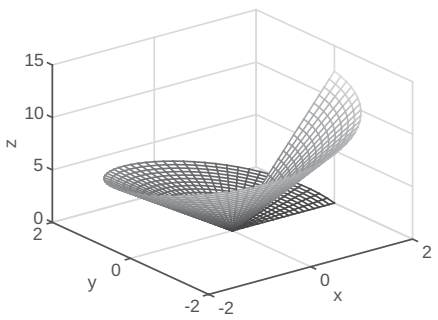
- Convert the polar coordinates grid to a grid in Cartesian coordinates. This can be done with MATLAB's built-in function `pol2cart` (see example below).
- Make a 3-D plot using the values of z and the Cartesian coordinates.

For example, the following script creates a plot of the function $z = r\theta$ over the domain $0 \le \theta \le 360°$ and $0 \le r \le 2$.

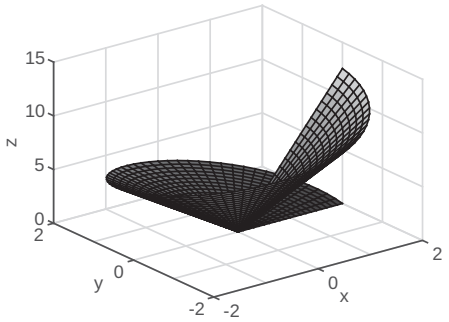
```
[th,r]=meshgrid((0:5:360)*pi/180,0:.1:2);
Z=r.*th;
[X,Y] = pol2cart(th,r);
mesh(X,Y,Z)
```

Type `surf(X,Y,Z)` for surface plot.

The figures created by the program are:



Mesh plot



Surface plot

10.4 THE `view` COMMAND

The `view` command controls the direction from which the plot is viewed. This is done by specifying a direction in terms of azimuth and elevation angles, as seen in Figure 10-3, or by defining a point in space from which the plot is viewed. To set the viewing angle of the plot, the `view` command has the form:

```
view(az,el) or view([az,el])
```

- `az` is the azimuth, which is an angle (in degrees) in the x y plane measured relative to the negative y axis direction and defined as positive in the counterclockwise direction.
- `el` is the angle of elevation (in degrees) from the x y plane. A positive value corresponds to opening an angle in the direction of the z axis.
- The default view angles are $az = -37.5°$, and $el = 30°$.

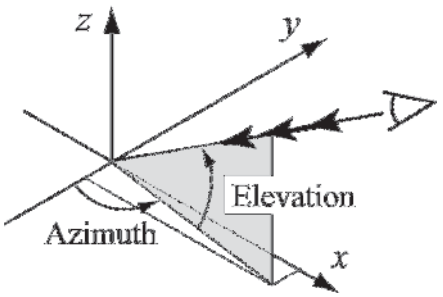
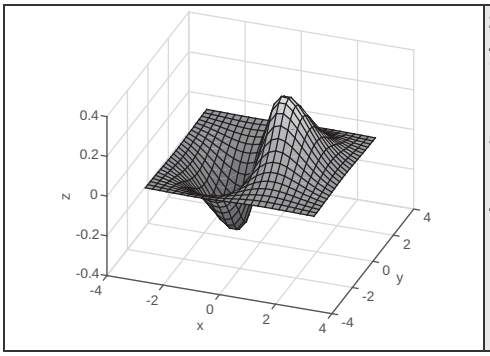


Figure 10-3: Azimuth and elevation angles.

As an example, the surface plot from Table 10-1 is plotted again in Figure 10-4, with viewing angles *az* = 20° and *el* = 35°.



