

Precalc
Solving LN Equations

$$\ln(\sqrt{2x}) - 1 = 4$$

$$\ln[(2x)^{1/2}] - 1 = 4$$

$$\ln[(2x)^{1/2}] = 5$$

$$(2) \cdot \frac{1}{2} \ln(2x) = 5(2)$$

$$\ln(2x) = 10$$

$$2x = \frac{e^{10}}{2}$$

$$x = \frac{e^{10}}{2} \checkmark$$

$$x \approx 11013.233$$

$$\ln(x-4) + \ln(x+1) = \ln(x-8)$$

$$\ln[(x-4)(x+1)] = \ln(x-8)$$

$$\ln(x^2 - 3x - 4) = \ln(x-8)$$

$$x^2 - 3x - 4 = x - 8$$

$$x^2 - 4x + 4 = 0$$

$$(x-2)(x-2) = 0$$

$$x-2 = 0$$

$$x = 2 \times$$

No solution

The graph shows the function $y = \ln(2x)$ in red and a horizontal line $y = 4$ in blue. The intersection point is labeled $(11013.233, 4)$.

The graph shows two curves: a green curve for $y = \ln(x+1)$ and a purple curve for $y = \ln(x-4)$. The purple curve has a vertical asymptote at $x=4$. The green curve has a vertical asymptote at $x=-1$. The two curves do not intersect.

graphs never intersect.

