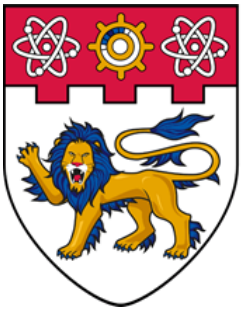


NANYANG TECHNOLOGICAL UNIVERSITY
SINGAPORE

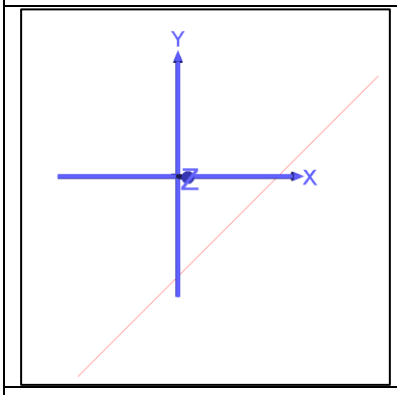
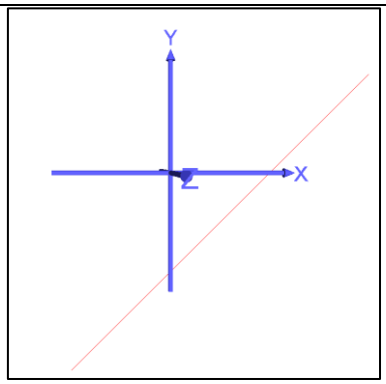
CZ2003 Computer Graphics and Visualization

Experiment 1: Parametric Curves

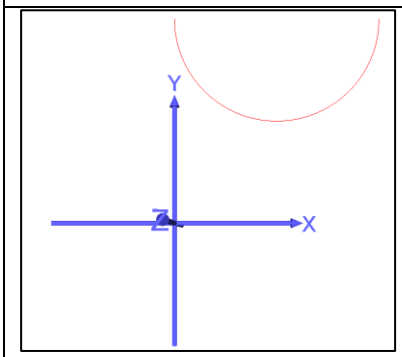
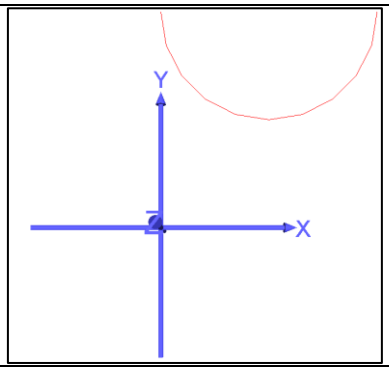
Name: Neo Rui Xuan Berlynn

Lab Group: SS1

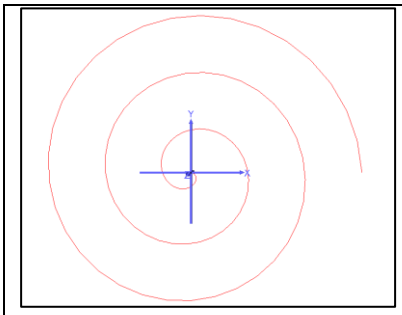
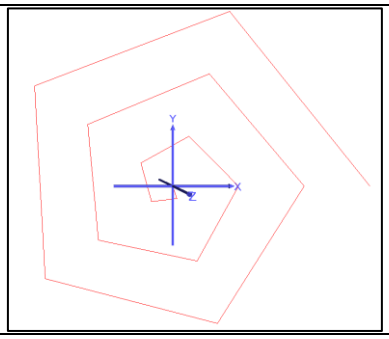
Parametric Curves (Experiment on Sampling Resolution)

Curve 1	Curve 2	Notes
		**Question 1a:** There is no difference when the sampling resolution is increased from 1 to 100 as it is just a straight line. The minimum sampling resolution is 1 as it only requires one straight line to create straight line, any lower than that would lead to empty graph.

