Desmos graphs

4 | witch of Maria Agnesi

Let B be the center of the orange circle with radius a, let D be the closest point to C on the x-axis, and let Q be the closest point to A on the y-axis.

4.1 | $x(t)$

$$\tan\theta = \frac{\overline{CD}}{\overline{OD}}$$
$$\cot\theta = \frac{\overline{OD}}{\overline{CD}}$$
$$\overline{CD}\cot\theta = \overline{OD}$$
$$2a\cot\theta = x$$

4.2 | $y(t)$

First, note that the distances
$$\overline{AB} = \overline{BO} = a$$

$$\angle AOB = 90 - \theta$$
$$\angle OAB = 90 - \theta \qquad \text{(isocelese triangle)}$$
$$\angle ABO = 2\theta$$

5 | something

8 | swallowtail catastrophe curves

Defined by
$$x = 2ct - 4t^3$$
$$y = -ct^2 + 3t^4$$

8.1 | features

8.1.1 | approaches a parabola-like shape above the y-axis

8.1.2 | approaches a parabola-like shape below the x-axis if $c > 0$

8.1.3 | has a cross-over in a triangle shape

1. gets bigger when c gets bigger

8.1.4 | it looks like a dorito that scales with the value of c

1. as c approaches zero from the positive direction, the swollowtail gets smaller

9 | **Lissajous Figures**

Defined by

$$x = a \sin(nt)$$
$$y = b \cos t$$

9.1 | **features**

9.1.1 | **spring-like coil shape (almost like standing waves) with tighter "loops" at the ends**

9.1.2 | a, b **control the size of the coil (default** $-1 \leq x, y \leq 1$ **because of range of** $\sin, \cos$

9.1.3 | **number of y-intercepts is** $n + 1$ **except in the degenerate cases** $n \leq 0$