1) check your answers on the homework

2) new notes on natural logarithms

3) lots of practice because it makes perfect - and yes - finish for homework..

check homework

Name: _____ **Unit 7:** Exponential & Logarithmic Functions

Date: _____ **Bell:** _____ **Homework 6:** Solving Logarithmic Equations

**** This is a 2-page document! ****

Directions: Solve each equation. Check for extraneous solutions.

1. $\log_3(3x-11) = \log_3(25-x)$

$3x-11 = 25-x$

$4x-11 = 25$

$4x = 36$

$\boxed{x=9}$ ✓

2. $\log_7(4n-7) = \log_7(-3n)$

$4n-7 = -3n$

$-7 = -7n$

~~$1 = n$~~

No Solution!

3. $\log_2 75 = \log_2 3 + \log_2(2y-1)$

$\log_2 75 = \log_2(3(2y-1))$

$75 = 6y-3$

$78 = 6y$

$13 = y$

4. $2 \cdot \log m = \log 36$

$\log m^2 = \log 36$

$m^2 = 36$

$m^2 - 36 = 0$

$(m+6)(m-6) = 0$

~~$m=-6$~~ | $\boxed{m=6}$ ✓

5. $\log_4 108 - \log_4 9 = \log_4(7a-9)$

$\log_4 \frac{108}{9} = \log_4(7a-9)$

$12 = 7a-9$

$21 = 7a$

$\boxed{3=a}$ ✓

6. $\frac{1}{3} \cdot \log_5 64 = \log_5 8 + \log_5 p$

$\log_5 64^{1/3} = \log_5 8 \cdot p$

$4 = 8p$

$\boxed{\frac{1}{2} = p}$ ✓

7. $\log(w^2+21) = \log(10w)$

$w^2+21 = 10w$

$w^2-10w+21 = 0$

$(w-7)(w-3) = 0$

✓ $\boxed{w=7}$ | $\boxed{w=3}$ ✓

8. $\log_2(2x) + \log_2(x-7) = \log_2(4x)$

$\log_2(2x(x-7)) = \log_2(4x)$

$2x^2-14x = 4x$

$2x^2-18x = 0$

$2x(x-9) = 0$

~~$x=0$~~ | $\boxed{x=9}$ ✓

9. $\log_4(2m^3-14m^2)-\log_4(2m)=\log_4 8$

$\log_4\left(\frac{2m^3-14m^2}{2m}\right)=\log_4 8$

$m^2-7m=8$

$m^2-7m-8=0$

$(m-8)(m+1)=0$

✓ $m=8$ | ~~$m=-1$~~

10. $2\cdot\log(x-3)=\log 25$

$\log(x-3)^2=\log 25$

$x^2-6x+9=25$

$x^2-6x-16=0$

$(x-8)(x+2)=0$

✓ $x=8$ | ~~$x=-2$~~

11. $\log_3(2x-7)=4$

$3^4=2x-7$

$81=2x-7$

$88=2x$

$44=x$ ✓

12. $\log_8(28k-20)+15=18$

$\log_8(28k-20)=3$

$8^3=28k-20$

$512=28k-20$

$532=28k$

$19=k$ ✓

12. $\log_9(15-4n)=\frac{1}{2}$

$9^{1/2}=15-4n$

$3=15-4n$

$-12=-4n$

$3=n$ ✓

14. $\log_2 4+\log_2(c-9)=5$

$\log_2(4(c-9))=5$

$2^5=4c-36$

$32=4c-36$

$68=4c$

$17=c$ ✓

15. $2\cdot\log_4 k=4$

$\log_4 k^2=4$

$4^4=k^2$

$256=k^2$

$0=k^2-256$

$0=(k+16)(k-16)$

~~$k=-16$~~ | $k=16$ ✓

16. $\log_8(p^2+15)=2$

$8^2=p^2+15$

$64=p^2+15$

$49=p^2$

$0=p^2-49$

$0=(p+7)(p-7)$

✓ $p=-7$ | $p=7$ ✓

Let's Learn about The Natural Logarithm!

It's easy and more something to memorize for now until we get to applications next week!

