Factoring POW

Find a general solution for the problem, what is the total T of all the factors (excluding the number itself) of a number N where $N = p^k \quad for\ p\ some\ prime\ number\ and\ k\ \varepsilon\ I$

P = 2	**P = 3**	**P = 5**
$T = p^k - 1$	$T = (p^k - 1)/2$	$T = (p^k - 1)/4$
N | **K** | **T** 2 | 1 | 1 4 | 2 | 3 8 | 3 | 7 16 | 4 | 15	**N** | **K** | **T** 3 | 1 | 1 9 | 2 | 4 27 | 3 | 13 81 | 4 | 40	**N** | **K** | **T** 5 | 1 | 1 25 | 2 | 6 125 | 3 | 31 625 | 4 | 156
$T = (p^k - 1)/(p - 1)$		

Proof:

$$T = \sum_{r=0}^{k-1} p^r$$

$$T = 1 + p + p^2 + \ ... \ + p^{k-2} + p^{k-1}$$

$$Tp = \quad p + p^2 + ... + \frac{p^k}{p} + p^k$$

$$-T = -1 - p - p^2 - ... - \frac{p^k}{p}$$

$$Tp - T = p^k - 1$$

Factor T out

$$T(p - 1) = p^k - 1$$

Divide both sides by (p - 1)

$$T = (p^k - 1)/(p - 1)$$