For the following, find where a function is increasing or decreasing. Then find where it takes on local or global maximum or minimum values if these values exist.

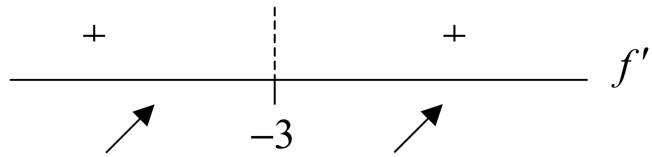
2. The function here is given as $f(x) = \dfrac{2x}{x+3}$.

i. Determine the **domain** of f. Since with $\dfrac{2x}{x+3}$ there is a fraction and $x = -3$ will result in division by 0 we must eliminate $x = -3$ from the domain. There is no possibility taking the radical of a number less than 0, so the domain for f is all real numbers, $(-\infty,-3)$ *and* $(-3,\infty)$. Next find the derivative of f. For $f(x) = \dfrac{2x}{x+3}$ using quotient rule,

$$f'(x) = \frac{(2x)'(x+3)-(2x)(x+3)'}{(x+3)^2}$$
$$= \frac{2(x+3)-(2x)1}{(x+3)^2}$$
$$= \frac{6}{(x+3)^2}$$

ii. Determine all possible **critical points** for the function. Recall critical points are values in the domain of f where the derivative f' is 0, or does not exist. Since $\dfrac{6}{(x+3)^2}$ only doesn't exist at $x = -3$, and this value **isn't** in the domain of f, $x = -3$ **IS NOT** a critical point. So f' always exist on $(-\infty,-3)$ *and* $(-3,\infty)$. Critical points will only possibly then occur at values of x where $f'(x) = 0$. Setting $f'(x) = 0$ we get that $\dfrac{6}{(x+3)^2} = 0$. Recall from algebra that a fraction can only be 0 when the numerator is 0, but $6 \neq 0$ so $f'(x) \neq 0$ on $(-\infty,-3)$ *and* $(-3,\infty)$. We reach the conclusion that there aren't any critical points.

iii. Next we create a $\pm$ number line **sign chart** for f'. First mark the point -3 on the sign chart as it was excluded from the domain. Since with $f'(x) = \dfrac{6}{(x+3)^2}$ the numerator and denominator are always + the derivative is always +. We can now easily create the following sign chart.



iv. Using the sign chart for the first derivative we can easily find intervals of **increase** and **decrease**. As $f' > 0$ on both sides of $x = -3$, the original function f is increasing when x is less than -3 and when x is greater than -3. As there are no critical points there are no **LOCAL MAX's** or **Min's**.

v. Since a **GLOBAL MAX** will occur either at an end point of the domain of f or at a LOCAL MAX we can see that there is NO GLOBAL MAX, as there are no end points in $(-\infty,-3)$ *and* $(-3,\infty)$. Similarly there isn't a GLOBAL MIN .

Summary:

1) Critical Points: NONE

2) Intervals of Increase: $(-\infty,3)$ *and* $(-3,\infty)$

3) Intervals of Decrease: NONE

4) Local Max's: NONE

5) Local Min's: NONE

6) Global Max: NONE

7) Global Min: NONE