -202/239
   double(A.x)
   ans =
   3.5314
   double(A.y)
   ans =
   -1.6987
   double(A.z)
   ans =
   -0.8452
4. [x,y,z] = solve(A1,A2,A3)
   x =
        844/239
   y =
        -406/239
   z =
        -202/239
5. A1 = sym('5.0*x + 6.0*y - 3.0*z = 10.0');
   A2 = sym('3.0*x - 3.0*y + 2.0*z = 14.0');
   A3 = sym('2.0*x - 4.0*y -12.0*z = 24.0');
   A = solve(A1,A2,A3)
   A =
        x: [1x1 sym]
        y: [1x1 sym]
        z: [1x1 sym]
   A.x
   ans =
   3.531380753138075313807531380753
   A.y
   ans =
```

```
    −1.6987447698744769874476987447699
    A.z
    ans =
    −.845188284518828451882845188284528
6. A = sym('x^2 +5*y −3*z^3=15');
    B = sym('4*x + y^2 −z = 10');
    C = sym('x + y + z =15');
    [X,Y,Z]=solve(A,B,C)
    X =
    11.560291920108418818149999909102−
    11.183481663794727000635376340336*i
    … lots more numbers−
    Y =
    3.509400275238902063684557712179 8+6.973288332460366414350138972212 3*i
    … lots more numbers
    Z =
    −.696921953473208818345576212814e−
                                    1+4.210193331334360586285237368123 6
    *i
    … lots more numbers
    double(X)
    ans =
        11.5603 −11.1835i
        10.2173 − 4.7227i
        16.8891 − 4.2178i
        16.8891 + 4.2178i
        10.2173 + 4.7227i
        11.5603 +11.1835i
        double(Y)
    ans =
        3.5094 + 6.9733i
        1.6407 + 5.5153i
        0.8499 + 7.8114i
        0.8499 − 7.8114i
        1.6407 − 5.5153i
        3.5094 − 6.9733i
    double(Z)
    ans =
```

```
   -0.0697 + 4.2102i
   3.1420 - 0.7926i
   -2.7390 - 3.5936i
   -2.7390 + 3.5936i
   3.1420 + 0.7926i
   -0.0697 - 4.2102i
```

실습문제 해답 12.5

```
1. eq1
   eq1 =
   x^2 == 1
   subs(eq1,x,4)
   ans =
   16 == 1
   ex1
   ex1 =
   x^2-1
   subs(ex1,x,4)
   ans =
        15
   EQ1
   EQ1 =
   X^2 == 1
   subs(EQ1,'X',4)
   ans =
   16 == 1
   EX1
   EX1 =
   X^2 - 1
   subs(EX1,'X',4)
   ans =
        15
   % etc
2. g = symfun(sym('x^2 + sin(x)*x'),sym('x'))
   g(x) =
   x*sin(x) + x^2
   g('a')
```

```
ans =
a*sin(a) + a^2
g(3)
ans =
3*sin(3) + 9
g([1:5])
ans =
[ sin(1) + 1, 2*sin(2) + 4, 3*sin(3) + 9, 4*sin(4) + 16, 5*sin(5) + 25]
```

실습문제 해답 12.6

1. ezplot(ex1)
   title('Problem 1')
   xlabel('x')
   ylabel('y')
2. ezplot(EX1)
   title('Problem 2')
   xlabel('x')
   ylabel('y')
3. ezplot(ex2,[−10,10])
   title('Problem 3')
   xlabel('x')
   ylabel('y')
4. ezplot(EX2,[−10,10])
   title('Problem 4')
   xlabel('x')
   ylabel('y')
5. Equations with only one variable have a single valid value of x; there are no x−y pairs.
6. ezplot(ex6)
   title('Problem 6')
   xlabel('x')
   ylabel('y')
7. ezplot('cos(x)')
   title('Problem 7')
   xlabel('x')
   ylabel('y')
8. ezplot('x^2−y^4 = 5')

```
    title('Problem 8')
    xlabel('x')
    ylabel('y')
9. ezplot('sin(x)')
    hold on
    ezplot('cos(x)')
    hold off
    title('Problem 9')
    xlabel('x')
    ylabel('y')
10. ezplot('sin(t)', '3*cos(t)')
    axis equal
    title('Problem 10')
    xlabel('x')
    ylabel('y')
```

실습문제 해답 12.7

