Example

Find the range, period, phase shift, and equation of vertical asymptotes of the function.

\[ y = 12 \tan (14x - 3) \]

**SOLUTION:**

For the general function \( y = A \tan(\omega x - \phi) \), the range is \((-\infty, \infty)\), the period is \( \frac{\pi}{\omega} \), the phase shift is \( \frac{\phi}{\omega} \) and the equation of vertical asymptotes is \( \omega x - \phi = \frac{\pi}{2} + n\pi \) where \( n \) is an integer.

In this case, the range is \((-\infty, \infty)\).

In addition, \( \omega = 14 \), which means \( \frac{\pi}{\omega} = \frac{\pi}{14} \). So then the period is \( \frac{\pi}{14} \).

Also, \( \phi = 3 \), and so \( \frac{\phi}{\omega} = \frac{3}{14} \). This is the phase shift.

Finally, solve \( 14x - 3 = \frac{\pi}{2} + n\pi \) for \( x \), and we can get the equation of vertical asymptotes is:

\[ x = \frac{3}{14} + \frac{\pi}{28} + \frac{n\pi}{14}, \]

where \( n \) is an integer.