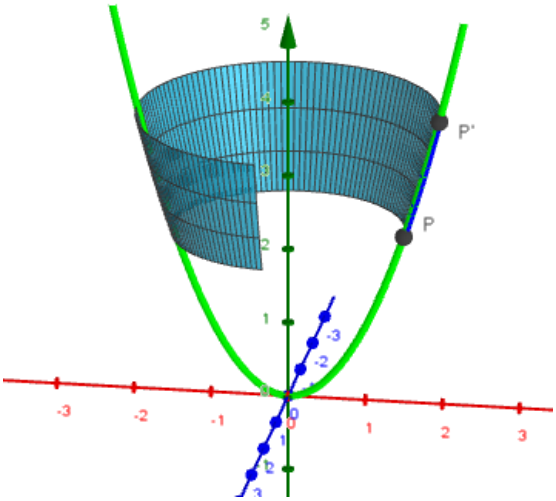
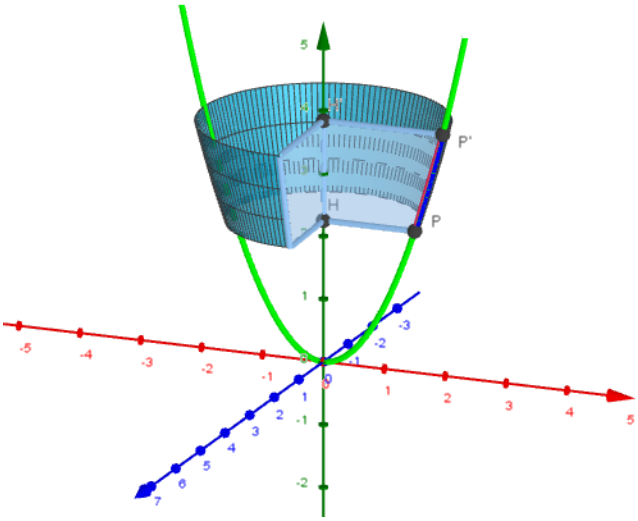
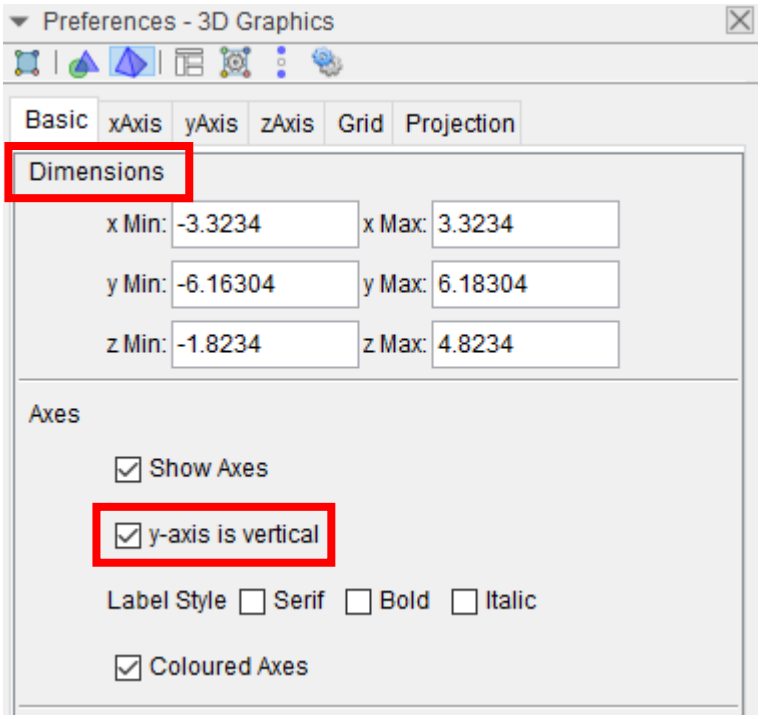
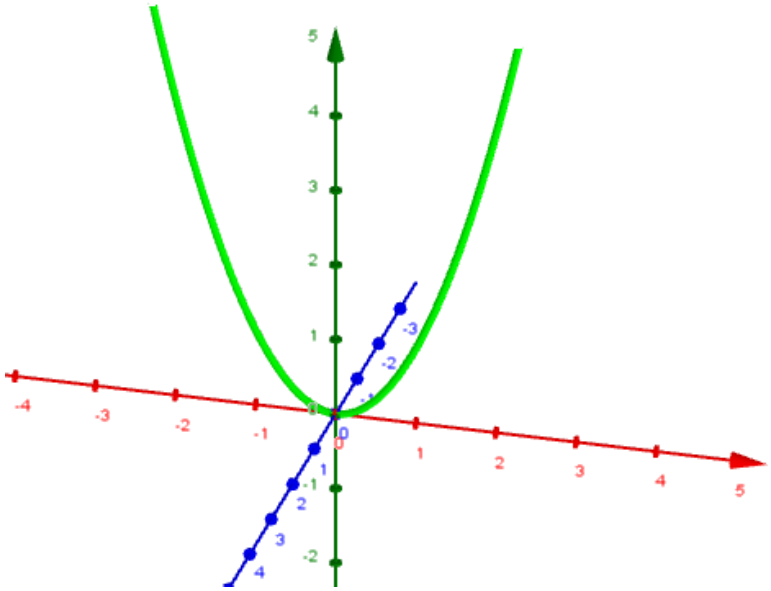
Task C: Surface of revolution

