**1**. [10 points] Be sure to show your work on this problem. Parts **a.** and **b.** are not related.

**a**. [4 points] Solve for the exact value(s) of $w$ in the equation

$$\log(1-w) - \log(1+w) = 1.$$

If there are no solutions, write "no solutions" in the blank and explain your answer.

$w =$ -9/11 .

*Solution:* Combining the logs, we have

$$\log\left(\frac{1-w}{1+w}\right) = 1.$$

Using both sides as an exponent of 10, gives $\frac{1-w}{1+w} = 10$, so $1-w = 10(1+w)$. Combining like terms gives us $-9 = 11w$, so $w = -9/11$.

**b**. [6 points] Write the quadratic function $y = -2x^2 + 16x - 1$ in vertex form by completing the square, write the $x$ and $y$ coordinates of the vertex, and indicate whether the vertex is a minimum, maximum or neither by circling the appropriate option.

In vertex form, $y =$ $-2(x-4)^2 + 31$ .

The vertex is $(x, y) =$ (4,31) .

The vertex is a:

maximum minimum neither

*Solution:* The leading coefficient of this function is negative, so whatever our vertex is, it's a max because the parabola opens downward. To complete the square, first we factor out a -2 from the first two terms to get

$$-2(x^2 - 8x) - 1.$$

We need to add 16 inside the parentheses and so we compensate for this by adding 32 outside the parentheses

$$-2(x^2 - 8x + 16) - 1 + 32.$$

Factoring the perfect square we created and combining the constants outside the parentheses, we get

$$-2(x-4)^2 + 31.$$