

# Long Maturity Overflowing 192e18

The Hifi AMM relies heavily on the `pow` function part of PRBMath. This is an exponential function that accepts fractional values for both the base and the exponent. The implementation is based on the following mathematical identity:

$$x^y = 2^{\log_2(x)*y}$$

One limitation of the `exp2` function in PRBMath is that it doesn't accept exponents greater than 192 ( $192 * 10^{18}$  in the PRBMath format). In most cases, this is not a problem:

1. The Yield Space exponent is sub-unitary (smaller than 1), and most computations use this exponent directly, not its inverse.
2. There is a natural limit to how large the token amounts can be. E.g. `Circle` can't increase the total supply of USDC to one quadrillion without help from the FED (fingers-crossed we won't get there anytime soon).

However, there is one computation where the upper bound of the `exp2` function could pose a problem. That is the inversion of the Yield Space exponent:

$$\frac{1}{1-g*t}$$

Combined with a long-dated bond expiration time (used as a base to `pow`), a contract call could revert due to the exponent being greater than 192.

Possible solutions to explore:

1. Reimplement `pow` such that it accepts exponents greater than 192.
2. Renormalize the time to maturity such that 1 unit = 10 years.
3. Write a custom `pow` function that introduces a normalization factor (see how Yield does it) to skirt around the upper bounds of PRBMath.

We're open to other ideas as well.