Log magnitude - Angle Diagram (Nichols plot)

⇒ Plot $|G(j\omega)|_{dB}$ vs. $\angle G(j\omega)$ as ω varies from ϕ to ∞

⇒ Angle in deg is horizontal axis

⇒ Magnitude in dB is vertical axis

⇒ Plot usually centered so "origin" corresponds to -180° in phase, ϕ dB in magnitude

Log magnitude - Angle Diagram (Nichols plot)

$\Rightarrow$ Plot $|G(j\omega)|_{dB}$ vs. $\angle G(j\omega)$ as ω varies from

0 to ∞

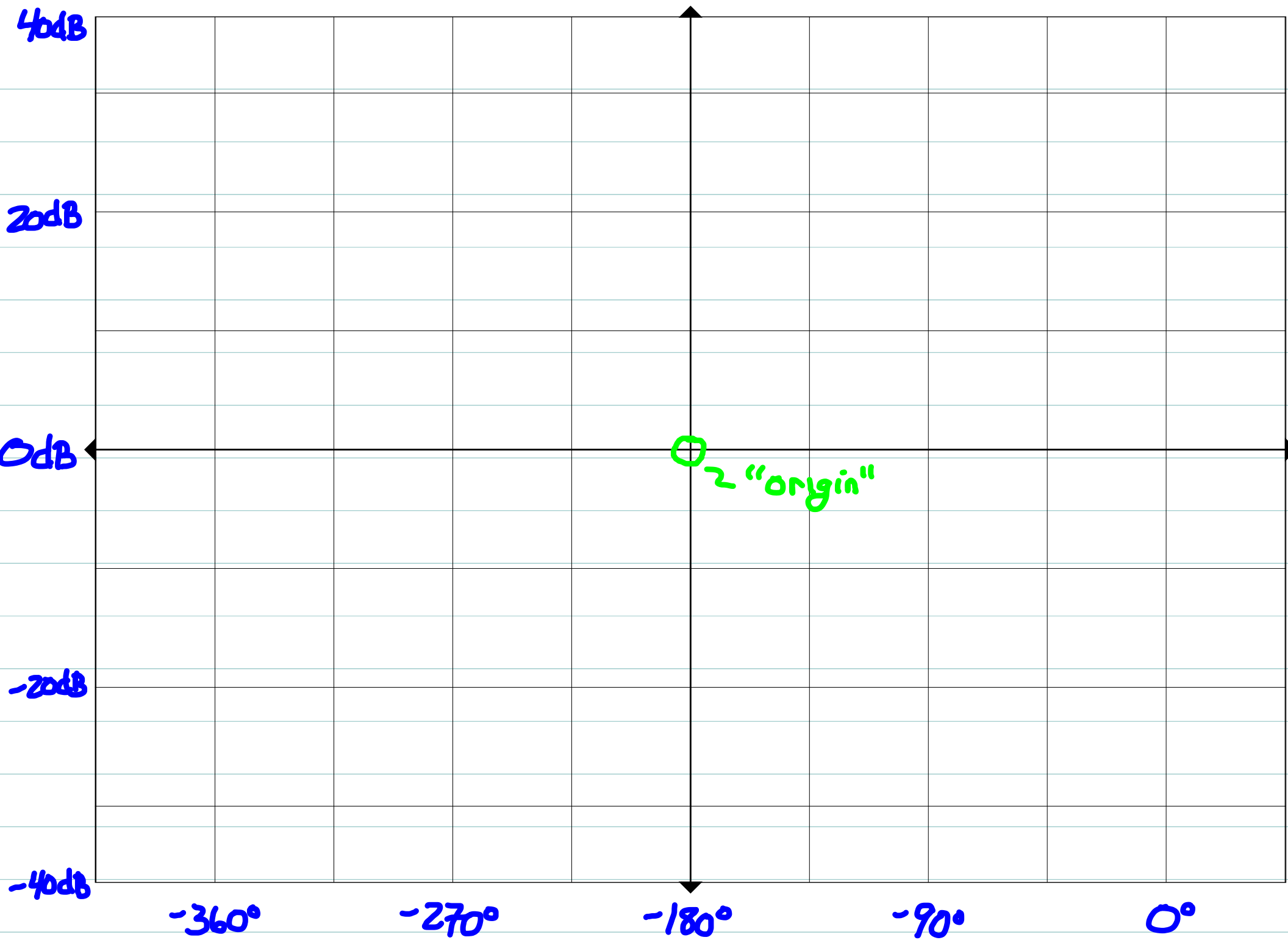
$\Rightarrow$ Angle in deg is horizontal axis

