

Lissajous Lab

1. Spin speed (1 point)

Go to lab page 2. Note you can adjust the figures by dragging the red points. Clicking the red X  at the bottom right of the applet erases the drawing so you can start again.

Adjust the green circle diameter to be half of the cyan circle diameter. When the cyan circle's red point spins around the cyan circle twice, how many times does the green circle's red point spin around the green circle?

- a. Once b. Twice c. Three times d. Four times e. Pi times

2. Frequency (1 point)

Consider the frequency to be the speed of the rotation of one of the red points, measured in rotations per minute. What happens to the frequency when the diameter of a circle is doubled?

- a. It stays the same b. Cut in half c. Doubled d. Quadrupled

3. Parametric equation (1 point)

Suppose the diameter of the cyan circle is 300, the diameter of the green circle is 100, and the point on the cyan circle moves so that its position at time t is given as $150 \sin(t)$. If the point on the green circle starts at the red end of the diameter, what equation could describe its motion?

- a. $50 \cos(t)$
b. $50 \cos(t/3)$
c. $50 \cos(3t)$
d. $450 \cos(t)$
e. $450 \cos(t/3)$
f. $450 \cos(3t)$

4. Shape matching (1 point)

Match the starting conditions to the shape of the final curve. **Note:** in all cases you must first drag the red points on the circles to the black points at the end of the diameters, and then click on "Animate both" to start the movement on both circles simultaneously.

1. Vertical diameter 200, horizontal diameter 150 Ribbon for remembrance
2. Vertical diameter 150, horizontal diameter 300 Arch
3. Vertical diameter 150, horizontal diameter 100 Pretzel

5. Rectangle dimensions (1 point)

The lissajous curve on lab page 2 always fits inside a certain rectangle. What are the dimensions of the rectangle?

- a. green diameter wide, cyan diameter high
b. green radius wide, cyan diameter high
c. green diameter wide, cyan radius high
d. green circumference wide, cyan circumference high
e. green radius wide, cyan radius high

6. Same shape settings (1 point)

Go to lab page 3. The initial picture uses $m = 2$ and $n = 3$. What other settings for m and n give the same picture (mark all correct choices)?

- a. $m=3, n=4$
- b. $m=4, n=5$
- c. $m=4, n=6$
- d. $m=5, n=7$
- e. $m=6, n=9$
- f. $m=8, n=16$

7. $m=0$ (1 point)

What happens when $m = 0$?

- a. There is a horizontal line
- b. There is a vertical line
- c. There is a diagonal line
- d. There is a circle
- e. There is a swirly-curly thing

8. $m=n$ (1 point)

What happens when $m = n$ (with offset 0)?

- a. There is a horizontal line
- b. There is a vertical line
- c. There is a diagonal line
- d. There is a circle
- e. There is a swirly-curly thing

9. Increase offset (1 point)

What happens when $m = n$ and you increase the x offset to $\pi/2$?

- a. The figure goes to a horizontal line
- b. The figure goes to a vertical line
- c. The figure goes to a longer diagonal line
- d. The figure goes to a circle
- e. There is a swirly-curly thing

10. Pretty (1 point)

Go to lab page 4. There is an artsy Lissajous curve sketcher that is currently the picture at the bottom of the course homepage. Which of the preset letters on the left of that Lissajous sketcher gives the prettiest picture (in your opinion)? Note that you can click on the green numbers to speed up or slow down the rotation. Use a capital letter to answer.