

## $y=(\ln x)^n$ 의 그래프

※ 다음 각 함수의 그래프의 개형을 그리시오.

1.  $y = \ln x$

2.  $y = (\ln x)^2$

3.  $y = (\ln x)^3$

4.  $y = (\ln x)^4$

5.  $y = (\ln x)^n$  (단,  $n$ 은 3 이상의 홀수)

6.  $y = (\ln x)^n$  (단,  $n$ 은 짝수인 자연수)

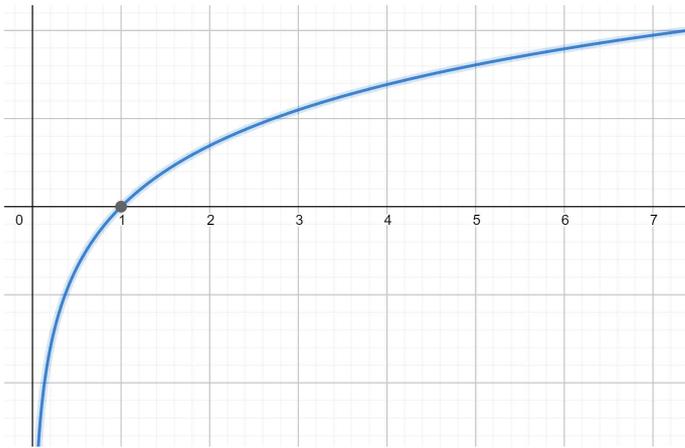
## $y = (\ln x)^n$ 의 그래프 -해답-

1.  $y = \ln x$

$$y' = \frac{1}{x} > 0 \Rightarrow \text{증가함수}$$

$$y'' = -\frac{1}{x^2} < 0 \Rightarrow \text{위로 볼록}$$

$$\lim_{x \rightarrow 0^+} \ln x = -\infty, \quad \lim_{x \rightarrow \infty} \ln x = \infty$$

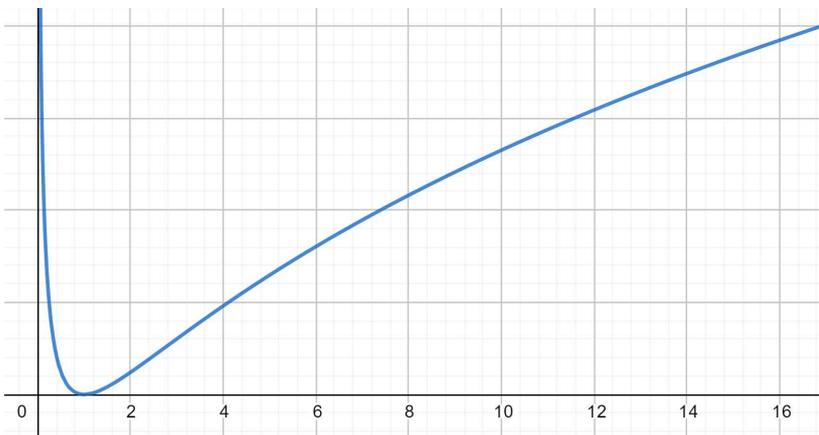


2.  $y = (\ln x)^2$

$$y' = \frac{2 \ln x}{x} \Rightarrow x = 1 \text{에서 극소(최소)}$$

$$y'' = \frac{2(1 - \ln x)}{x^2} \Rightarrow x = e \text{에서 변곡점}$$

$$\lim_{x \rightarrow 0^+} (\ln x)^2 = \infty, \quad \lim_{x \rightarrow \infty} (\ln x)^2 = \infty$$

