Mixing
Getting a Mixing Parameter

// create a value of 0. or 1. from the value of x with respect to the location of an edge:

float t = step( float edge, float x );

// create a value in the range 0. to 1. from the value of x with respect to the location of edge0 and edge1:

float t = smoothstep( float edge0, float edge1, float x );
Using that Mixing Parameter to Blend Two Quantities

// use the returned value from step( ) or smoothstep( ) to blend value0 to value1:

\[ T \text{ out} = \text{mix}( T \text{ value0}, T \text{ value1}, \text{float t}) ; \]

where \( T \) can be just about any type: float, vec2, vec3, vec4, ...

\[ \text{out} = (1.-t) \times \text{value}_0 + t \times \text{value}_1 \]

One would expect \( 0. \leq t \leq 1. \)
but that doesn’t have to be true. After all, these are just numbers.

For a fun exercise with this, change the morphing slider to go beyond 0.-1.

As we will see later, there are really good uses for going beyond the range 0.-1.
in float vX, vY;
in vec3 vColor;
in float vLightIntensity;

uniform float uA;
uniform float uP;
uniform float uTol;

const vec3 WHITE = vec3( 1., 1., 1. );

void main( )
{
    float f = fract( uA*vX );

    float t = smoothstep( 0.5-uP-uTol, 0.5-uP+uTol, f ) - smoothstep( 0.5+uP-uTol, 0.5+uP+uTol, f );
    vec3 rgb = vLightIntensity * mix( WHITE, vColor, t );
    gl_FragColor = vec3( rgb, 1. );
}
Moral: There are many ways to turn [ 0. - 1. ] into [ 0. - 1. ]
Sidebar: Why Do These Two Curves Match So Closely?

\[ y = \sin^2 \left( \frac{\pi}{2} x \right) \]

\[ y = 3x^2 - 2x^3 \]

The Taylor Series expansion of \[ y = \sin^2 \left( \frac{\pi}{2} x \right) \] around x=0.5 is:

\[
y = \left( \frac{1}{2} - \frac{\pi}{4} + \frac{\pi^3}{96} \right) + x \left( \frac{\pi}{2} - \frac{\pi^3}{16} \right) + x^2 \left( \frac{\pi^3}{8} \right) - x^3 \left( \frac{\pi^3}{12} \right)
\]

\[
= .038 -.37x + 3.88x^2 - 2.58x^3
\]

which is pretty close to:

\[ y = 3x^2 - 2x^3 \]
Cubic vs. Quintic

\[ y = 10x^3 - 15x^4 + 6x^5 \]

\[ y = 3x^2 - 2x^3 \]

Both go from 0. to 1.
Both have initial and final slopes of 0.
The quintic has initial and final curvatures of 0.