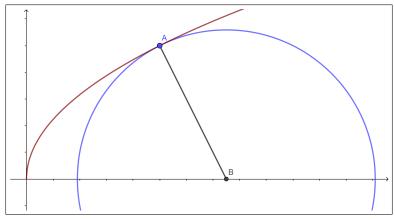
**Problem 1.** Let  $f(x) = \sqrt{x}$ . Then the point (1,1) is a point on the graph of f. There is a unique line which passes through (1,1) and otherwise lies above the graph of f. This is called the *tangent line*.



Descartes found the slope of this line by first finding the unique circle, centered on the x-axis, which is tangent to the graph of f. Let (h,0) be the center of this circle. In the diagram above, point A=(1,1) is the point of tangency, and point B=(h,0) is the center of the circle.

- (a) Find the distance r from A to B, written in terms of h.
- (b) Write the equation of the circle centered at B with radius r.
- (c) Plug  $y = \sqrt{x}$  into the equation of the circle. You now have a quadratic equation in variable x and constant h. Put this equation in standard form  $ax^2 + bx + c = 0$ .

(d)	Write the a, b, and c you found in part (c). Plug a, b, and c into the discriminant $b^2 - 4ac$ .
(e)	We want the discriminant to be zero (why?). Set $b^2 - 4ac = 0$ and solve for $h$ .
(f)	Find the slope of the line through $A$ and $B$ .
(g)	Find the slope of the tangent line.