

How thick must the trunks of the trees in a regularly spaced circular orchard grow if they are to block completely the view from the center?

Here are three orchards with an *orchard radius*, R , of 5. The first is *transparent*; you can see out from the origin. The third orchard is not transparent, and the middle one will be considered below. Let r be the tree radius.

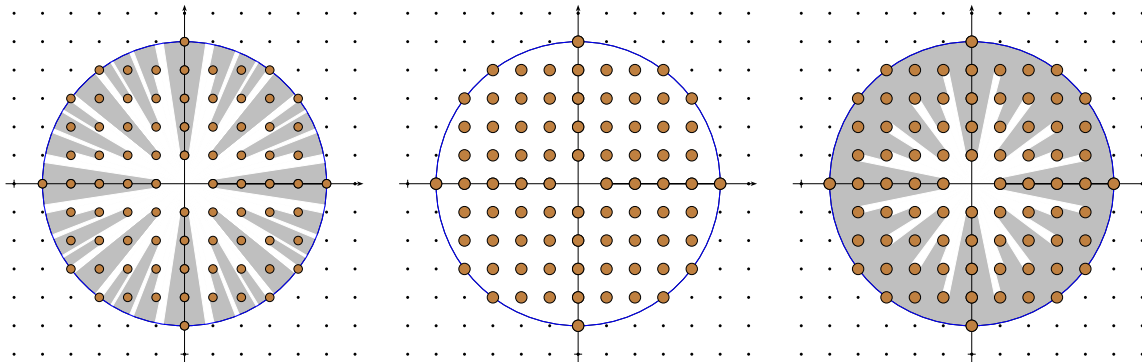
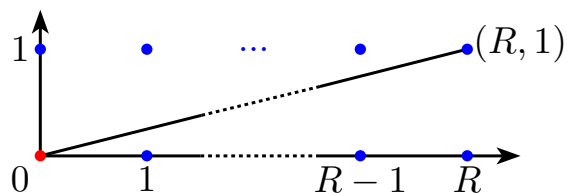


Figure 1: Sample Orchards: The middle orchard has $R = 5$ and $r = .2$

1. Assuming that trees cannot overlap, what is the maximum value for r ?
2. Is the tree at $(2, 2)$ ever visible from the origin? Explain.

3. Assume no trees are planted outside of the orchard border. Assume you stand at point $(R, 1)$ on the plane.

(a) Explain why we need only consider trees at $(1, 0)$ and $(R - 1, 1)$ that might interfere with seeing the origin from point $(R, 1)$.



(b) What is the largest bound for r that allows the origin to be visible from $(R, 1)$?

(c) Can we see out of the sample orchard on the middle of figure 1?

4. Which trees in the first quadrant are never visible from the origin?

5. If the r is very small, what fraction of the trees in the sample orchard are visible from the origin?