1st Derivative Test
Uses: Finding Local Max and Min
Finding intervals where a function is increasing & decreasing.

Step 1	Find the first derivative. $f'(x)$
Step 2	Find the critical values. Places where ***$f'(x) = 0$ or $f'(x)$ is undefined*** - *Set **$f'(x) = 0$** and solve for **x**.* - If you have a fraction, set the denominator equal to zero and solve for ***x*** to determine if there are any places where ***$f'(x)$ is undefined.***
Step 3	Do the first derivative test. (# Line Game) - Draw a # line, label the critical values, and choose test values on the left and right of all the critical values. - Plug test values into the ***first derivative $f'(x)$***. - If the value is positive put a plus and draw an increasing arrow above that test value to indicate that region is increasing. - If the value is negative put a minus and draw a decreasing arrow above the test value to indicate that region is decreasing.
Step 4	Draw conclusions. You have all the data you need to answer any questions involving local max's, local mins, and the intervals where the original ***$f(x)$*** is increasing or deceasing. *NOTE:* You have only found x-values at this point, if they want to know the actual max or min values you will need to plug those x-values back into the original ***$f(x)$*** to determine the y-values that go with them.

2nd Derivative Test
Uses: Finding intervals where a function is concave up (like a cup) or concave down (like a frown).

Step 1	Find the second derivative. $f''(x)$
Step 2	Find the inflection points. Places where ***$f''(x) = 0$ or $f''(x)$ is undefined*** - *Set **$f''(x) = 0$** and solve for **x**.* - If you have a fraction, set the denominator equal to zero and solve for ***x*** to determine if there are any places where ***$f''(x)$ is undefined.***
Step 3	Do the second derivative test. (# Line Game) - Draw a # line, label the inflection points, and choose test values on the left and right of all the inflection points. - Plug test values into the ***second derivative $f''(x)$***. - If the value is positive put a plus and draw **U** for concave up (like a cup) above that test value to indicate that region is concave up. - If the value is negative put a minus and draw an upside down **U** for concave down (like a frown) above that test value to indicate that region is concave down.
Step 4	Draw conclusions. You have all the data you need to answer any questions involving the intervals where the original ***$f(x)$*** is concave up or down. *NOTE:* You have only found x-values at this point, if they want to know the actual inflection *point* you will need to plug those x-values back into the original ***$f(x)$*** to determine the y-values that go with them.

Determine Absolute Max and Absolute Mins
Note: Absolute Max/Min problems generally have an interval [a,b] that you are provided with in addition to the equation.

Step 1	Find the first derivative. $f'(x)$
Step 2	Find the critical values. Places where ***$f'(x) = 0$ or $f'(x)$ is undefined*** - *Set **$f'(x) = 0$** and solve for **x**.* - If you have a fraction, set the denominator equal to zero and solve for ***x*** to determine if there are any places where ***$f'(x)$ is undefined.*** - ***Check that all the critical values you found are in the interval [a,b] that you are given and discard any that are not inside the interval.***
Step 3	Plug all critical values, that you found in Step 2, and end points (the **a** and **b** from the interval you were given) into the original equation ***$f(x)$.*** - The largest y-value from these wins the Absolute Max award. - The smallest y-value from these wins the Absolute Min award. *Note:* You will always have both.

The Stability Test
Use for determining if an equilibrium point is stable or unstable.

Step 1	Find the equilibrium points.
Step 2	Create and ***$f(x)$*** equation based on the DTDS you were given, and use it to find the ***first derivative, $f'(x)$.***
Step 3	Plug your equilibrium values from Step 1 into your derivative ***$f'(x)$*** and to get your comparison value (the y-value).
Step 4	Take the absolute value of each of your comparison values from Step 3. - If the value is less than 1, ***< 1***, then the point is stable. - If the value is greater than 1, ***> 1***, then the point is unstable. - If the value is equal to 1, ***$=1$***, then the test failed (and you wasted your time.