

## Task 3

[Function CYCLOID](#) Create a CYCLOID function that makes it easy to draw a closed surface resulting from the rotation of one period of the cycloid around the x-axis (the result is a single-color smooth surface that is displayed using the lighting model).

### Function:

```
function CYCLOID(r)
    t = linspace(0, 2*pi, 100);
    theta = linspace(0, 2*pi, 100);

    [T, Theta] = meshgrid(t, theta);

    X = r * (T - sin(T));
    Y = r * (1 - cos(T)) .* cos(Theta);
    Z = r * (1 - cos(T)) .* sin(Theta);

    surf(X, Y, Z);

    shading interp;
    light;
    lighting gouraud;
    material dull;
    axis equal;
    xlabel('x');
    ylabel('y');
    zlabel('z');
    title('Cycloid Rotated Surface');
end
```

CYCLOID generates and plots a 3D surface representing a rotated cycloid, based on a given radius  $r$ . The cycloid curve is parameterized by  $t$ , and the rotation is achieved by varying  $\theta$  around a circle. The coordinates  $X$ ,  $Y$ , and  $Z$  are calculated using the parametric equations of the cycloid, where  $T$  and  $\Theta$  are meshgrids created from  $t$  and  $\theta$  to cover the entire surface. The function then uses these coordinates to plot the surface with `surf`, applying smooth shading (`shading interp`), adding a light source (`light`), setting the lighting model to `gouraud` for soft shading effects, and using a dull material to give the surface a non-shiny appearance. It sets the axes to be equal for proper aspect ratio and labels the axes and the plot title.

### Run:

```
radius = 1;
CYCLOID(radius);
```

Plot:

