

# 1 Graphs Involving the Distance Formula

Learn more about the geometry of  $|\vec{r} - \vec{r}'|$  in two dimensions.

- (a) Make sketches of the following functions, by hand, on the same axes:

$$y = \sin x$$
$$y = \sin(x + 2)$$

Briefly describe the role that the number 2 plays in the shape of the second graph

- (b) Make a sketch of the graph

$$|\vec{r} - \vec{a}| = 2$$

for each of the following values of  $\vec{a}$ :

$$\vec{a} = \vec{0}$$
$$\vec{a} = 2\hat{x} - 3\hat{y}$$
$$\vec{a} = \text{points due east and is 2 units long}$$

- (c) Derive a more familiar equation equivalent to

$$|\vec{r} - \vec{a}| = 2$$

for arbitrary  $\vec{a}$ , by expanding  $\vec{r}$  and  $\vec{a}$  in rectangular coordinates. Simplify as much as possible. (Ok, ok, I know this is a terribly worded question. What do I mean by “more familiar”? What do I mean by “simplify as much as possible”? Why am I making you read my mind? Try it anyway. Real life is not full of carefully worded problems. Bonus points to anyone who can figure out a better way of wording the question that doesn’t give the point away.)

- (d) Write a brief description of the geometric meaning of the equation

$$|\vec{r} - \vec{a}| = 2$$