

1154-11-366

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We prove that if two Calabi-Yau invertible pencils have the same dual weights, then they share a common factor in their zeta functions. By using Dwork cohomology, we demonstrate that this common factor is related to a hypergeometric Picard-Fuchs differential equation. The factor in the zeta function is defined over the rationals and has degree at least the order of the Picard-Fuchs equation. As an application, we relate several pencils of K3 surfaces to the Dwork pencil, obtaining new cases of arithmetic mirror symmetry. (Received September 02, 2019)