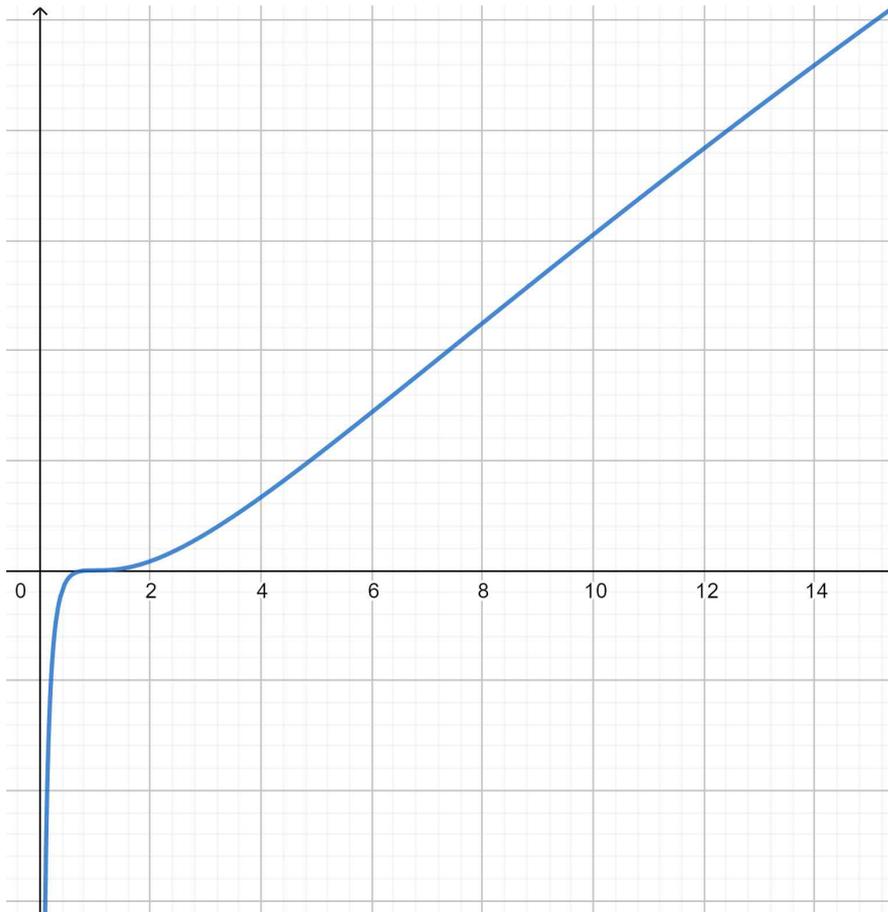


3.  $y = (\ln x)^3$

$$y' = \frac{3(\ln x)^2}{x} \geq 0 \Rightarrow \text{증가함수}$$

$$y'' = \frac{3\{2\ln x - (\ln x)^2\}}{x^2} = \frac{3\ln x(2 - \ln x)}{x^2} \Rightarrow x = 1, e^2 \text{에서 변곡점}$$

$$\lim_{x \rightarrow 0^+} (\ln x)^3 = -\infty, \lim_{x \rightarrow \infty} (\ln x)^3 = \infty$$

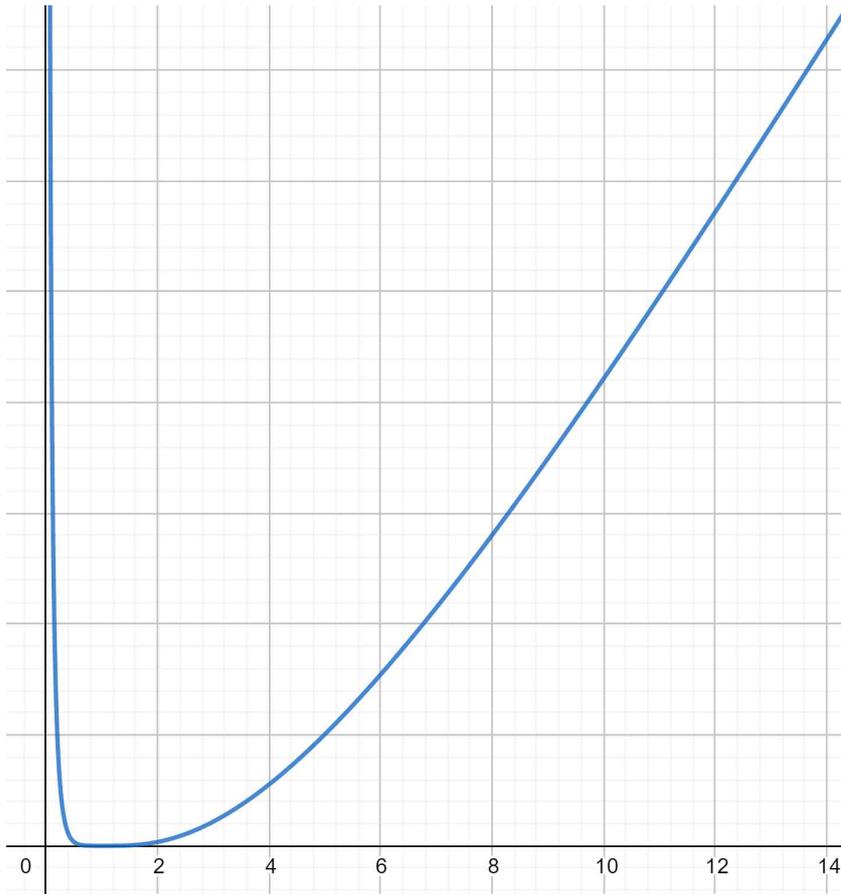


4.  $y = (\ln x)^4$

$y' = \frac{4(\ln x)^3}{x} \Rightarrow x = 1$ 에서 극소(최소)

$y'' = \frac{4\{3(\ln x)^2 - (\ln x)^3\}}{x^2} = \frac{4(\ln x)^2(3 - \ln x)}{x^2} \Rightarrow x = e^3$ 에서 변곡점

$\lim_{x \rightarrow 0^+} (\ln x)^4 = \infty, \lim_{x \rightarrow \infty} (\ln x)^4 = \infty$



5.  $y = (\ln x)^n$  (단,  $n$ 은 3 이상의 홀수)

$$y' = \frac{n(\ln x)^{n-1}}{x} \geq 0 \Leftrightarrow \text{증가함수}$$

$$y'' = \frac{n\{(n-1)(\ln x)^{n-2} - (\ln x)^{n-1}\}}{x^2} = \frac{n(\ln x)^{n-2}(n-1-\ln x)}{x^2} \Leftrightarrow x = 1, e^{n-1} \text{에서 변곡점}$$

$$\lim_{x \rightarrow 0^+} (\ln x)^n = -\infty, \lim_{x \rightarrow \infty} (\ln x)^n = \infty$$

6.  $y = (\ln x)^n$  (단,  $n$ 은 짝수인 자연수)

$$y' = \frac{n(\ln x)^{n-1}}{x} \Leftrightarrow x = 1 \text{에서 극소(최소)}$$

$$y'' = \frac{n\{(n-1)(\ln x)^{n-2} - (\ln x)^{n-1}\}}{x^2} = \frac{n(\ln x)^{n-2}(n-1-\ln x)}{x^2} \Leftrightarrow x = e^{n-1} \text{에서 변곡점}$$

$$\lim_{x \rightarrow 0^+} (\ln x)^n = \infty, \lim_{x \rightarrow \infty} (\ln x)^n = \infty$$