Mixing/Blending

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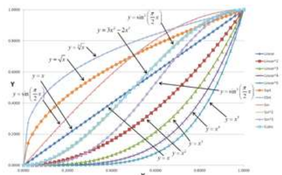
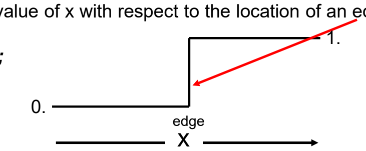


Getting a Mix/Blend Parameter

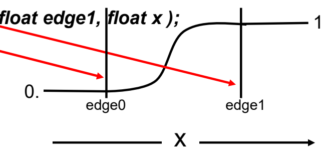
// create a value of **0.** ***or*** **1.** from the value of x with respect to the location of an edge:

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);



Note that neither step( ) nor smoothstep( ) does any mixing or blending by themselves! They each produce a blending *parameter* which is used by the mix( ) function.

Using that Mixing Parameter to Blend Two Quantities

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

T out = mix(T value0, T value1, float t);

where T can be just about any type: float, vec2, vec3, vec4, …

$$out = (1.\text{-}t) * value_0 + t * value_1$$

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.

Combine Two smoothsteps to Make a "SmoothPulse" in a Fragment Shader

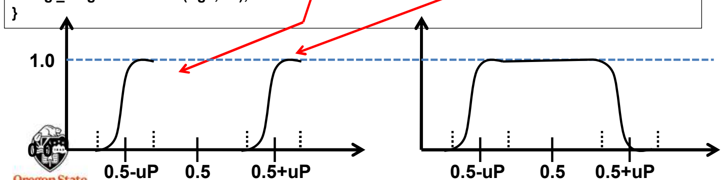
```
in float  vX, vY;
in vec3 vColor;
in float  vLightIntensity;

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. );
}
```



Fun With One: There are many ways to turn [0.-1.] into [0.-1.]

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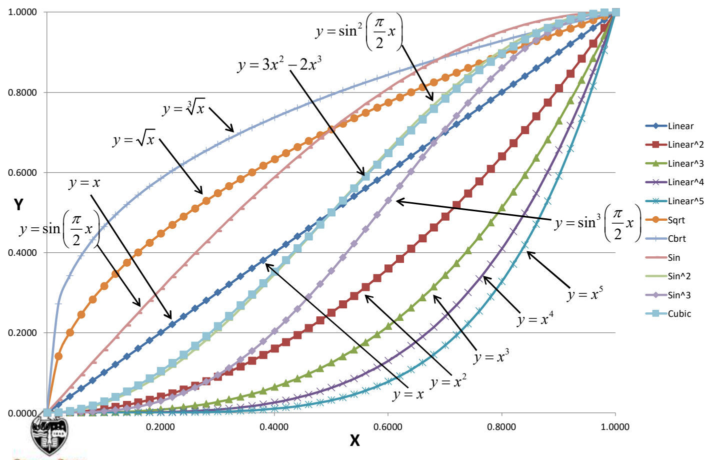

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Sidebar: Why Do These Two Curves Match So Closely?

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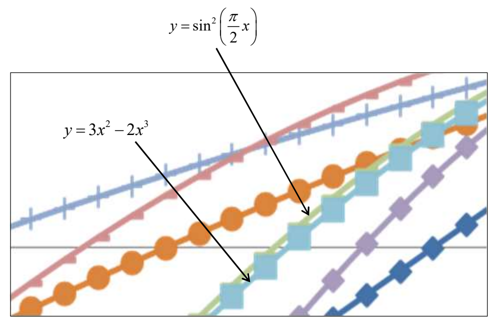

The Taylor Series expansion of $y = \sin^2\left(\frac{\pi}{2}x\right)$ around x=0.5 is:

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

$$= .038 - .37x + 3.88x^2 - 2.58x^3$$

which is pretty close to: $y = 3x^2 - 2x^3$

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Cubic vs. Quintic

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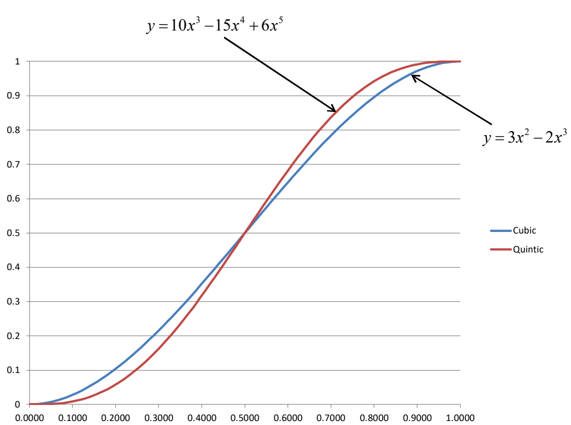

Both go from 0. to 1.
Both have initial and final slopes of 0.
The quintic has initial and final curvatures of 0.

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