```
Z=sym('sin(sqrt(X^2+Y^2))')
Z =
sin(sqrt(X^2+Y^2))
1. ezmesh(Z)
    title('Problem 1')
    xlabel('x')
    ylabel('y')
    zlabel('z')
2. ezmeshc(Z)
    title('Problem 2')
    xlabel('x')
    ylabel('y')
    zlabel('z')
3. ezsurf(Z)
    title('Problem 3')
    xlabel('x')
    ylabel('y')
    zlabel('z')
4. ezsurfc(Z)
    title('Problem 4')
```

```
    xlabel('x')
    ylabel('y')
    zlabel('z')
5. ezcontour(Z)
    title('Problem 5')
    xlabel('x')
    ylabel('y')
    zlabel('z')
6. ezcontourf(Z)
    title('Problem 6')
    xlabel('x')
    ylabel('y')
    zlabel('z')
7. figure(7)
    ezpolar('x*sin(x)')
    title('Problem 7')
8. t = sym('t');
    x = t;
    y = sin(t);
    z = cos(t);
    ezplot3(x,y,z,[0,30])
    title('Problem 8')
    xlabel('x')
    ylabel('y')
    zlabel('z')
```

실습문제 해답 12.8

```
1. diff(sym('x^2+x+1'))
    ans =
    2*x+1
    diff(sym('sin(x)'))
    ans =
    cos(x)
    % or define x as symbolic
    x = sym('x')
    x =
    x
```

```
diff(tan(x))
ans =
1+tan(x)^2
diff(log(x))
ans =
1/x
```

2.
```
diff(sym('a*x^2 + b*x + c'))
ans =
2*a*x+b
diff(sym('x^0.5 - 3*y'))
ans =
.5/x^.5
diff(sym('tan(x+y)'))
ans =
1+tan(x+y)^2
diff(sym('3*x + 4*y - 3*x*y'))
ans =
3-3*y
```

3.
```
% There are several different approaches
diff(diff(sym('a*x^2 + b*x + c')))
ans =
2*a
diff(sym('x^0.5 - 3*y'),2)
ans =
-.25/x^1.5
diff(sym('tan(x + y)'),'x',2)
ans =
2*tan(x+y)*(1+tan(x+y)^2)
diff(diff(sym('3*x + 4*y - 3*x*y'),'x'))
ans =
-3
```

4.
```
diff(sym('y^2 - 1'),'y')
ans =
2*y
% or, since there is only one variable
diff(sym('y^2 - 1'))
ans =
2*y
```

```
%
diff(sym('2*y + 3*x^2'),'y')
ans =
2
diff(sym('a*y + b*x + c*x'),'y')
ans =
a
```

5.
```
diff(sym('y^2−1'),'y',2)
ans =
2
% or, since there is only one variable
diff(sym('y^2−1'),2)
ans =
2
%
diff(diff(sym('2*y + 3*x^2'),'y'),'y')
ans =
0
diff(sym('a*y + b*x + c*x'),'y',2)
ans =
0
```

실습문제 해답 12.9

1.
```
int(sym('x^2 + x + 1'))
ans =
(x*(2*x^2 + 3*x + 6))/6
% or define x as symbolic
x = sym('x')
x =
x
int(x^2 + x + 1)
ans =
(x*(2*x^2 + 3*x + 6))/6
int(sin(x))
ans =
−cos(x)
int(tan(x))
```

```
ans =
-log(cos(x))
int(log(x))
ans =
x*(log(x) - 1)
2. % you don't need to specify that integration is with
   % respect to x, because it is the default
   int(sym('a*x^2 + b*x + c'))
   ans =
   (a*x^3)/3 + (b*x^2)/2 + c*x
   int(sym('x^0.5 - 3*y'))
   ans =
   .66666666666666666666666666666667*x^(3/2)-3.*x*y
   int(sym('tan(x+y)'))
   ans =
   -log(cos(x + y))
   int(sym('3*x + 4*y - 3*x*y'))
   ans =
   (3/2 - (3*y)/2)*x^2 + 4*y*x
3. int(int(x^2 + x + 1))
   ans =
   (x^2*(x^2 + 2*x + 6))/12
   int(int(sin(x)))
   ans =
   -sin(x)
   int(int(tan(x)))
   ans =
   - (polylog(2, -exp(x*2*i))*i)/2 - (x*(x + log(exp(x*2*i) + 1)*2*i)*i)/2
   - x*log(cos(x))
   int(int(log(x)))
   ans =
   (x^2*(2*log(x) - 3))/4
   int(int(sym('a*x^2 + b*x + c')))
   ans =
   (x^2*(a*x^2 + 2*b*x + 6*c))/12
   int(int(sym('x^0.5 - 3*y')))
   ans =
   .26666666666666666666666666666667*x^(5/2)-
```

