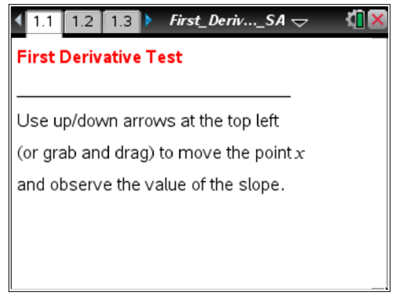
Name ______________

Class ______________

Open the TI-Nspire document *First_Derivative_Test.tns.*



The first derivative test uses the sign of the first derivative to check whether a critical point for a function **f** is the location of a local maximum, local minimum, or neither. This activity will illustrate how and why the test works.

You will want to review these important definitions:

Definition: A function **f** has a critical point at c if

- the value c is in the domain of the function **f** (in other words, $\mathbf{f}(c)$ is defined) and
- either $\mathbf{f}'(c) = 0$ or $\mathbf{f}'(c)$ is undefined.

Definition: A function has a local maximum at c if $\mathbf{f}(c) \geq \mathbf{f}(x)$ when x is near c (that is, if $\mathbf{f}(c) \geq \mathbf{f}(x)$ for all x in some open interval containing c). Similarly, **f** has a local minimum at c if $\mathbf{f}(c) \leq \mathbf{f}(x)$ when x is near c (if $\mathbf{f}(c) \geq \mathbf{f}(x)$ for all x in some open interval containing c).

Move to page 1.2.

1. Each page of problem 1 in the document has a graph of a function with a single critical point.

> **Tech Tip:** Use the up and down arrows to easily change the value of x. Also you can select the value of x and type in the number.
>
> **Tech Tip:** To change the value of x, tap on the point to highlight it. Then, begin sliding it.

a. Grab the white point on the x-axis and move it to see the slope of the tangent line change as you move along each graph. Complete the table below.

Function graph on page	Critical point (and reason *why* it is a critical point)	Location of local max, local min, or neither	Intervals where slope of tangent line is positive	Intervals where slope of tangent line is negative
1.2	$x =$			
1.3	$x =$			
1.4	$x =$			
1.5	$x =$			

b. Summarize your findings for the four graphs.

Move to page 2.1.

2. The graph shown here is that of a function with six different critical points indicated on the *x*-axis (by black dots). Use the up/down arrows at the upper left (or grab and drag) to move the white point along the *x*-axis and see the slope of the tangent line (when it exists).

   a. Explain why each of these marked points is a critical point, and classify each as the location of a local minimum, local maximum, or neither.

Critical point	**Reason why it is a critical point**	**Location of local max, local min, or neither**	**Describe any change of sign of f' at *x* = *a***
***x* = –8**			
***x* = –6**			
***x* = –4**			
***x* = –2**			
***x* = 1**			
***x* = 5**			

   b. Use what you have learned to complete the definition of the first derivative test below:

   Suppose **f** is continuous at the critical point *a*:

   - If the first derivative **f′** changes sign from positive to negative at *a*, then **f**(*a*) is ___________________________.
   - If the first derivative **f′** changes sign from negative to positive at *a*, then **f**(*a*) is ___________________________.
   - If the first derivative **f′** does not change sign at *a*, then **f** has ________________________ ____ .