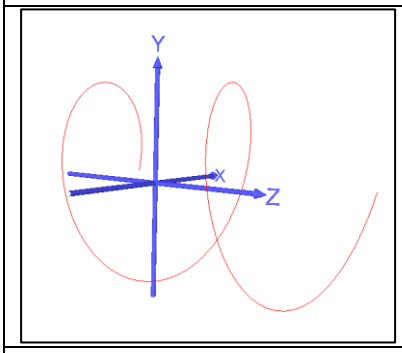
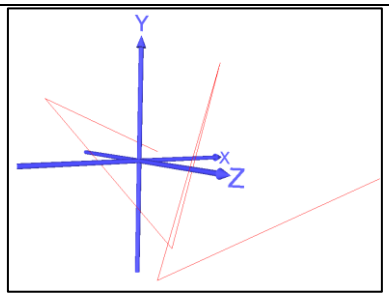
Above is the snapshot of "Lab1_Qn1_1.wrl" which defines a straight line by parametric equations
x=-1+3*u;
y=-2+3*u;
z=0;
with parameter domain [0,1]. The sampling resolution is 100.
	Above is the snapshot of "RLab1_Qn1_1.wrl" which defines the same curve as the picture on the left with the same equation. The sampling resolution is 1.	

		**Question 1b:** With a low sampling resolution like 10, the arc appears very jagged and has many sharp edges. The more the number of samples used, the more accurate and smooth the arc will be. This is because the arc is created by joining multiple straight line together between points defined in the formula, such that it appears like a smooth arc. If the sampling resolution is further reduced to 1, the system will produce a straight line.

Above is the snapshot of "Lab1_Qn1_2.wrl" which defines a circular arc with parametric equations
x=cos(pi + u*pi) + 1;
y=sin(pi + u*pi) + 2;
z=0;
with parameter domain [0,1]. The sampling resolution is 100.
	Above is the snapshot of "RLab1_Qn1_2.wrl" which defines the same curve as the picture on the left with the same equation. The sampling resolution is 10.	

<table>
<tr>
<td>  </td>
<td>  </td>
<td rowspan="2">Question 1c:
When the sampling resolution is equivalent to the number of rotation multiplier (in this case, 6), it will create a straight line as it creates sampling along the x-axis.

When the sampling resolution is 15 on the image on the right, it can be observed that there are 15 straight lines forming the spiral.

As the sampling resolution is increased, more lines are used to create the curve and thus making a smoother spiral when sampling resolution is 100.</td>
</tr>
<tr>
<td>Above is the snapshot of “Lab1_Qn1_3.wrl” which defines a origin-centered 2D spiral curve with parametric equations
x=4*u*cos(-6*pi*u);
y=4*u*sin(-6*pi*u);
z=0;
with parameter domain [0,1]. The sampling resolution is 100.</td>
<td>Above is the snapshot of “RLab1_Qn1_3.wrl” which defines the same curve as the picture on the left with the same equation. The sampling resolution is 15.</td>
</tr>
<tr>
<td>  </td>
<td>  </td>
<td rowspan="2">Question 1d:
When the sampling resolution is 5, a very jagged helix with sharp edges is produced.

As the sampling resolution is increased to 100, the edges smoothen out and becomes a proper smooth helix as more and more lines contribute to the formation of the helix.

When the number of sampling resolution is equivalent to the number of rotation multiplier (in this case, 4), it will create a zig zag line on x and z axis. This is because it will create sampling along the x and y axis.</td>
</tr>
<tr>
<td>Above is the snapshot of “Lab1_Qn1_4.wrl” which defines a 3D cylindrical helix with parametric equations
x=cos(4*u*pi);
y=sin(4*u*pi);
z=-1+3*u;
with parameter domain [0,1]. The sampling resolution is 100.</td>
<td>Above is the snapshot of “RLab1_Qn1_4.wrl” which defines the same curve as the picture on the left with the same equation. The sampling resolution is 5.</td>
</tr>
</table>

