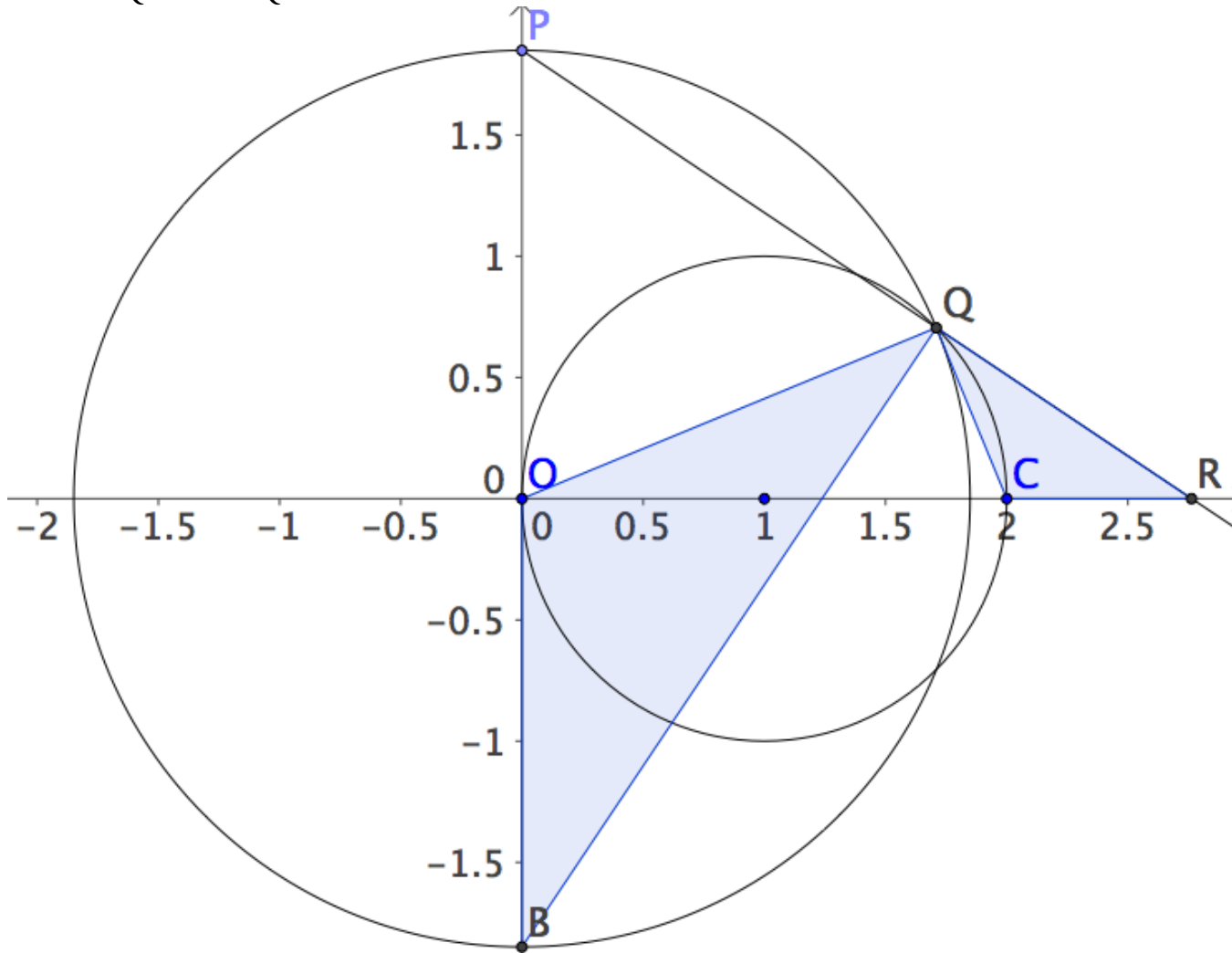


1. Shrinking circle problem: What happens to R as P approaches O on the y -axis?

Given a unit circle centered at $(1, 0)$, a circle centered at $(0, 0)$ going through a point P on the y -axis, Q is the intersection of the two circles, and R is the intersection of ray PQ and the x -axis. If P is at $(0, p)$ and R at $(r, 0)$, evaluate $\lim_{p \rightarrow 0} r$.

(a) Show $\triangle QCR \sim \triangle QOB$

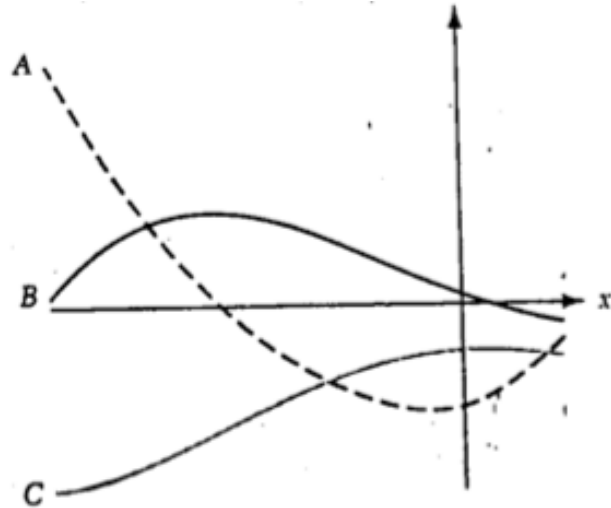


(b) Explain why this leads to a solution.

2. Let $f(x) = 3x^2 + 4$. Use an algebraic definition of the derivative (a difference quotient) to compute $f'(x)$. Be sure to show all your work.

3. Find the functions.

Graphs A, B and C can be seen as $f(x), f'(x)$, and $f''(x)$. Which is which? Explain.



4. $f(x)$ even and differentiable $\implies f'(x)$ odd

Consider why this statement is true by looking at the geometry behind the $h \rightarrow 0$ difference quotient. Draw a good diagram labeling the relevant points.

5. What is a *logarithm*? Use the equation $a = \log_b c$ to setup a definition.

6. Consider a function $f(x)$, defined on the reals such that $f(x) = x^2$ for irrational values of x , and $f(x) = 4$ for rational values of x . Discuss the continuity of $f(x)$.