In your notebook:

Base *e* and Natural Logs (*ln*)

Natural Base (*e*): $e \approx 2.71828....$ Find *e* on your calculator.. (2 places)

Natural Base Exponential Function: $y = e^x$ (inverse of ln)

Natural Logarithm (*ln*): $\log_e x = \ln x$ (inverse of e)

Example 1 **Evaluate Natural Bases**

a) e^2

b) $e^{-1.5}$

Julie:Erase the smileys to reveal answer

Use your calculator to see if you get the same answer.

Example 2 **Evaluate Natural Logs**

a) $\ln(4)$

b) $\ln(0.05)$

Notice the ln key on your calculator (that is the log base e)

Today's packet is much of what we've been doing (all the same rules and techniques apply - but with base e (natural logarithms :)

pass out and go over the next 2 pages as much as they need from you.

Name:	**Date:**
Topic:	**Class:**

Main Ideas/Questions	**Notes/Examples**		
What is "e"?	• e is an _____ _____ with an approximate value of _____. • e often occurs as the **base of exponential and logarithmic functions** that describe **real-world scenarios**.		
Base "e" Exponential Functions	• Exponential functions with base e are called _____ _____ exponential functions. • Example: _____		
Base "e" Logarithmic Functions	• Logarithmic functions with base e are called _____ _____ • Example: _____. This is often abbreivated as _____.		
Converting Between Forms	**Write each equation in logarithmic form.**		
	1. $e^x = 24$	**2.** $e^9 = x$	**3.** $e^{x+5} = 72$
	Write each equation in exponential form.		
	4. $\ln x = 58$	**5.** $\ln 6 = x$	**6.** $\ln (x-9) = 32$
Simplifying with Properties	**Condense each expression into a single logarithm.**		
	7. $\ln 3 + \ln 16$	**8.** $\ln 63 - 2 \cdot \ln 3$	**9.** $\frac{1}{3} \cdot \ln 64 + 2 \cdot \ln x$
	Expand each logarithm.		
	10. $\ln 5x$	**11.** $\ln \left(\frac{a^3}{b}\right)^2$	**12.** $\ln \sqrt[3]{m^2 n}$

Name:	Date:
Topic:	Class:

Main Ideas/Questions	Notes/Examples
What is "e"?	• e is an irrational number with an approximate value of 2.71828... . • e often occurs as the **base of exponential and logarithmic functions** that describe **real-world scenarios.**
Base "e" Exponential Functions	• Exponential functions with base e are called natural base exponential functions. • Example: $f(x) = e^x$
Base "e" Logarithmic Functions	• Logarithmic functions with base e are called natural logarithms • Example: $f(x) = \log_e x$. This is often abbreviated as $f(x) = \ln x$.
Converting Between Forms	**Write each equation in logarithmic form.**
	1. $e^x = 24$ → $\log_e 24 = x$, $\ln 24 = x$
	2. $e^9 = x$ → $\log_e x = 9$, $\ln x = 9$
	3. $e^{x+5} = 72$ → $\log_e 72 = x+5$, $\ln 72 = x+5$
	Write each equation in exponential form.
	4. $\ln_e x = 58$ → $e^{58} = x$
	5. $\ln_e 6 = x$ → $e^x = 6$
	6. $\ln_e (x-9) = 32$ → $e^{32} = x-9$
Simplifying with Properties	**Condense each expression into a single logarithm.**
	7. $\ln 3 + \ln 16$ → $\ln 3 \cdot 16$, $\ln 48$
	8. $\ln 63 - 2 \cdot \ln 3$ → $\ln \frac{63}{3^2}$, $\ln \frac{63}{9} = \ln 7$
	9. $\frac{1}{3} \cdot \ln 64 + 2 \cdot \ln x$ → $\ln 64^{1/3} \cdot x^2$, $\ln 4x^2$
	Expand each logarithm.
	10. $\ln 5x$ → $\ln 5 + \ln x$
	11. $\ln \left(\frac{a^3}{b}\right)^2 = \ln \frac{a^6}{b^2}$ → $6 \cdot \ln a - 2 \cdot \ln b$
	12. $\ln \sqrt[3]{m^2 n}$ → $\ln m^{2/3} n^{1/3}$, $\frac{2}{3} \cdot \ln m + \frac{1}{3} \ln n$

Solving Equations

Solve each equation below. Check for extraneous solutions.

