First of all, we can rewrite the equation in terms of the variables w, x, y and z:

$$((-x^y)^z)^w$$

Now let's simplify this equation to make it easier to not only read, but also to work with:

$$(-1)^{zw}\ x^{yzw}$$

So now we know that the size depends on yzw and that the sign depends on if zw is even or odd as an even power will make it positive and an odd power will make it negative.

Now that we have that useful simplified equation and some useful rules, we can now start slowly dissecting the problem. First, the base can only be one from $\{1, 2, 3, 4\}$. The other three numbers would be our yzw. We can then deduce our possible exponents from that:

$$\{1, 2, 3\} = 6$$
$$\{1, 2, 4\} = 8$$
$$\{1, 3, 4\} = 12$$
$$\{2, 3, 4\} = 24$$

Next up, the signs are based on zw. zw is only negative when their values are $(3,1)$ or $(1,3)$ since they're odd.

Now we can simply put in our values and see how many cases there are:

$1^{24} = 1$ (cannot be negative as 1 is needed as an exponent for it to be negative)

$2^{12} = 4096$ or -4096 (as 1 and 3 can go to the exponent to make it negative as well)

$3^{8} = 6561$ (cannot be negative as 3 is needed as an exponent for it to be negative)

$4^{6} = 2^{12}$ so once again 4096 or -4096

Therefore, there are **4** distinct values: $-4096, 1, 4096, 6561$ and the highest value is 6561 while the lowest value is -4096.