Evaluate the following limits

1. \( \lim_{x \to 2} 3x^3 - 8x + 7 \)

Always try to plug in \( x = a \). In this case, it’s \( x = 2 \). Since this is a polynomial, we know

\[
\lim_{x \to a} f(x) = f(a)
\]

therefore,

\[
\lim_{x \to 2} 3x^3 - 8x + 7 = 3(2)^3 - 8(2) + 7 = 15
\]

2. \( \lim_{x \to 3} \sqrt{\frac{2x^2 - 6}{x + 3}} \)

This function is a composition of a rational function and a radical. Both of them have the following property,

\[
\lim_{x \to a} f(x) = f(a), \text{ as long as } a \text{ is in the domain of } f(x)
\]

Therefore,

\[
\lim_{x \to 3} \sqrt{\frac{2x^2 - 6}{x + 3}} = \sqrt{\frac{2(3)^2 - 6}{(3) + 3}} = \sqrt{\frac{12}{6}} = \sqrt{2}
\]

3. \( \lim_{x \to 3} \frac{x^2 - 4x}{x^2 - 3x - 4} \)

This is another rational function that has the property

\[
\lim_{x \to a} f(x) = f(a), \text{ as long as } a \text{ is in the domain of } f(x)
\]

You just need to check if \( x = 3 \) is in the domain. You can check this by plugging it in. If you get 0 on the denominator, then \( x = 3 \) is not in the domain.

\[
\lim_{x \to 3} \frac{x^2 - 4x}{x^2 - 3x - 4} = \frac{(3)^2 - 4(3)}{(3)^2 - 3(3) - 4} = \frac{3}{4}
\]
Since \( x = 3 \) didn’t give us 0 on the denominator, \( x = 3 \) is in the domain of \( \frac{x^2 - 4x}{x^2 - 3x - 4} \)

4. \( \lim_{x \to 0} \frac{3x - 5}{|3x - 5|} \)

We have a hybrid rational function. The denominator is an absolute value function. But since you can absolute value anything, we just need to make sure \( x = 0 \) is in the domain (which it is). So let’s plug it in.

\[
\lim_{x \to 0} \frac{3x - 5}{|3x - 5|} = \frac{3(0) - 5}{|3(0) - 5|} = \frac{-5}{5} = -1
\]