The point counts below are in moduli space, where each point is counted as the reciprocal of its stabilizer (in PGL_4). To get counts in parameter space, multiply by $\#\mathrm{PGL}_4(\mathbb{F}_q) = q^6(q^4-1)(q^3-1)(q^2-1)$. To get averages, divide by q^4.

Alternatively, the coefficient of $(-q)^i$ is the Betti number β_{4-i} of the associated cover of moduli space. To get the Betti numbers for the cover of parameter space, tensor with $H^*(\mathrm{PGL}_4)$.

In some identification with the blow up of 6 points (so defined up to $W(E_6)$), the exceptional divisors are named $E_1, \ldots, E_6$, the conics are named $F_1, \ldots, F_6$, and the lines through pairs of points are named $G_{12}, \ldots, G_{56}$.

Marking	Example	Unordered	Ordered
Nothing		q^4	Same as unordered
One line	E_1	q^4	Same as unordered
Two skew lines	E_1, E_2	q^4-q^3+1	$q^4-q^3+q^2-q+2$
Two intersecting lines	E_1, G_{12}	q^4	q^4-q+1
Three skew lines	E_1, E_2, E_3	$q^4-2q^3+q^2-q+4$	$q^4-4q^3+9q^2-15q+14$
Tritangent	E_1, F_2, G_{12}	q^4	q^4-q+1
Four skew lines	E_1, E_2, E_3, E_4	$q^4-2q^3+2q^2-3q+4$	$q^4-10q^3+45q^2-95q+75$
Five skew lines	$E_1, E_2, \ldots, E_5$	$q^4-q^3+q^2-q+2$	$q^4-15q^3+81q^2-185q+150$
Six skew lines	$E_1, E_2, \ldots, E_6$	q^4-q^3+1	$q^4-15q^3+81q^2-185q+150$
Double six	$E_1, \ldots, E_6, F_1, \ldots, F_6$	q^4-q^3	$q^4-15q^3+81q^2-185q+150$
Twenty-seven lines		q^4	$q^4-15q^3+81q^2-185q+150$