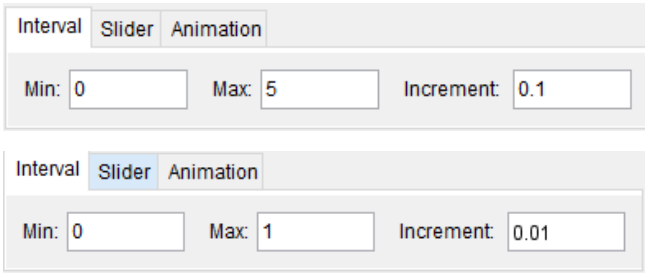
To create a dynamic worksheet to explore how a surface of revolution is generated.

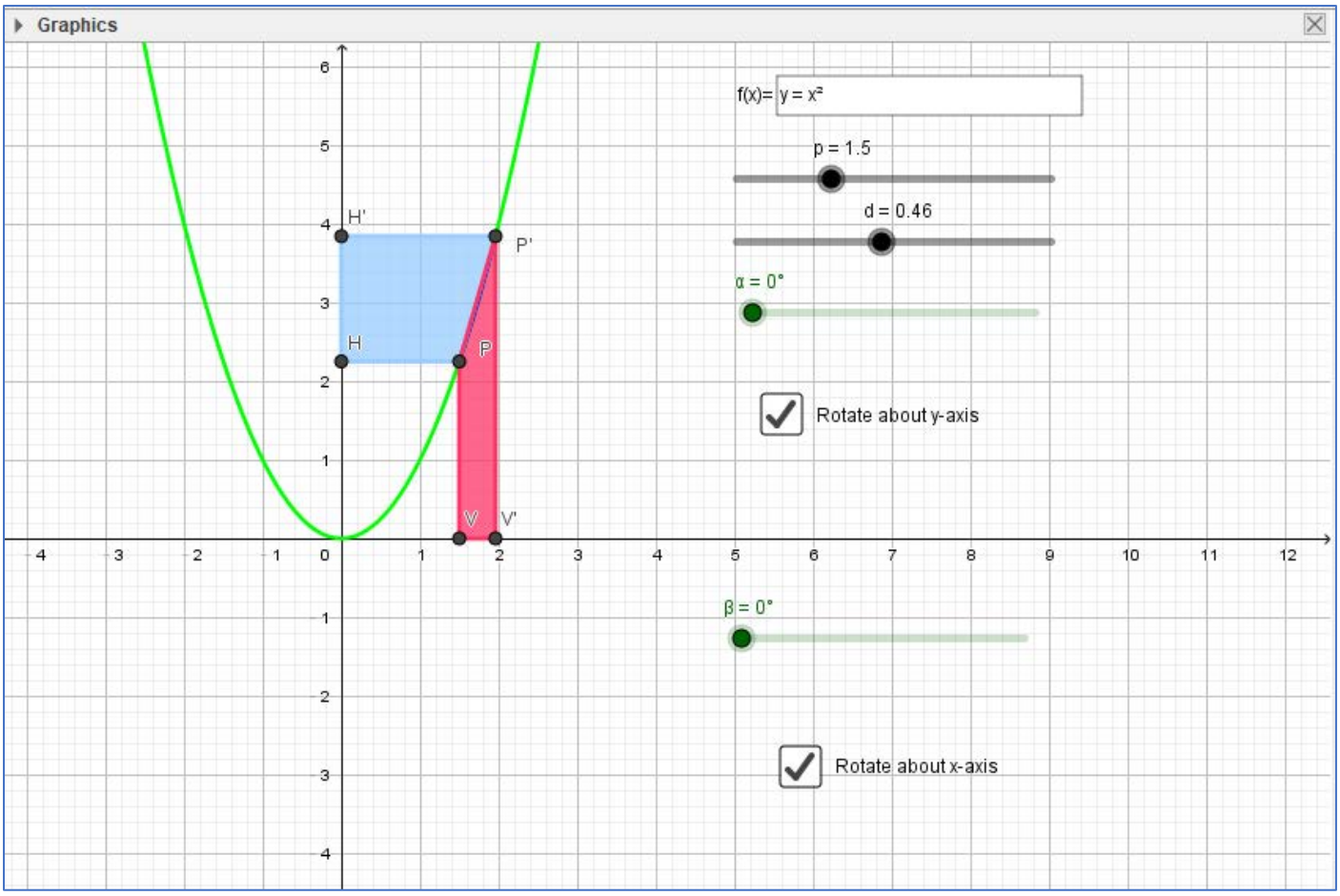


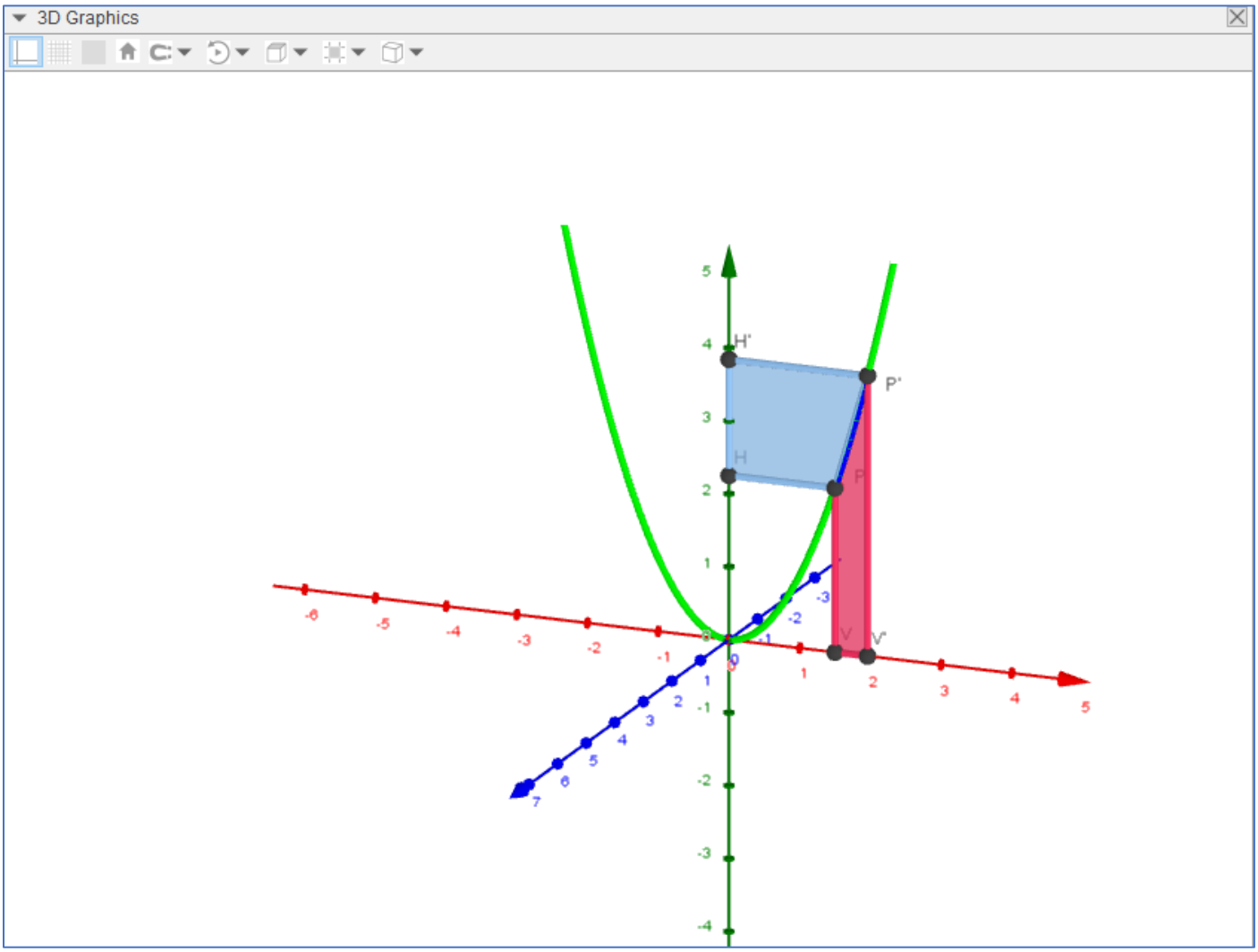


Step	Objects to be created	Action
1.	A function of x to be discussed	◆ Choose "3D Graphics" module. Choose to hide *xOy* plane. Select the properties of axes. Choose "y-axis is vertical".  ◆ In the "View" menu, choose to open "Graphics" view. In "Graphics" window, enter and arbitrary function $f(x) = x^2$ in the input field. Then create an input box with caption "f (x) = ", and link the box to $f(x)$. Hide the graph of $y = f(x)$. ◆ In "3D Graphics" window, define a parametric function $c(t)$ by

Step	Objects to be created	Action
		inputting “c(t)=curve[t,f(t),0,t,-5,5]”. Change the colour of the graph to green.  ◆ Teachers and students can key in other functions in *x* for other curves.