```
1.500000000000000000000000000000*y*x^2
int(int(sym('tan(x+y)')))
ans =
- (polylog(2, -exp(x*2*i + y*2*i))*i)/2
- ((x + y)*(x + y + log(exp(x*2*i + y*2*i) + 1)*2*i)*i)/2
- log(cos(x + y))*(x + y)
int(int(sym('3*x + 4*y -3*x*y')))
ans =
(1/2 - y/2)*x^3 + 2*y*x^2
4. int(sym('y^2-1'))
ans =
(y*(y^2 - 3))/3
int(sym('2*y+3*x^2'),'y')
ans =
y*(3*x^2 + y)
int(sym('a*y + b*x + c*z'),'y')
ans =
(a*y^2)/2 + (b*x + c*z)*y
5. int(int(sym('y^2-1')))
ans =
(y^2*(y^2 - 6))/12
int(int(sym('2*y+3*x^2'),'y'),'y')
ans =
(y^2*(9*x^2 + 2*y))/6
int(int(sym('a*y + b*x + c*z'),'y'),'y')
ans =
(a*y^3)/6 + ((b*x)/2 + (c*z)/2)*y^2
6. int(x^2 + x + 1,0,5)
ans =
355/6
int(sin(x),0,5)
ans =
1-cos(5)
int(tan(x),0,5)
ans =
NaN
int(log(x),0,5)
ans =
5*log(5)-5
```

실습문제 해답 13.1

```
1. plot(x,y,'-o')
   title('Problem 1')
   xlabel('x-data')
   ylabel('y-data')
   grid on
2. interp1(x,y,15)
   ans =
        34
3. interp1(x,y,15,'spline')
   ans =
        35.9547
4. interp1(y,x,80)
   ans =
        39.0909
5. interp1(y,x,80,'spline')
   ans =
        39.2238
6. new_x = 10:2:100;
   new_y = interp1(x,y,new_x,'spline');
   figure(2)
7. plot(x,y,'o',new_x,new_y)
   legend('measured data','spline interpolation')
   title('Problem 6 and 7')
   xlabel('x-data')
   ylabel('y-data')
```

실습문제 해답 13.2

```
y = 10:10:100';
x = [15, 30];
z = [23 33
   45   55
   60   70
   82   92
   111  121
   140  150
```

```
    167   177
    198   198
    200   210
    220   230];
1. plot(y,z,'-o')
   title('Problem 1')
   xlabel('y-data')
   ylabel('z-data')
   legend('x=15','x=30')
2. new_z = interp2(x,y,z,15,20)
   new_z =
        45
3. new_z = interp2(x,y,z,15,20,'spline')
   new_z =
        45
4. new_z = interp2(x,y,z,[20,25],y')
   new_z =
        26.3333 29.6667
        48.3333 51.6667
        63.3333 66.6667
        85.3333 88.6667
        114.3333 117.6667
        143.3333 146.6667
        170.3333 173.6667
        198.0000 198.0000
        203.3333 206.6667
        223.3333 226.6667
```

실습문제 해답 13.3

```
x = [10:10:100];
y= [23 33
    45   55
    60   70
    82   92
    111  121
    140  150
    167  177
```