13. $\ln(4x-27) = \ln(15-2x)$

14. $2 \cdot \ln k = \ln(2k+15)$

15. $\ln 72 - \ln 4 = \ln 6 + \ln(a-2)$

16. $2 \cdot \ln(m+4) = \ln 4$

17. $\ln 8x = 2$

18. $\ln x - \ln 9 = 7$

19. $e^x = 57$

20. $e^{y+3} - 6 = 24$

21. $5e^{4n} = 95$

22. $2e^{c-9} + 3 = 87$

Solving Equations

Solve each equation below. Check for extraneous solutions.

13. $\ln(4x-27) = \ln(15-2x)$

$4x-27 = 15-2x$

$6x = 42$

$\boxed{x=7}$

14. $2 \cdot \ln k = \ln(2k+15)$

$k^2 = 2k+15$

$k^2-2k-15=0$

$(k-5)(k+3)=0$

$\boxed{k=5}$ | ~~$k=-3$~~

15. $\ln 72 - \ln 4 = \ln 6 + \ln(a-2)$

$\frac{72}{4} = 6(a-2)$

$18 = 6a-12$

$30 = 6a$

$\boxed{5=a}$

16. $2 \cdot \ln(m+4) = \ln 4$

$(m+4)^2 = 4$

$m^2+8m+16 = 4$

$m^2+8m+12=0$

$(m+6)(m+2)=0$

~~$m=-6$~~ | $\boxed{m=-2}$

17. $\ln_e 8x = 2$

$e^2 = 8x$

$7.3891 = 8x$

$\boxed{0.9236 = x}$

18. $\ln x - \ln 9 = 7$

$\ln_e \frac{x}{9} = 7$

$e^7 = \frac{x}{9}$

$1096.6332 = \frac{x}{9}$

$\boxed{9869.6984 = x}$

19. $e^x = 57$

$\log_e 57 = x$

$\ln 57 = x$

$\boxed{4.0431 = x}$

20. $e^{y+3} - 6 = 24$

$e^{y+3} = 30$

$\log_e 30 = y+3$

$\ln 30 = y+3$

$3.4012 = y+3$

$\boxed{0.4012 = y}$

21. $5e^{4n} = 95$

$e^{4n} = 19$

$\log_e 19 = 4n$

$\ln 19 = 4n$

$2.9444 = 4n$

$\boxed{0.7361 = n}$

22. $2e^{c-9} + 3 = 87$

$2e^{c-9} = 84$

$e^{c-9} = 42$

$\log_e 42 = c-9$

$\ln 42 = c-9$

$3.7377 = c-9$

$\boxed{12.7377 = c}$

Name: _____ **Unit 7:** Exponential & Logarithmic Functions

Date: _____ **Bell:** _____ **Homework 9:** Base e and Natural Logarithms

**** This is a 2-page document! ****

Directions: Write each equation in logarithmic form.

1. $e^3 = x$	**2.** $e^x = 36$	**3.** $e^{x-9} = 74$

Directions: Write each equation in exponential form.

4. $\ln 53 = x$	**5.** $\ln x = 18$	**6.** $\ln 87 = x + 4$

Directions: Condense each expression as a single logarithm.

7. $\ln 4 + \ln 3x$	**8.** $\frac{1}{2} \cdot \ln 256 - 3 \cdot \ln 2$	**9.** $7 \cdot \ln a - 4 \cdot \ln b$

Directions: Expand each logarithmic expression.

10. $\ln(2m^8)$	**11.** $\ln\left(\frac{m^5}{n^2}\right)^3$	**12.** $\ln\sqrt{r^8 s^5}$

Directions: Solve each equation. Be sure to check for extraneous solutions.

13. $\ln(9x - 7) = \ln(5x + 33)$	**14.** $\ln(2x^2 - 15) = \ln(x^2 + 34)$

Name: _____ **Unit 7:** Exponential & Logarithmic Functions

Date: _____ **Bell:** _____ **Homework 9:** Base e and Natural Logarithms

**** This is a 2-page document! ****

Directions: Write each equation in logarithmic form.