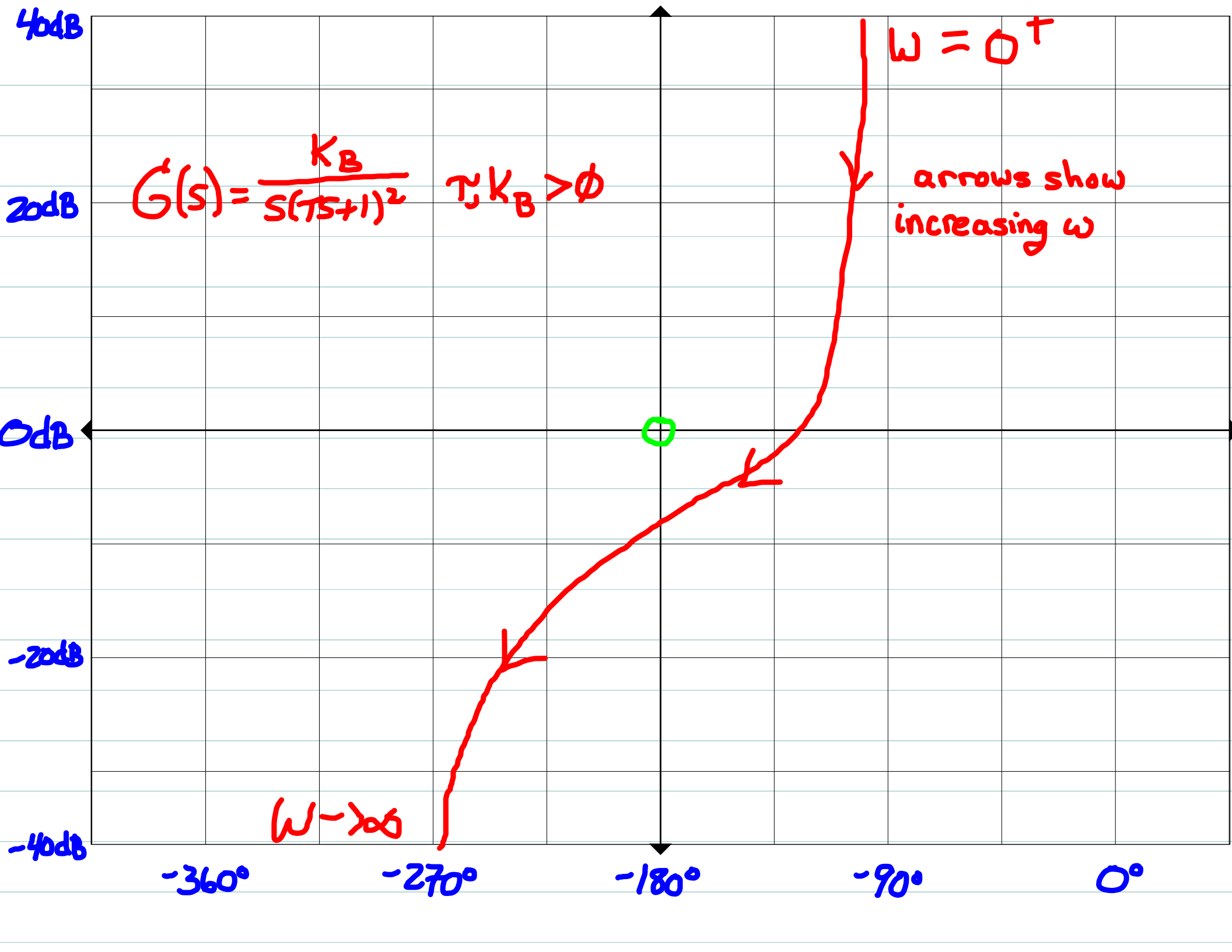
$\Rightarrow$ Magnitude in dB is vertical axis

