Investigation / Report: **Giant Numbers**

Mathematics challenge questions often include problems of the type, "What is the units digit of 7^{100}?" One solution method examines the following list:

$$7^1 = 7$$

$$7^2 = 49$$

$$7^3 = 343$$

$$7^4 = 2401$$

$$7^5 = 16807$$

$$7^6 = 117149$$

$$7^7 = 823543$$

Note the repeating pattern of the units digits above. $7^{100} = (7^4)^{25}$ Since the units digit of 7^4 is one, then the units digit of $(7^4)^{25}$ must be one since $(1)^{25} = 1$.

Investigate problems of this type and try other integers raised to large powers to find the patterns. Use a binomial expansion method from Algebra II to set up a way to evaluate this type of problem, such as:

$$7^{100} = (10-3)^{10}.$$

Write a report detailing your findings and illustrating methods of solution that could be used.