

# Formulas for Photoshop blending modes

Posted: April 21st, 2010

Do you want to apply one of the Photoshop blending modes to two images but using a PixelMath-like tool? Here's a list of the current Photoshop blending modes and their equivalent PixelMath formula that I could find. While some of the formulas are precisely what Photoshop does, others are just an approximated guess. Also, blending modes that cannot be achieved by a straight PixelMath operation - such as Luminosity, Hue or Color - are excluded.

The formulas below assume the pixels in the image have a numeric range between 0 and 1, which is the default in PixInsight

In most cases, in order to mimic Photoshop's behavior, the option "Rescaled" in PixInsight's PixelMath should be checked, particularly those modes that could generate out-of-range values. Some other times, it doesn't matter, such as in the Darken and Lighten modes.

Blend mode	Commutativity	Formula	Addtl .info
Darken	commutative	$\min(\text{Target}, \text{Blend})$	
Multiply	commutative	$\text{Target} * \text{Blend}$	
Color Burn	non-commutative	$1 - (1 - \text{Target}) / \text{Blend}$	
Linear Burn	commutative	$\text{Target} + \text{Blend} - 1$	
Lighten	commutative	$\max(\text{Target}, \text{Blend})$	
Screen	commutative	$1 - (1 - \text{Target}) * (1 - \text{Blend})$	
Color Dodge	non-commutative	$\text{Target} / (1 - \text{Blend})$	
Linear Dodge	commutative	$\text{Target} + \text{Blend}$	
Overlay	non-commutative	$(\text{Target} > 0.5) * (1 - (1 - 2 * (\text{Target} - 0.5)) * (1 - \text{Blend})) + (\text{Target} \leq 0.5) * ((2 * \text{Target}) * \text{Blend})$	A combination of multiply and screen. Also the same as Hard Light commuted
Soft Light	non-commutative	$(\text{Blend} > 0.5) * (1 - (1 - \text{Target}) * (1 - (\text{Blend} - 0.5))) + (\text{Blend} \leq 0.5) * (\text{Target} * (\text{Blend} + 0.5))$	A combination of multiply and screen (The formula is only approximate)
Hard Light	non-commutative	$(\text{Blend} > 0.5) * (1 - (1 - \text{Target}) * (1 - 2 * (\text{Blend} - 0.5))) + (\text{Blend} \leq 0.5) * (\text{Target} * (2 * \text{Blend}))$	A combination of multiply and screen. Also the same as Overlay commuted
Vivid Light	non-commutative	$(\text{Blend} > 0.5) * (\text{Target} / (1 - 2 * (\text{Blend} - 0.5))) + (\text{Blend} \leq 0.5) * (1 - (1 - \text{Target}) / (2 * \text{Blend}))$	A combination of color burn and color dodge
Linear Light	non-commutative	$(\text{Blend} > 0.5) * (\text{Target} + 2 * (\text{Blend} - 0.5)) + (\text{Blend} \leq 0.5) * (\text{Target} + 2 * \text{Blend} - 1)$	A combination of linear burn and linear dodge
Pin Light	non-commutative	$(\text{Blend} > 0.5) * (\max(\text{Target}, 2 * (\text{Blend} - 0.5))) + (\text{Blend} \leq 0.5) * (\min(\text{Target}, 2 * \text{Blend}))$	A combination of darken and lighten
Difference	commutative	$ \text{Target} - \text{Blend} $	
Exclusion	commutative	$0.5 - 2 * (\text{Target} - 0.5) * (\text{Blend} - 0.5)$	