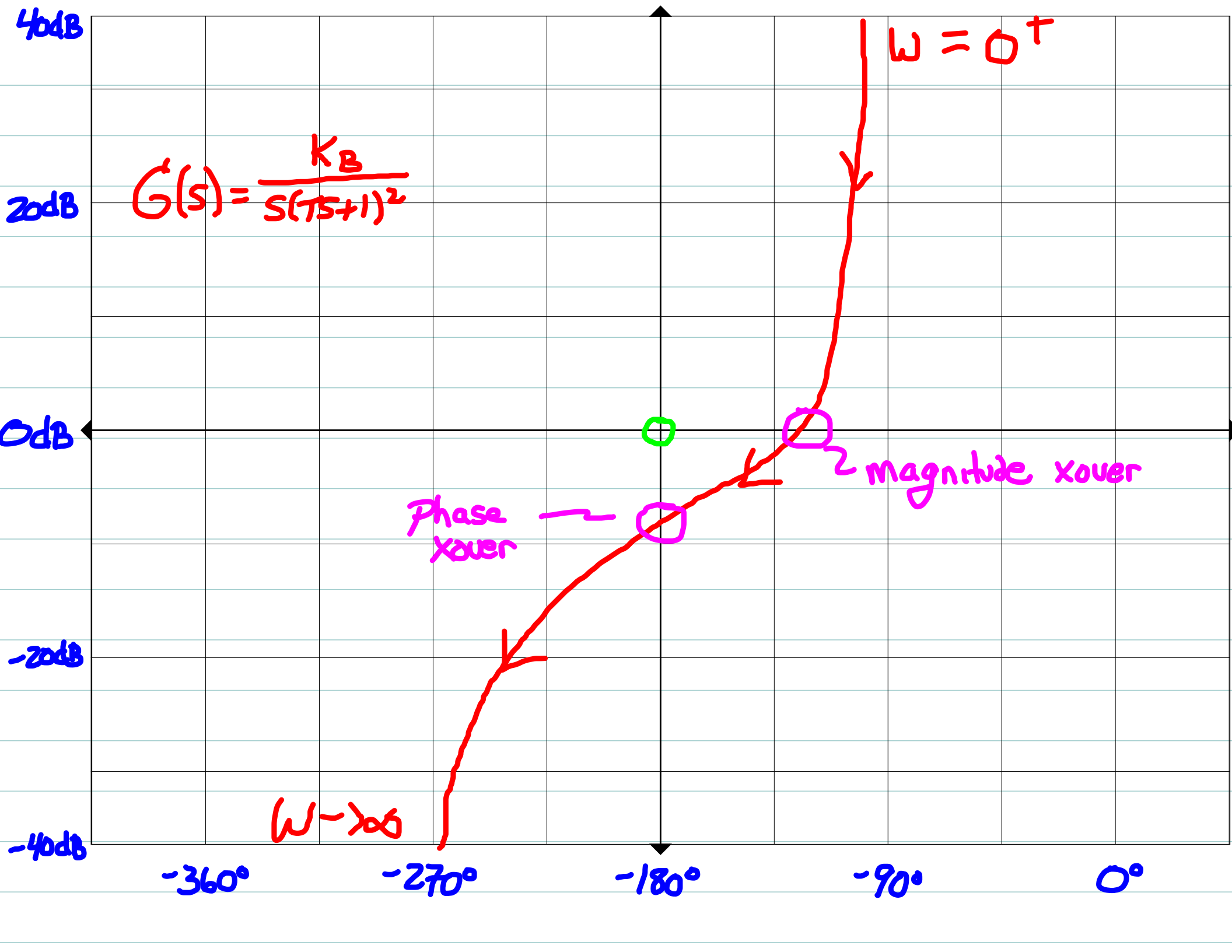
$\Rightarrow$ Plot usually centered so "origin" corresponds to