```
    198   198
    200   210
    220   230]';
1. coef = polyfit(x,y(1,:),1)
    coef =
        2.3224  -3.1333
2. new_x = 10:2:100;
    new_y = polyval(coef,new_x)
    new_y =
        Columns 1 through 6
        20.0909 24.7358 29.3806 34.0255 38.6703 43.3152
        Columns 7 through 12
        47.9600 52.6048 57.2497 61.8945 66.5394 71.1842
        Columns 13 through 18
        75.8291 80.4739 85.1188 89.7636 94.4085 99.0533
        Columns 19 through 24
        103.6982 108.3430 112.9879 117.6327 122.2776 126.9224
        Columns 25 through 30
    131.5673 136.2121 140.8570 145.5018 150.1467 154.7915
        Columns 31 through 36
        159.4364 164.0812 168.7261 173.3709 178.0158 182.6606
        Columns 37 through 42
        187.3055 191.9503 196.5952 201.2400 205.8848 210.5297
        Columns 43 through 46
        215.1745 219.8194 224.4642 229.1091
3. figure(1)
    plot(x,y(1,:),'o',new_x,new_y)
    title('Problem 3 - Linear Regression Model - z = 15')
    xlabel('x-axis')
    ylabel('y-axis')
4. figure(2)
    coef2 = polyfit(x,y(2,:),1)
    coef2 =
        2.2921 7.5333
    new_y2 = polyval(coef2,new_x);
    plot(x,y(2,:),'o',new_x,new_y2)
    title('Problem 4 - Linear Regression Model -z = 30')
    xlabel('x-axis')
    ylabel('y-axis')
```

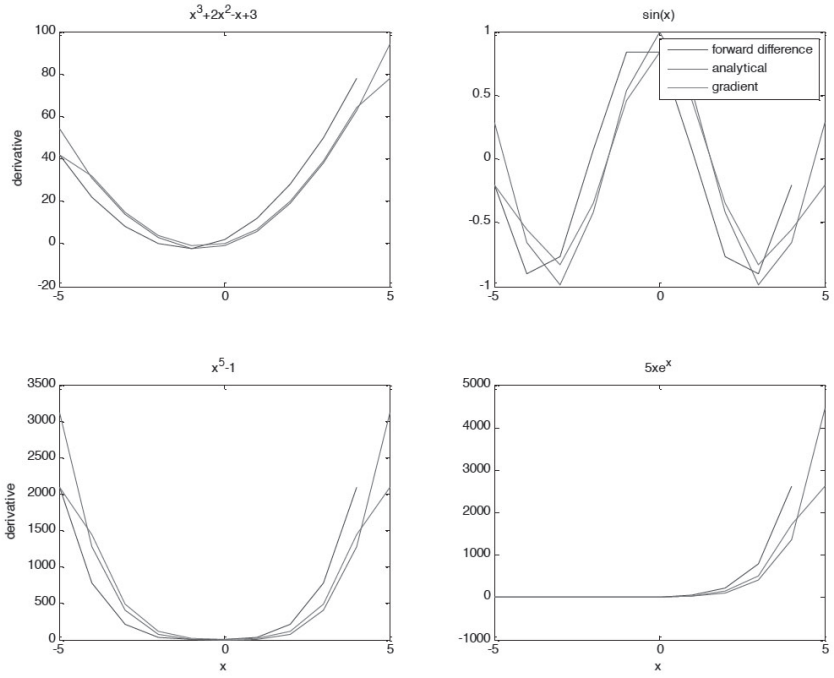
실습문제 해답 13.4

```
1. x = −5:1:5;
   y1 = x.^3 + 2.*x.^2 − x + 3;
   dy_dx1 = diff(y1)./diff(x)
   dy_dx =
        42 22 8 0 −2 2 12 28 50 78
   dy_dx_analytical1=3*x.^2 + 4*x −1
   dy_dx_analytical =
        54 31 14 3 −2 −1 6 19 38 63 94
   table = [[dy_dx1,NaN]',dy_dx_analytical1']
   table =
        42      54
        22      31
        8       14
        0       3
        −2      −2
        2       −1
        12      6
        28      19
        50      38
        78      63
        NaN     94
   % We added NaN to the dy_dx vector so that the length
   % of each vector would be the same
2. a. x = −5:1:5;
      y2a = sin(x);
      dy_dx2a = diff(y2a)./diff(x);
      dy_dx_analytical2a=cos(x);
      table = [[dy_dx2a,NaN]',dy_dx_analytical2a']
      table =
           −0.2021      0.2837
           −0.8979      −0.6536
           −0.7682      −0.9900
            0.0678      −0.4161
            0.8415      0.5403
            0.8415      1.0000
            0.0678      0.5403
           −0.7682      −0.4161
```

