

Max/Min with Wile E. Coyote

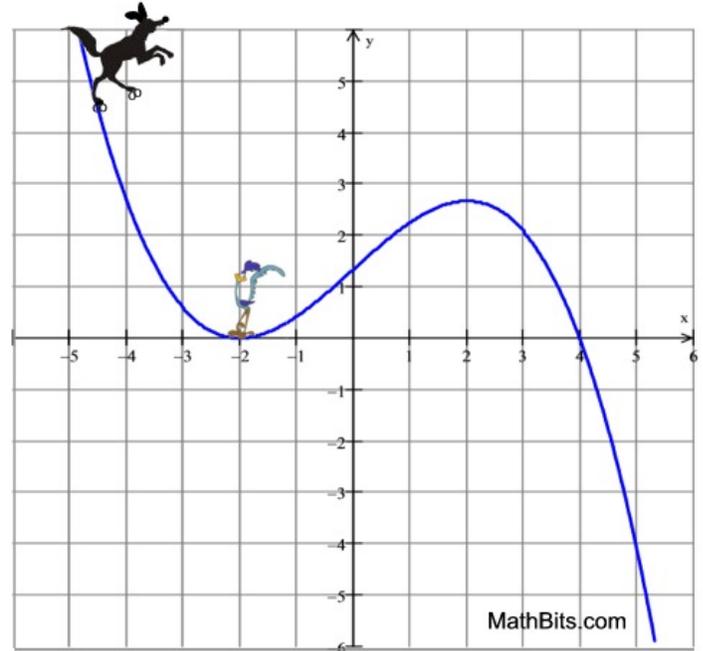
Name _____

“Hot Rod and Reel”

Directions: Wile E. Coyote and the Road Runner are at it again. Answer the following questions pertaining to their exploits. Show all work.

1. Wile E. Coyote’s roller skating strategy turns out to be yet another failure in his quest to capture the elusive Road Runner bird. As he skates down the hill, the bird trips him, sending him airborne and eventually over the edge of a cliff.

The path the coyote travels is modeled by the equation $f(x) = -\frac{1}{12}x^3 + x + \frac{4}{3}$ on the interval $[-6, 6]$, as shown in the graph at the right.



a.) Use the First Derivative Test to find the relative maximum and minimum locations on the path. Express your findings as ordered pairs.

b.) Find the inflection point on the path, where the coyote’s path changed from concave up to concave down. Show your work and state your answer as an ordered pair.

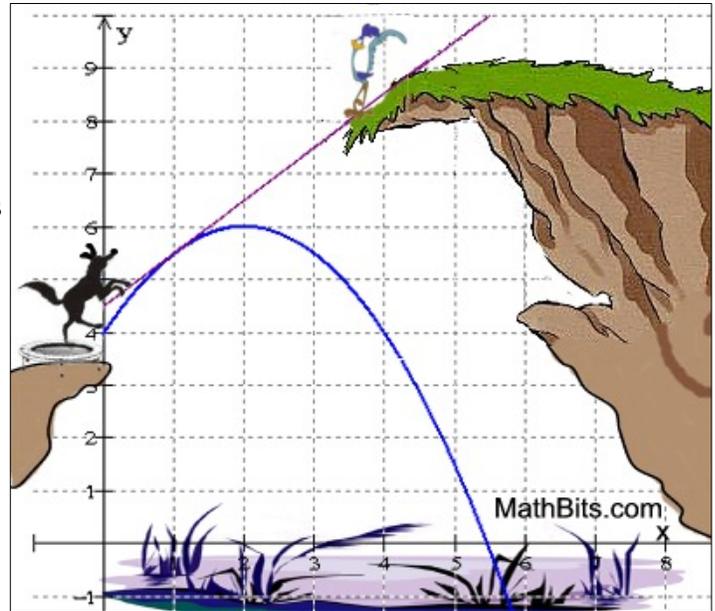
c.) If each unit on the graph represents 10 feet, and the x -axis represents ground-level, find:

- the height of the coyote’s take-off spot on the hill (the absolute maximum).
- the coyote’s maximum air-borne height after being tripped by the road runner (relative max).
- the depth of the canyon into which the coyote fell (the absolute minimum).

2. Our intrepid coyote tries yet another strategy to capture the Road Runner. This time he is convinced that a trampoline will propel him to the edge of the overhang where the bird is standing. Unfortunately, his trampoline is too small for such an expanse and his journey follows the parabolic arc modeled by the equation

$$f(x) = -\frac{1}{2}(x-2)^2 + 6.$$

a.) Using the First Derivative Test, find the absolute maximum height attained by the coyote's jump from the trampoline. Each unit on the graph represents 10 feet.



b.) The x -axis represents ground level and also the surface of a pond on water. If the coyote's trampoline voyage was contained to the interval $[0,7]$, how far underwater was he when he finally stopped traveling?

c.) In this case, Wile E. Coyote would have been wise to use one of his many propulsion rockets, to follow a straight line to the bird. The straight line tangent to the parabolic path at $x = 1$ will intercept the Road Runner.

- Using your knowledge of derivatives, find the slope of this tangent line.
- Write the equation of the tangent line.
- If the Road Runner is standing on this line, what are possible coordinates of his location?
- Find the distance from the coyote (located on the line at the y -axis) to your location of the bird. Round answer to the *nearest tenth* of a foot.