

## Key for Homework: Solving Exponential Equations

**Task:** Using two different methods (symbol manipulation and Goal Seek in spreadsheet), solve the following problems:

1.  $4^x = 3$  (solve for  $x$ )
2.  $6^{-t+1} = 22$  (solve for  $t$ )
3.  $6^{m+3} = 4^m$  (solve for  $m$ )

### Solutions:

1.  $4^x = 3$  (solve for  $x$ )

$$\log(4^x) = \log(3)$$

$$x \log(4) = \log(3)$$

$$x = \frac{\log(3)}{\log(4)}$$

Check:  $\frac{\log(3)}{\log(4)} \approx 0.792481$ ,  $4^{0.792481} \approx 2.99999896$ , equals 3 to within rounding error

2.  $6^{-t+1} = 22$  (solve for  $t$ )

$$\log(6^{-t+1}) = \log(22)$$

$$(-t+1) \cdot \log(6) = \log(22)$$

$$-t+1 = \frac{\log(22)}{\log(6)}$$

$$t = 1 - \frac{\log(22)}{\log(6)}$$

Check:  $1 - \frac{\log(22)}{\log(6)} \approx -0.725143$ .  $6^{-(0.725143)+1} \approx 21.999975$ , equals 22 to within rounding error

3.  $6^{m+3} = 4^m$  (solve for  $m$ )

$$\log(6^{m+3}) = \log(4^m)$$

$$(m+3) \cdot \log(6) = m \cdot \log(4)$$

$$m \cdot \log(6) + 3 \cdot \log(6) = m \cdot \log(4)$$

$$m \cdot \log(6) - m \cdot \log(4) = -3 \cdot \log(6)$$

$$m \cdot (\log(6) - \log(4)) = -3 \cdot \log(6)$$

$$m = \frac{-3 \cdot \log(6)}{\log(6) - \log(4)}$$

Check:  $\frac{-3 \cdot \log(6)}{\log(6) - \log(4)} \approx -13.25707$ ,  $6^{-13.25707+3} \approx 1.04339\text{E-}08$ ,  $4^{-13.25707} \approx 1.04339\text{E-}08$  also.