$$\ln(x+2) - \ln(4x+3) = \ln\left(\frac{1}{x}\right)$$

$$\ln\left[\frac{(x+2)}{(4x+3)}\right] = \ln\left(\frac{1}{x}\right)$$

$$\frac{x+2}{4x+3} \times \frac{1}{x} \rightarrow x(x+2) = 4x+3$$

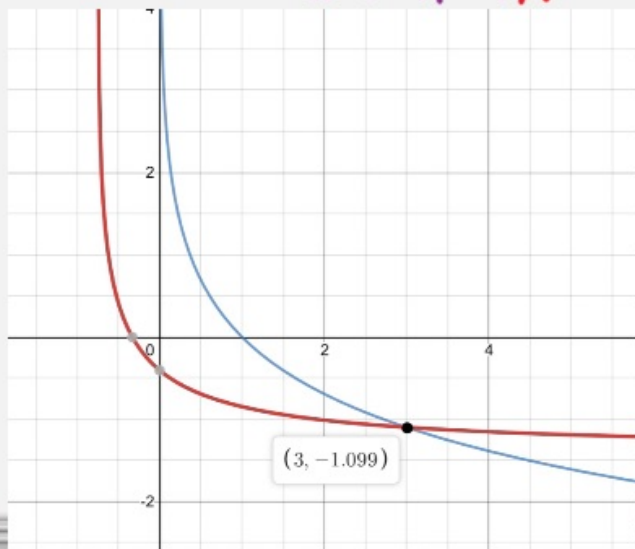
$$x^2 + 2x = 4x + 3$$

$$x^2 - 2x - 3 = 0 \quad \begin{matrix} -3 \\ \times \\ -2 \end{matrix}$$

$$(x-3)(x+1) = 0$$

$$x-3=0 \quad x+1=0$$

$$\checkmark x=3 \quad x=-1 \times$$



$$\ln(x-3) = \ln(7x-23) - \ln(x+1)$$

$$\ln(x-3) = \ln\left[\frac{(7x-23)}{(x+1)}\right]$$

$$\frac{(x-3)}{1} \times \frac{(7x-23)}{(x+1)}$$

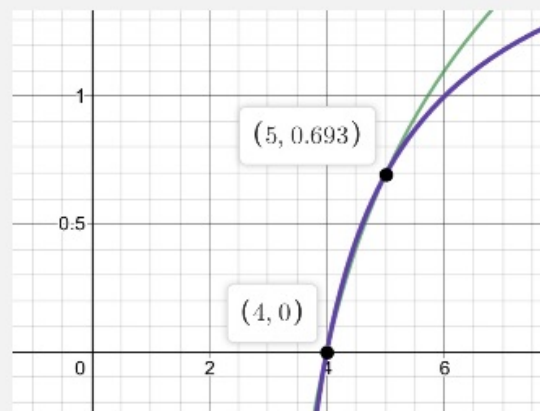
$$(x-3)(x+1) = (7x-23)$$

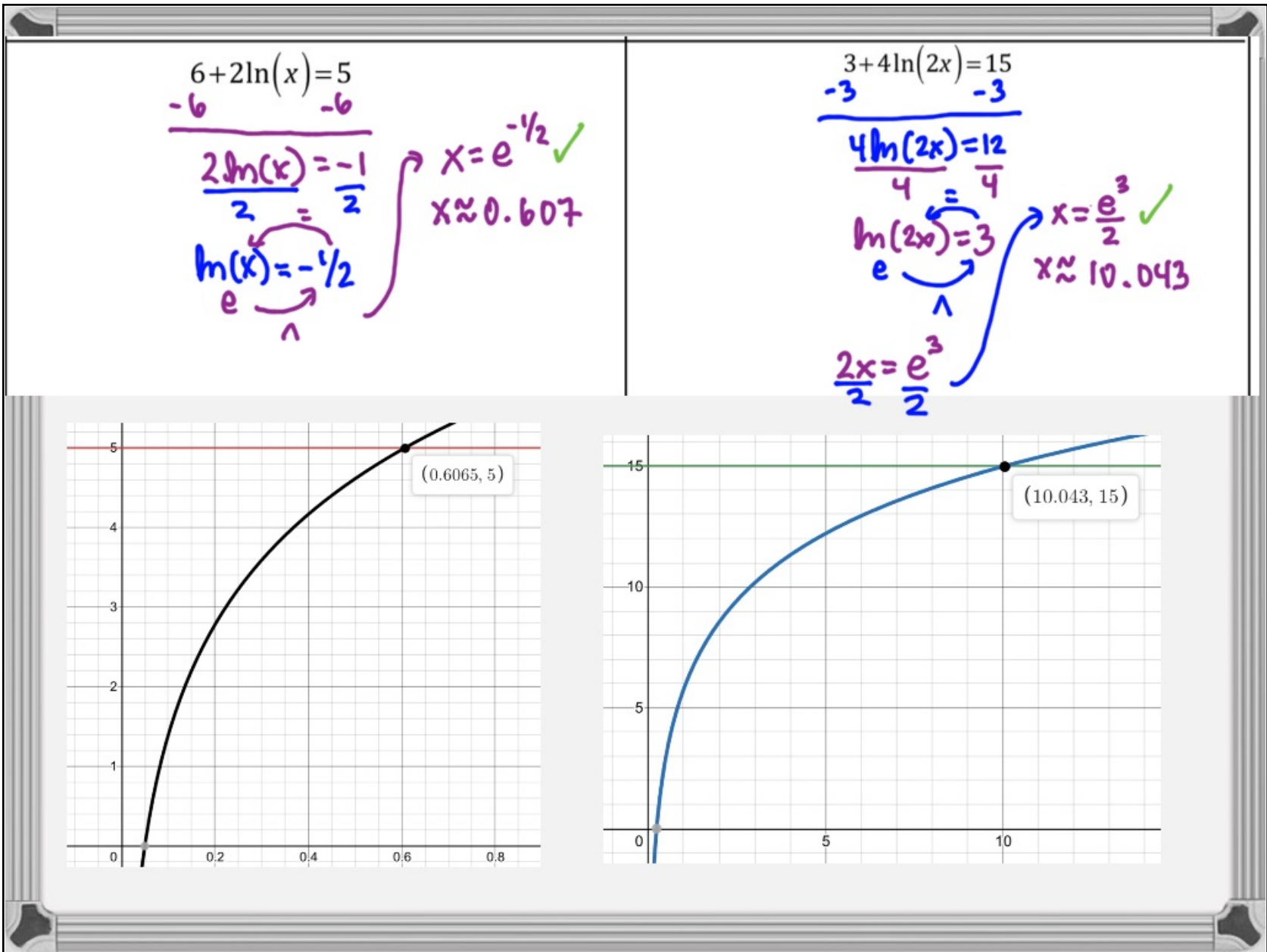
$$x^2 - 2x - 3 = 7x - 23$$

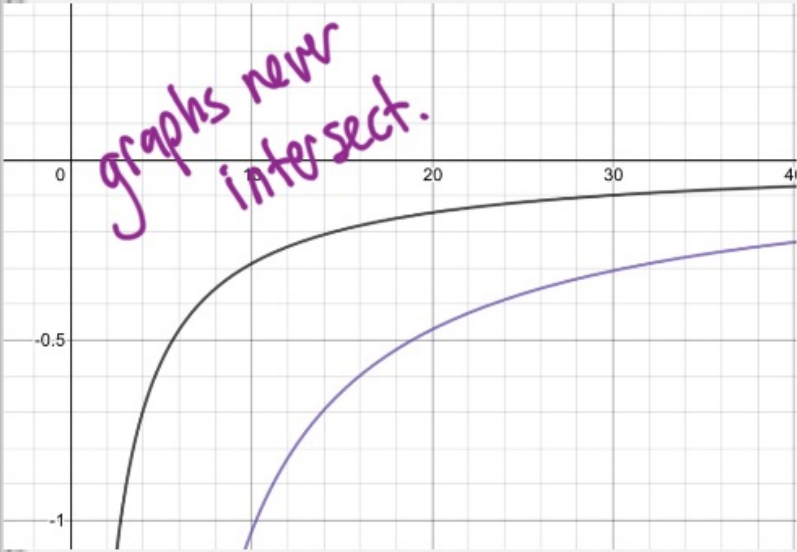
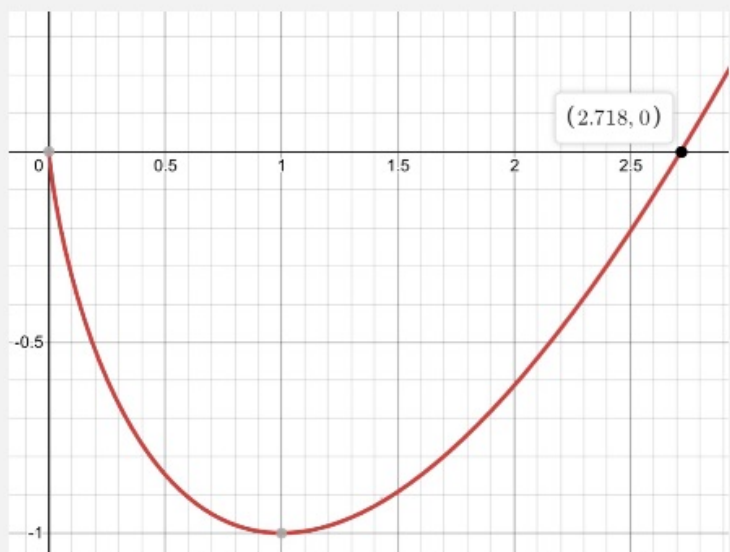
$$x^2 - 9x + 20 = 0 \quad \begin{matrix} -4 \\ \times \\ -5 \end{matrix}$$

$$(x-4)(x-5) = 0$$