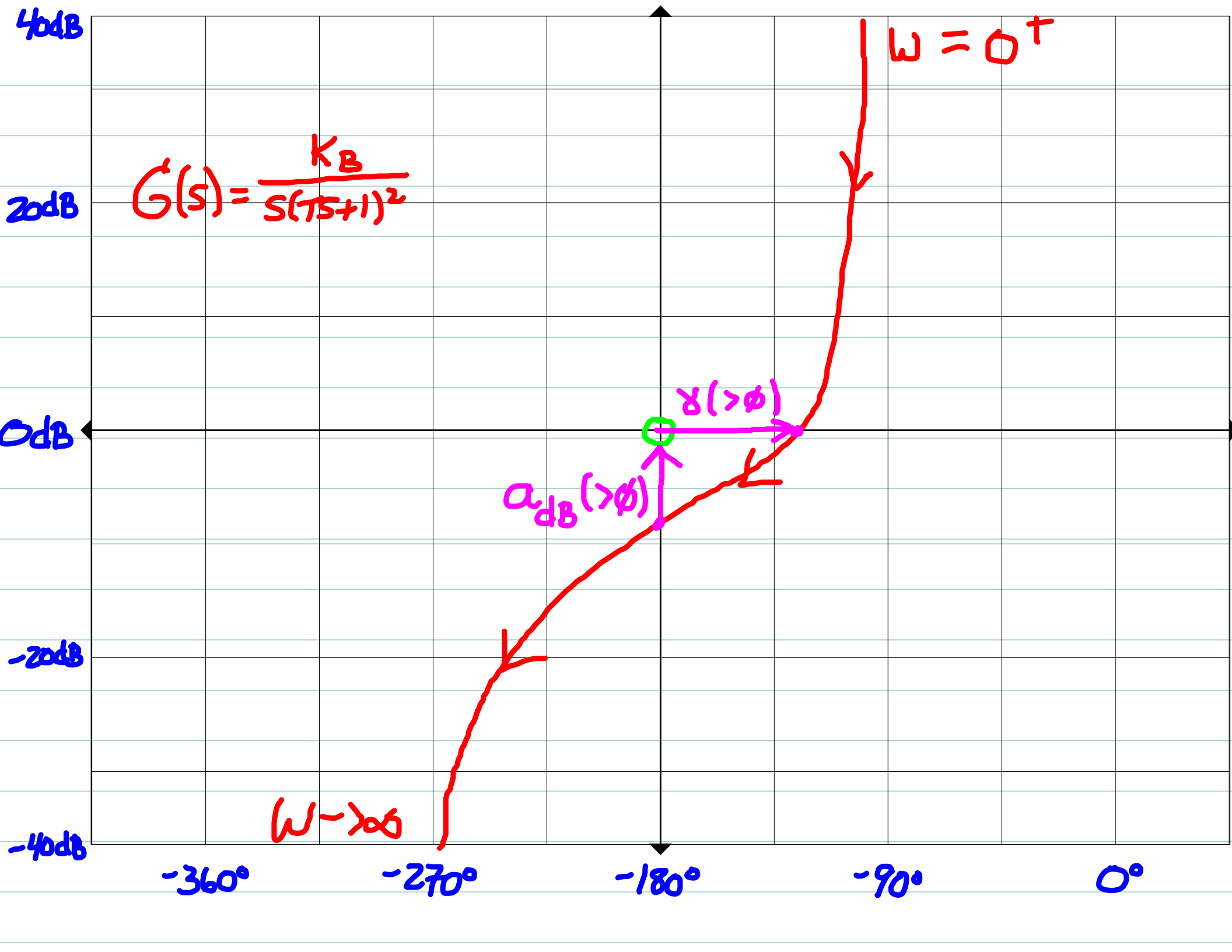
-180° in phase, 0 dB in magnitude

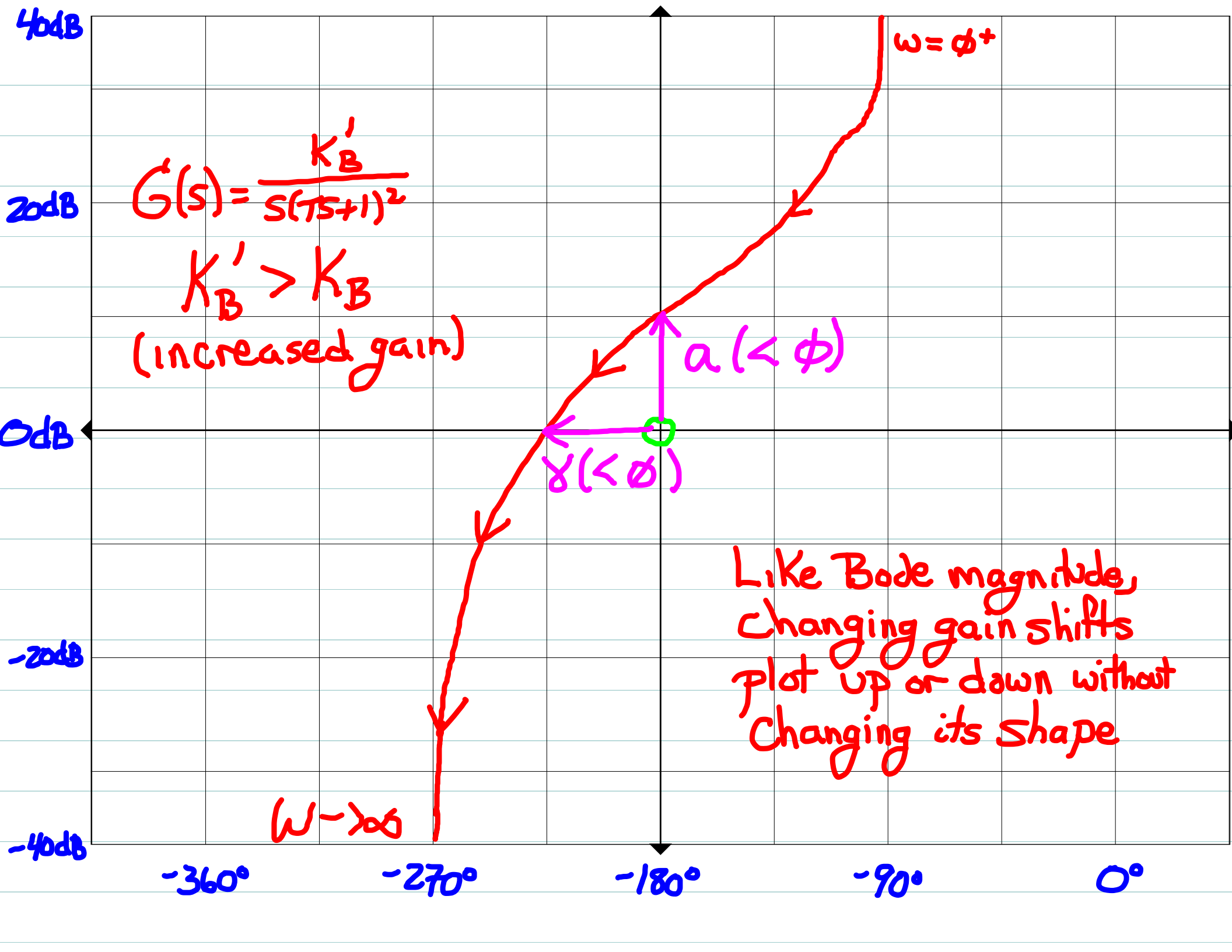
$\Rightarrow$ "origin" of plot corresponds to -1 point on polar diagram


40dB
20dB
0dB
-20dB
-40dB
-360°
-270°
-180°
-90°
0°
"origin"


40dB
20dB
0dB
-20dB
-40dB
-360°
-270°
-180°
-90°
0°
$G(s) = \frac{K_B}{s(Ts+1)^2}$
$T, K_B > 0$
$\omega = 0^+$
arrows show increasing ω
$\omega \to \infty$


40dB
20dB
0dB
-20dB
-40dB
$G(s) = \frac{K_B}{s(\tau s+1)^2}$
$\omega = 0^+$
magnitude xover
Phase xover
$\omega \to \infty$
-360°
-270°
-180°
-90°
0°


40dB
20dB
0dB
-20dB
-40dB
-360°
-270°
-180°
-90°
0°
$G(s) = \frac{K_B}{s(\tau s+1)^2}$
$\omega = 0^+$
$\gamma(>\phi)$
$a_{dB}(>\phi)$
$\omega \to \infty$


40dB
20dB
0dB
-20dB
-40dB
-360°
-270°
-180°
-90°
0°
$G(s) = \frac{K_B'}{s(Ts+1)^2}$
$K_B' > K_B$
(increased gain)
$\omega = \phi^+$
$a (< \phi)$
$\gamma (< \phi)$
$\omega \to \infty$
Like Bode magnitude, changing gain shifts plot up or down without changing its shape

⇒ Primary use is to easily see margins, measured along orthogonal axes relative to "origin"

⇒ Phase margin measured along horizontal axis to magnitude crossover point

⇒ positive if crossing is to right of "origin"
negative otherwise

⇒ Gain margin (in dB) measured along vertical axis to phase crossover point

⇒ positive if crossing is below "origin"
negative otherwise.

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⇒ Why is proximity of polar/Nichols to -1 so important??