1. $e^3 = x$

$3 = \ln x$

2. $e^x = 36$

$x = \ln 36$

3. $e^{x-9} = 74$

$x - 9 = \ln 74$

Directions: Write each equation in exponential form.

4. $\ln 53 = x$

$53 = e^x$

5. $\ln x = 18$

$x = e^{18}$

6. $\ln 87 = x + 4$

$87 = e^{x+4}$

Directions: Condense each expression as a single logarithm.

7. $\ln 4 + \ln 3x$

$\ln 12x$

8. $\frac{1}{2} \cdot \ln 256 - 3 \cdot \ln 2$

$\ln \frac{256^{1/2}}{2^3}$

$\ln 2$

9. $7 \cdot \ln a - 4 \cdot \ln b$

$\ln \frac{a^7}{b^4}$

Directions: Expand each logarithmic expression.

10. $\ln(2m^8)$

$\ln 2 + 8 \ln m$

11. $\ln\left(\frac{m^5}{n^2}\right)^3 = \ln \frac{m^{15}}{n^6}$

$15 \cdot \ln m - 6 \cdot \ln n$

12. $\ln\sqrt{r^8 s^5} = \ln r^4 s^{5/2}$

$4 \cdot \ln r + \frac{5}{2} \cdot \ln s$

Directions: Solve each equation. Be sure to check for extraneous solutions.

13. $\ln(9x - 7) = \ln(5x + 33)$

$9x - 7 = 5x + 33$

$4x = 40$

$\boxed{x = 10}$

14. $\ln(2x^2 - 15) = \ln(x^2 + 34)$

$2x^2 - 15 = x^2 + 34$

$x^2 = 49$

$x^2 - 49 = 0$

$(x + 7)(x - 7) = 0$

$\boxed{x = -7}$ $\boxed{x = 7}$

15. $\ln 60 - \ln 4 = \ln (x^2 + 2x)$	**16.** $\ln 8 + \ln(n - 9) = 5 \cdot \ln 2$
17. $\ln (4w + 9) = 5$	**18.** $\ln k - \ln 14 = 2$
19. $e^x = 21$	**20.** $-2e^c + 14 = -6$
21. $e^{y-1} - 27 = 54$	**22.** $4e^{3k} + 1 = 85$
23. $e^{5-2p} + 2 = 4$	**24.** $3e^{4m-7} - 8 = 106$

15. $\ln 60 - \ln 4 = \ln(x^2 + 2x)$

$\frac{60}{4} = x^2 + 2x$

$0 = x^2 + 2x - 15$

$0 = (x+5)(x-3)$

$x = -5$ | $x = 3$

16. $\ln 8 + \ln(n-9) = 5 \cdot \ln 2$

$8(n-9) = 2^5$

$8n - 72 = 32$

$8n = 104$

$n = 13$

17. $\ln(4w+9) = 5$

$4w + 9 = e^5$

$4w + 9 = 148.4132$

$4w = 139.4132$

$W = 34.8533$

18. $\ln k - \ln 14 = 2$

$\frac{k}{14} = e^2$

$\frac{k}{14} = 7.3891$

$K = 103.4468$

19. $e^x = 21$

$x = \ln 21$

$x = 3.0445$

20. $-2e^c + 14 = -6$

$-2e^c = -20$

$e^c = 10$

$c = \ln 10$

$c = 2.3026$

21. $e^{y-1} - 27 = 54$

$e^{y-1} = 81$

$y - 1 = \ln 81$

$y - 1 = 4.3944$

$y = 5.3944$

22. $4e^{3k} + 1 = 85$

$4e^{3k} = 84$

$e^{3k} = 21$

$3k = \ln 21$

$3k = 3.0445$

$k = 1.0148$

23. $e^{5-2p} + 2 = 4$

$e^{5-2p} = 2$

$5 - 2p = \ln 2$

$5 - 2p = 0.6931$

$-2p = -4.3069$

$p = 2.1534$

24. $3e^{4m-7} - 8 = 106$

$3e^{4m-7} = 114$

$e^{4m-7} = 38$

$4m - 7 = \ln 38$

$4m - 7 = 3.6376$

$4m = 10.6376$

$m = 2.6594$