FACTOR IDENTIFICATION

BLAINE HOLCOMB

ABSTRACT. Cosines can be used to create a continuous equation to identify the factors of a number.

Theorem 1. *Factor Identification*
The number, x, is a factor of N, if and only if $cos(2\pi x) + cos(2\pi \frac{N}{x}) = 2$.

Proof. By definition, for any real number, x, $-1 \le cos(2\pi x) \le 1$ and $cos(2\pi x) = 1$ iff x is an integer. Since $-1 \le cos(2\pi x) \le 1$ for any x, then for any $y \in \mathfrak{R}$, $-2 \le (cos(2\pi x) + cos(2\pi y)) \le 2$. And, since $cos(2\pi x) = 1$ iff x is an integer, then $cos(2\pi y) = 1$ iff y is an integer. Hence, $cos(2\pi x) + cos(2\pi y) = 2$ iff x and y are both integers. Finally, for any natural number, N, x is an integer and $\frac{N}{x}$ is an integer iff x is a factor of N. Therefore, $(cos(2\pi x) + cos(2\pi \frac{N}{x})) = 2$ iff x is a factor of N. $\square$