1) Find \( \lim_{x \to \frac{\pi}{2}^-} \frac{1}{\tan(x)} \),

Recall: \( \frac{1}{\tan(x)} = \frac{1}{\frac{\sin(x)}{\cos(x)}} = \frac{\cos(x)}{\sin(x)} \)

\( \sin(\frac{\pi}{2}) = 1 \) and \( \cos(\frac{\pi}{2}) = 0 \)

So as \( x \) approaches \( \frac{\pi}{2} \) from the left, \( \cos(x) \) goes to 0
and \( \sin(x) \) goes to 1.

So \( \lim_{x \to \frac{\pi}{2}^-} \frac{1}{\tan(x)} = \lim_{x \to \frac{\pi}{2}^-} \frac{\cos(x)}{\sin(x)} = \frac{0}{1} = 0 \)

\[ \lim_{x \to \frac{\pi}{2}^-} \frac{1}{\tan(x)} = 0 \]
2) Find the horizontal and vertical asymptotes of \( f(x) = \frac{2x+3}{(x-4)^2} \).

**Horizontal asymptotes**

\[
\lim_{x \to \infty} \frac{2x + 3}{(x-4)^2} = \lim_{x \to \infty} \frac{2x + 3}{x^2 - 8x + 16} = \lim_{x \to \infty} \frac{\frac{2x + 3}{x^2}}{\frac{x^2 - 8x + 16}{x^2}} = \lim_{x \to \infty} \frac{\frac{2}{x} + \frac{3}{x^2}}{1 - \frac{8}{x} + \frac{16}{x^2}} = 0
\]

Similarly,

\[
\lim_{x \to -\infty} \frac{2x + 3}{x^2 - 8x + 16} = \lim_{x \to -\infty} \frac{\frac{2x + 3}{x^2}}{\frac{x^2 - 8x + 16}{x^2}} = \lim_{x \to -\infty} \frac{\frac{2}{x} + \frac{3}{x^2}}{1 - \frac{8}{x} + \frac{16}{x^2}} = 0
\]

So the line \( y = 0 \) is a horizontal asymptote as \( x \) goes to \( \infty \) and as \( x \) goes to \( -\infty \).

**Vertical asymptote**

The only possible vertical asymptote is where the denominator of \( f(x) \) is 0, which is at \( x = 4 \). To check that \( x = 4 \) is actually a vertical asymptote, we must check to see if the numerator is a non-zero number at \( x = 4 \). Well, \( 2x + 3 \) is 11 for \( x = 4 \). So as \( x \) approaches 4, the numerator of \( f(x) \) goes to 11 and the denominator goes to 0 which gives us a vertical asymptote.