<table>
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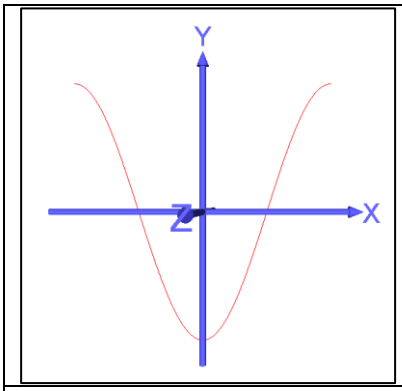
<td> 
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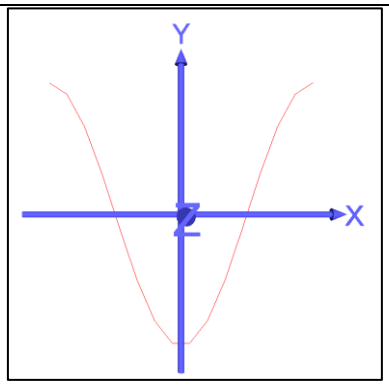
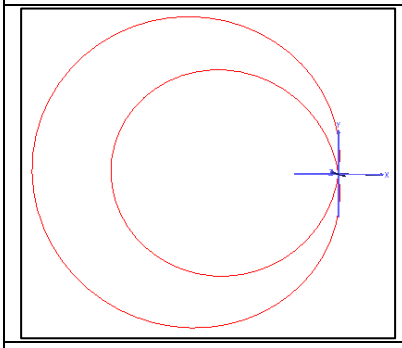
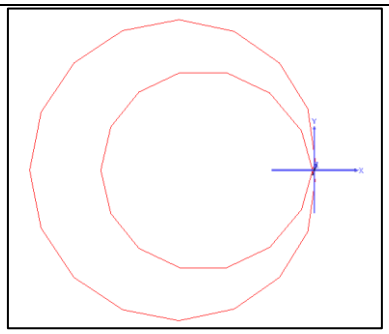
<td> 
</td>
<td rowspan="2">Question 2:
For sampling resolutions below 4:
When the number of sampling resolution is 1, it creates a straight line.
When the number of sampling resolution is even, it creates a V shape (2 straight lines).
When the number of sampling resolution is odd, it creates a _/ shape (3 straight lines).

With a low sampling resolution like 15, the curve appears very jagged with several sharp edges.

As the sampling resolution is increased to 100, the curve becomes smoother.</td>
</tr>
<tr>
<td>Above is the snapshot of “Lab1_Qn2.wrl” which define a curve with parametric equations
x=-1+2*u;
y=cos(2*pi*u);
z=0;
with parameter domain [0,1]. The sampling resolution is 100.</td>
<td>Above is the snapshot of “RLab1_Qn2.wrl” which defines the same curve as the picture on the left with the same equation. The sampling resolution is 15.</td>
</tr>
<tr>
<td>  </td>
<td>  </td>
<td rowspan="2">Note:
When the number of sampling resolution is 2, it creates a straight line.
When the number of sampling resolution is 3, it creates a triangle (3 straight lines).
A sampling resolution of 5 creates a star (5 straight lines).

With a low sampling resolution like 30, the curve appears very jagged with several sharp edges.

As the sampling resolution is increased to 100, the curve appears to be smoother.</td>
</tr>
<tr>
<td>Above is the snapshot of “Lab1_Qn3.wrl” which define a curve with parametric equations
x=(1-7*cos(2*pi*u)) * cos(2*pi*u);
y=(1-7*cos(2*pi*u)) * sin(2*pi*u);
z=0;
with parameter domain [0,1]. The sampling resolution is 100.</td>
<td>Above is the snapshot of “RLab1_Qn3.wrl” which defines the same curve as the picture on the left with the same equation. The sampling resolution is 30.</td>
</tr>
</table>