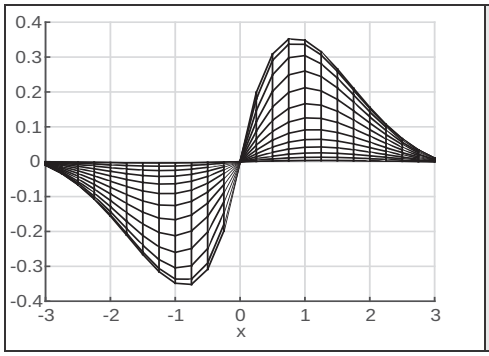

```
x=-3:0.25:3;
y=-3:0.25:3;
[X,Y]=meshgrid(x,y);
Z=1.8.^(-1.5*sqrt(X.^2+
Y.^2)).*cos(0.5*Y).*sin(X);
surf(X,Y,Z)
view(20,35)
```

Figure 10-4: A surface plot of the function $z = 1.8^{-1.5\sqrt{x^2+y^2}}\sin(x)\cos(0.5y)$ with viewing angles of *az* = 20° and *el* = 35°.

- With the choice of appropriate azimuth and elevation angles, the `view` command can be used to plot projections of 3-D plots on various planes according to the following table:

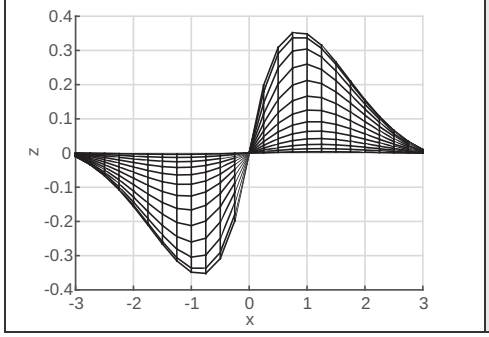
Projection plane	***az* value**	***el* value**
x y (top view)	0	90
x z (side view)	0	0
y z (side view)	90	0

An example of a top view is shown next. Figure 10-5 shows the top view of the function that is plotted in Figure 10-1. Examples of projections onto the *x z* and *y z* planes are shown next, in Figures 10-6 and 10-7, respectively. The figures show mesh plot projections of the function plotted in Table 10-1.




```
t=0:0.1:6*pi;
x=sqrt(t).*sin(2*t);
y=sqrt(t).*cos(2*t);
z=0.5*t;
plot3(x,y,z,'k','linewidth',1)
view(0,90)
grid on
xlabel('x'); ylabel('y')
zlabel('z')
```

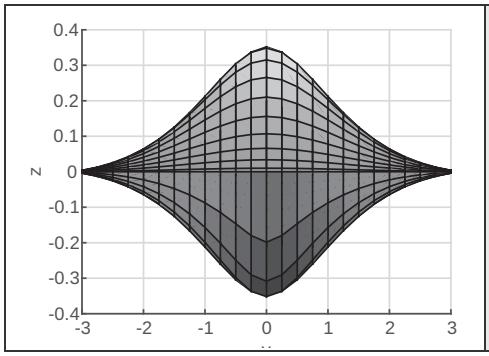
Figure 10-5: A top view plot of the function $x = \sqrt{t}\sin(2t)$, $y = \sqrt{t}\cos(2t)$, $z = 0.5t$ for $0 \le t \le 6\pi$.




```
x=-3:0.25:3;
y=-3:0.25:3;
[X,Y]=meshgrid(x,y);
Z=1.8.^(-1.5*sqrt(X.^2+
Y.^2)).*cos(0.5*Y).*sin(X);
mesh(X,Y,Z)
view(0,0)
```

Figure 10-6: Projections onto the x z plane of the function.

$$z = 1.8^{-1.5\sqrt{x^2+y^2}}\sin(x)\cos(0.5y).$$




```
x=-3:0.25:3;
y=-3:0.25:3;
[X,Y]=meshgrid(x,y);
Z=1.8.^(-1.5*sqrt(X.^2+
Y.^2)).*cos(0.5*Y).*sin(X);
surf(X,Y,Z)
view(90,0)
```

Figure 10-7: Projections onto the y-z plane of the function.

$$z = 1.8^{-1.5\sqrt{x^2+y^2}}\sin(x)\cos(0.5y).$$