```
        −0.7682        −0.4161
        −0.8979        −0.9900
        −0.2021        −0.6536
           NaN          0.2837
b. x = −5:1:5;
   y2b = x.^5−1;
   dy_dx=diff(y2b)./diff(x);
   dy_dx_analytical2b = 5*x.^4;
   table = [[dy_dx2b,NaN]',dy_dx_analytical2b']
   table =
    2101    3125
     781    1280
     211     405
      31      80
       1       5
       1       0
      31       5
     211      80
     781     405
    2101    1280
     NaN    3125
c. x = −5:1:5;
   y2c = 5*x.*exp(x);
   dy_dx2c = diff(y2c)./diff(x);
   dy_dx_analytical2c=5*exp(x) + 5*x.*exp(x);
   table = [[dy_dx2c,NaN]',dy_dx_analytical2c']
   table =
      1.0e+003 *
      −0.0002        −0.0001
      −0.0004        −0.0003
      −0.0006        −0.0005
      −0.0005        −0.0007
       0.0018              0
       0.0136         0.0050
       0.0603         0.0272
       0.2274         0.1108
       0.7907         0.4017
       2.6184         1.3650
       NaN            4.4524
```

```
3. dy_dx31=gradient(y1)
   dy_dx31 =
        42 32 15 4 -1 0 7 20 39 64 78
   dy_dx3a=gradient(y2a)
   dy_dx3a =
   Columns 1 through 6
        -0.2021 -0.5500 -0.8330 -0.3502 0.4546 0.8415
   Columns 7 through 11
        0.4546 -0.3502 -0.8330 -0.5500 -0.2021
   dy_dx3b=gradient(y2b)
   dy_dx3b =
   Columns 1 through 5
        2101 1441 496 121 16
   Columns 6 through 11
        1 16 121 496 1441 2101
   dy_dx3c=gradient(y2c)
   dy_dx3c =
   1.0e+003 *
   Columns 1 through 6
        -0.0002 -0.0003 -0.0005 -0.0005 0.0007 0.0077
   Columns 7 through 11
        0.0369 0.1438 0.5090 1.7045 2.6184
4. subplot(2,2,1)
   plot(x',[[dy_dx1,NaN]',dy_dx_analytical1',dy_dx31'])
   title('x^3+2x^2-x+3')
   ylabel('derivative')
   subplot(2,2,2)
   plot(x',[[dy_dx2a,NaN]',dy_dx_analytical2a',dy_dx3a'])
   title('sin(x)')
   legend('forward difference','analytical','gradient')
   subplot(2,2,3)
   plot(x',[[dy_dx2b,NaN]',dy_dx_analytical2b',dy_dx3b'])
   title('x^5-1')
   xlabel('x')
   ylabel('derivative')
   subplot(2,2,4)
   plot(x',[[dy_dx2c,NaN]',dy_dx_analytical2c',dy_dx3c'])
   title('5xe^x')
```

```
xlabel('x')
```



실습문제 해답 13.5

1.
```
x=linspace(-1,1,11);
y = x.^3 + 2*x.^2 - x + 3;
trapz(x,y)
ans =
    7.36
quad('x.^3+2*x.^2 -x + 3',-1,1)
ans =
    7.3333
quadl('x.^3+2*x.^2 -x + 3',-1,1)
ans =
    7.3333
double(int(sym('x^3+2*x^2 -x + 3'),-1,1))
ans =
    7.3333
a = -1;
```

```
b = 1;
1/4*(b^4-a^4)+2/3*(b^3-a^3)-1/2*(b^2-a^2)+3*(b-a)
ans =
    7.3333
```

2. a. `y= sin(x);`

```
trapz(x,y)
ans =
    2.7756e-17
quad('sin(x)',-1,1)
ans =
    0
quadl('sin(x)',-1,1)
ans =
    0
double(int(sym('sin(x)'),-1,1))
ans =
    0
a = -1;
b = 1;
cos(b)-cos(a)
ans =
    0
```

b. `y= x.^5-1;`

```
trapz(x,y)
ans =
    -2
quad('x.^5-1',-1,1)
ans =
    -2
quadl('x.^5-1',-1,1)
ans =
    -2.0000
double(int(sym('x^5-1'),-1,1))
ans =
-2
    a = -1;
b = 1;
(b^6-a^6)/6-(b-a)
```

```
    ans =
        -2
c. y = 5*x.*exp(x);
    trapz(x,y)
    ans =
        3.7693
    quad('5*x.*exp(x)',-1,1)
    ans =
        3.6788
    quadl('5*x.*exp(x)',-1,1)
    ans =
        3.6788
    double(int(sym('5*x*exp(x)'),-1,1))
    ans =
        3.6788
    a = -1;
    b = 1;
    -5*(exp(b)-exp(a)) + 5*(b*exp(b)-a*exp(a))
    ans =
        3.6788
```