Evaluate the following limits

1. $\lim_{x\to 4} \dfrac{x^2-4x}{x^2-3x-4}$

   (a) Try plugging in $x = 4$ to see what happens.

   $$\lim_{x\to 4} \frac{x^2-4x}{x^2-3x-4} = \frac{(4)^2-4(4)}{(4)^2-3(4)-4} = \frac{0}{0}$$

   (b) This is called an indeterminate. It means we can't get the value by just plugging in it. The limit might exist or it might not. We must use a different method. We work around this by factoring the top and bottom.

   (c) Factor the top and bottom

   $$\begin{aligned} \lim_{x\to 4} \frac{x^2-4x}{x^2-3x-4} &= \lim_{x\to 4} \frac{x(x-4)}{(x-4)(x+1)} \\ &= \lim_{x\to 4} \frac{x}{x+1} \\ &= \frac{4}{5} \end{aligned}$$

2. $\lim_{x\to 0} \dfrac{x}{3x^2+x}$

   (a) Try plugging in $x = 0$ to see what happens.

   $$\lim_{x\to 0} \frac{x}{3x^2+x} = \frac{0}{3(0)^2+0} = \frac{0}{0}$$

   (b) This is called an indeterminate. It means we can't get the value by just plugging in it. The limit might exist or it might not. We must use a different method. We work around this by factoring the top and bottom.

   (c) Factor the top and bottom

$$\begin{aligned}\lim_{x\to 0}\frac{x}{3x^2+x} &= \lim_{x\to 0}\frac{x}{x(3x+1)}\\ &= \lim_{x\to 0}\frac{1}{3x+1}\\ &= \frac{1}{3(0)+1}\\ &= 1\end{aligned}$$

3. $\lim_{x\to -5}\dfrac{3x^2+22x+35}{2x^2+9x-5}$

   (a) Try plugging in $x=-5$ to see what happens.

$$\lim_{x\to -5}\frac{3x^2+22x+35}{2x^2+9x-5} = \frac{3(-5)^2+22(-5)+35}{2(-5)^2+9(-5)-5} = \frac{0}{0}$$

   (b) This is called an indeterminate. It means we can't get the value by just plugging in it. The limit might exist or it might not. We must use a different method. We work around this by factoring the top and bottom.

   (c) Factor the top and bottom

$$\begin{aligned}\lim_{x\to -5}\frac{3x^2+22x+35}{2x^2+9x-5} &= \lim_{x\to -5}\frac{(x+5)(3x+7)}{(x+5)(2x-1)}\\ &= \lim_{x\to -5}\frac{3x+7}{2x-1}\\ &= \frac{3(-5)+7}{2(-5)-1}\\ &= \frac{8}{11}\end{aligned}$$