

13.5 Natural Logs and Applications Day 1 Homework

**Directions:** Write each equation in logarithmic form.

1.  $e^3 = x$   
 $\ln x = 3$

2.  $e^x = 36$   
 $\ln 36 = x$

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

**Directions:** Write each equation in exponential form.

4.  $\ln 53 = x$   
 $e^x = 53$

5.  $\ln x = 18$   
 $e^{18} = x$

6.  $\ln 87 = x + 4$   
 $e^{x+4} = 87$

**Directions:** Condense each expression as a single logarithm.

7.  $\ln 4 + \ln 3x$   
 $\ln 12x$

8.  $\frac{1}{2} \cdot \ln 256 - 3 \cdot \ln 2$   
 $\ln \sqrt{256} - \ln 2^3$   
 $\ln \frac{16}{8} = \ln 2$

9.  $7 \cdot \ln a - 4 \cdot \ln b$   
 $\ln a^7 - \ln b^4$   
 $\ln \frac{a^7}{b^4}$

**Directions:** Expand each logarithmic expression.

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

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

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

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

13.  $\ln(9x - 7) = \ln(5x + 33)$   
 $9x - 7 = 5x + 33$   
 $4x = 40$   
 $x = 10$   
 $\ln(83) = \ln(83) \checkmark$

14.  $\ln(2x^2 - 15) = \ln(x^2 + 34)$   
 $2x^2 - 15 = x^2 + 34$   
 $x^2 = 49$   
 $x = \pm 7$   
 $x = 7$     $x = -7$   
 $\ln(83) = \ln(83) \checkmark$

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

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

$$15 = x^2 + 2x$$

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

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

$$x = -5 \quad x = 3$$

$$\ln 15 = \ln(15) \checkmark$$

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

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

$$8(n-9) = 32$$

$$8n - 72 = 32$$

$$8n = 104$$

$$n = 13$$

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

$$e^5 = 4w+9$$

$$148.4132 = 4w+9$$

$$4w = 139.4132$$

$$w \approx 34.8533$$

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

$$\ln \frac{k}{14} = 2$$

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

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

$$k \approx 103.4468$$

$$19. e^x = 21$$

$$\ln 21 = x$$

$$x \approx 3.0445$$

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

$$-2e^c = -20$$

$$e^c = 10$$

$$\ln 10 = c$$

$$c \approx 2.3026$$

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

$$e^{y-1} = 81$$

$$y-1 = \ln 81$$

$$y-1 = 4.3944$$

$$y \approx 5.3944$$

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

$$4e^{3k} = 84$$

$$e^{3k} = 21$$

$$\ln 21 = 3k$$

$$3.0445 = 3k$$

$$k \approx 1.0148$$

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

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

$$\ln 2 = 5-2p$$

$$0.6931 = 5-2p$$

$$-2p = -4.3069$$

$$p \approx 2.1534$$

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

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

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

$$\ln 38 = 4m-7$$

$$3.6376 = 4m-7$$

$$10.6376 = 4m$$

$$m \approx 2.6594$$