$$\checkmark x=4 \quad x=5 \checkmark$$





$\ln(x-5) - \ln(x+4) = \ln(x-1) - \ln(x+2)$ $\ln\left[\frac{(x-5)}{(x+4)}\right] = \ln\left[\frac{(x-1)}{(x+2)}\right]$ $\frac{(x-5)}{(x+4)} \times \frac{(x-1)}{(x+2)} \rightarrow (x-5)(x+2) = (x-1)(x+4)$ $x^2 - 3x - 10 = x^2 + 3x - 4$ $-6x - 6 = x = -1 \quad \times$	$x \ln(x) - x = 0$ $x[\ln(x) - 1] = 0$ <p style="color: red;">$\times x = 0$</p> $\ln(x) - 1 = 0$ $\ln(x) = 1$ <p style="text-align: center;">e</p> $x = e \quad \checkmark$ $x \approx 2.718$
 <p style="color: purple; font-style: italic;">graphs never intersect.</p>	

$\ln^2(x) - 3\ln(x) + 2 = 0$

$$\begin{array}{r} 2 \\ -1 \times -2 \\ \hline -3 \end{array}$$

$$t^2 - 3t + 2 = 0 \quad \ln(x) = t$$

$$(t-1)(t-2) = 0$$

$t=1 \quad t=2$

$\ln(x) = 1$
 e

$\ln(x) = 2$
 e^2

$x = e \checkmark \quad x = e^2 \checkmark$
 $x \approx 2.718 \quad x \approx 7.389$

