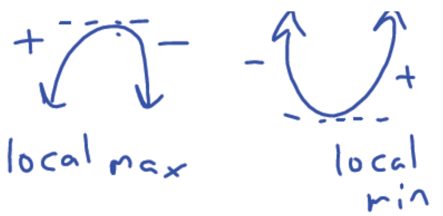
Lesson 1 - Critical Points & Turning Points

We have already discussed **critical points – points where the derivative is either zero or undefined**. (We will not refer to points as being critical points if the function is not defined at the point as well).

A turning point of a graph is a point where the derivative changes from negative to positive or vice versa.



The first derivative test can be used to find turning points. If a function has a turning point $(c, f(c))$ then $(c, f(c))$ must be a critical point (but the opposite is not true). That is a critical point might not be a turning point.

To use the first derivative test we find all values of *c* such that $f'(c) = 0$. (that is find all critical points). We then "test" each point to determine whether it is in fact a turning point.

1. Sketch the graph of the polynomial function $\boldsymbol{f(x) = x^4 - 8x^3 + 18x^2}$ by:

a) Determining the end-behaviour.

b) Finding any intercepts.

c) Find all critical points.

d) Determine whether or not a critical point is a turning point. You can either check y-values on either side of the critical point, or check the derivative on either side (to see if the graph goes from increasing to decreasing or vice versa).

Check the solution online when you have completed.

2. How many turning points are on the graph of $\boldsymbol{f(x) = 3x(x+2)^{\frac{2}{3}}}$

Check the solution online when you have completed.

3**. Show that the function has $\boldsymbol{y = \frac{x^3}{x^2+1}}$ no turning points.**

Check the solution online when you have completed.

If a critical point is not a turning point, then it must be an inflection point that also a horizontal tangent line. However, not all inflection points are critical points! An inflection point with a horiztontal tangent line is called a “saddle” point.

4. Visit desmos.com and see that you can in fact check your solutions using graphing software. (Important to know for this unit).

5. Complete textbook questions page 172 #1ck, #3, 11