Step	Objects to be created	Action
2.	The surface of revolution and solid of revolution of the curve about *y*-axis and *x*-axis.	◆ In “Graphics” window, create two sliders “p” and “d”, with the interval settings as follows respectively:  ◆ In “3D Graphics” window, define two points *P* and *P’* by inputting “P=c(p)” and “P’=c(p+d)” respectively. ◆ In “3D Graphics” window, define a parametric function *c*_1(*t*) by inputting “c_1(t)=curve[t,f(t),0,t,p,p+d]”. Change the colour of the curve *c*_1(*t*) to blue. ◆ In “Graphics” window, create a slider of angle α from 0° to 360°. In “3D Graphics” window, define a surface a = Surface(c_1, α, yAxis). Create two points H=(0,f(p),0) and H’=(0,f(p+d),0). Construct polygon PP’H’H. By using the “Rotate around Line” button, rotate the polygon PP’H’H around y-axis, with angle of rotation being α. ◆ In “Graphics” window, create a check box, labelled with “Rotation about y-axis” and link to Angle α, H, H’, polygon PP’H’H and its edges, and Surface a. ◆ Repeat the same process to create “Rotate about x-axis”. In “Graphics” window, create a slider of angle β from 0° to 360°. In “3D Graphics” window, define a surface a_1 = Surface(c_1, α, xAxis). Create two points V=(p,0,0) and V’=(p+d,0,0). Construct polygon PVV’P’. By using the “Rotate around Line” button, rotate the polygon PVV’P’ around x-axis, with angle of rotation being β. ◆ In “Graphics” window, create a check box, labelled with “Rotation about x-axis” and link to Angle β, V, V’, polygon PVV’P’ and its edges, and Surface a_1.


Graphics
f(x)= y = x²
p = 1.5
d = 0.46
α = 0°
Rotate about y-axis
β = 0°
Rotate about x-axis
H'
P'
H
P
V
V'


3D Graphics
H'
P'
H
P
V
V'