

Rugby School

Nikarika Patel

## A Big Power

$$\begin{aligned} 2^{2000} &= 10^x \\ \therefore x &= \log 2^{2000} \\ x &= 2000 \log 2 \end{aligned}$$

$$\text{Let } \log 2 = y$$

$$\therefore 10^y = 2$$

Now, we know that  $8^{1/3}$  is 2.

$$\therefore y < 1/3$$

$y$  is only slightly smaller than 0.33

$$y \approx 0.31$$

$$\begin{aligned} \therefore 2^{2000} &\approx 10^{2000y} \\ &\approx 10^{620} \end{aligned}$$

$$\begin{aligned} 2^{16} &= 65536 \\ 2^{2000} &= (2^{16})^{125} \end{aligned}$$

Now, because  $2^{16}$  ends in 6,  $2^{2000}$  will also end in 6.

$$\text{Now } 6^1 = \underline{06}$$

$$6^2 = \underline{36}$$

$$6^3 = \underline{216}$$

$$6^4 = \underline{1296}$$

$$6^5 = \underline{7776}$$

$$6^6 = \underline{\quad 56}$$

$$6^7 = \underline{\quad 36}$$

This goes in a pattern

$\therefore 65536^{125}$  will end in 76.