Euler characteristic

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The term *Euler characteristic* is defined for several objects.

If K is a finite simplicial complex of dimension m, let α_i be the number of simplexes of dimension i. The *Euler characteristic* of K is defined to be

$$\chi(K) = \sum_{i=0}^{m} (-1)^i \alpha_i.$$

Next, if K is a finite CW complex, let α_i be the number of i-cells in K. The *Euler characteristic* of K is defined to be

$$\chi(K) = \sum_{i \geq 0} (-1)^i \alpha_i.$$

If X is a finite polyhedron, with triangulation K, a simplicial complex, then the *Euler characteristic* of X is $\chi(K)$. It can be shown that all triangulations of X have the same value for $\chi(K)$ so that this is well-defined.

Finally, if $C = \{C_q\}$ is a finitely generated graded group, then the *Euler characteristic* of C is defined to be

$$\chi(C) = \sum_{q \geq 0} (-1)^q rank(C_q).$$