$\ln(2x+1) + \ln(x-3) - 2\ln(x) = 0$

$\ln[(2x+1)(x-3)] - \ln(x^2) = 0$

$+ \ln(x^2) + \ln(x^2)$

$\ln(2x^2 - 5x - 3) = \ln(x^2)$

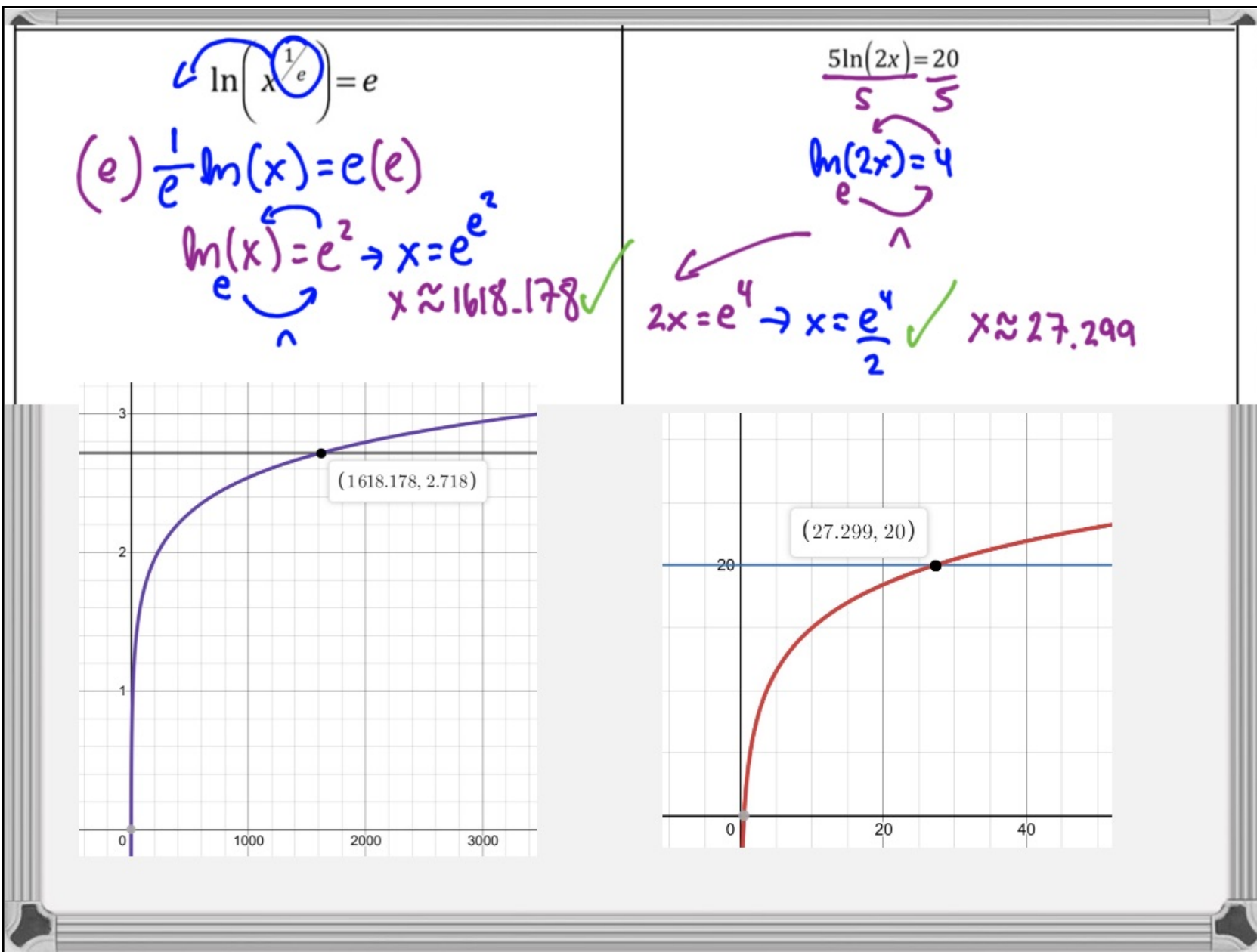
$2x^2 - 5x - 3 = x^2$

$-x^2 \quad -x^2$

$x^2 - 5x - 3 = 0$

$\frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-3)}}{2(1)}$

$\frac{5 \pm \sqrt{37}}{2} \rightarrow \approx 5.541 \checkmark$
 $\rightarrow \approx -0.541 \times$



$2\ln(\sqrt{x}) - \ln(1-x) = 2$

$\frac{1}{2}\ln(x^{1/2}) - \ln(1-x) = 2$

$2(\frac{1}{2})\ln(x) - \ln(1-x) = 2$

$\ln\left[\frac{x}{1-x}\right] = 2$

$\frac{x}{1-x} = e^2 \rightarrow x = e^2(1-x) \rightarrow x = e^2 - e^2x$

$x + e^2x = e^2$

$x(1+e^2) = e^2$

$x = \frac{e^2}{1+e^2} \approx 0.881$

$\frac{\ln x}{x^2 - 5x + 6} = 1$

$\ln(x) = x^2 - 5x + 6$

cannot solve algebraically.

$\ln^2(x) - 4 = 0$ <p style="text-align: right; color: purple;">$\ln(x) = t$</p> $t^2 - 4 = 0$ $t = \pm 2$ $\ln(x) = \pm 2$ <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> $\ln(x) = 2$ $x = e^2 \checkmark$ $x \approx 7.389$ </div> <div style="text-align: center;"> $\ln(x) = -2$ $x = e^{-2} \checkmark$ $x \approx 0.135$ </div> </div>	$e^{\ln(x^2-1)} = 3$ $x^2 - 1 = 3$ $x^2 = 4$ $x = \pm 2 \checkmark \checkmark$
