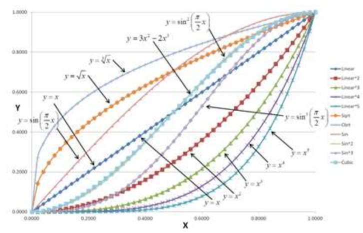
# Mixing/Blending

Oregon State University
Mike Bailey
mjb@cs.oregonstate.edu





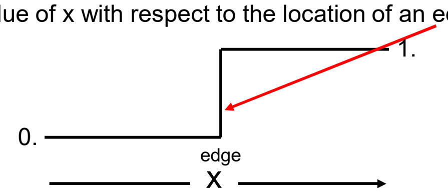




## Getting a Mix/Blend Parameter

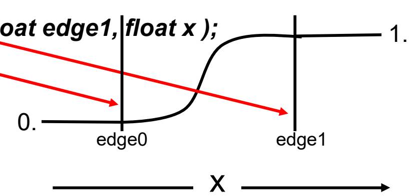
// create a value of **0.** ***or*** **1.** from the value of x with respect to the location of an edge:

***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, …

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

One would expect $0. \le t \le 1.$
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.

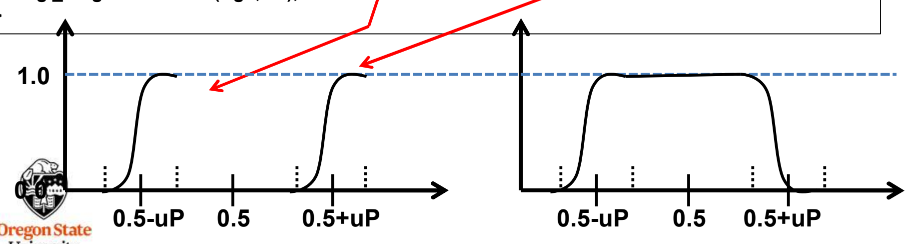
Oregon State
University
Computer Graphics



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



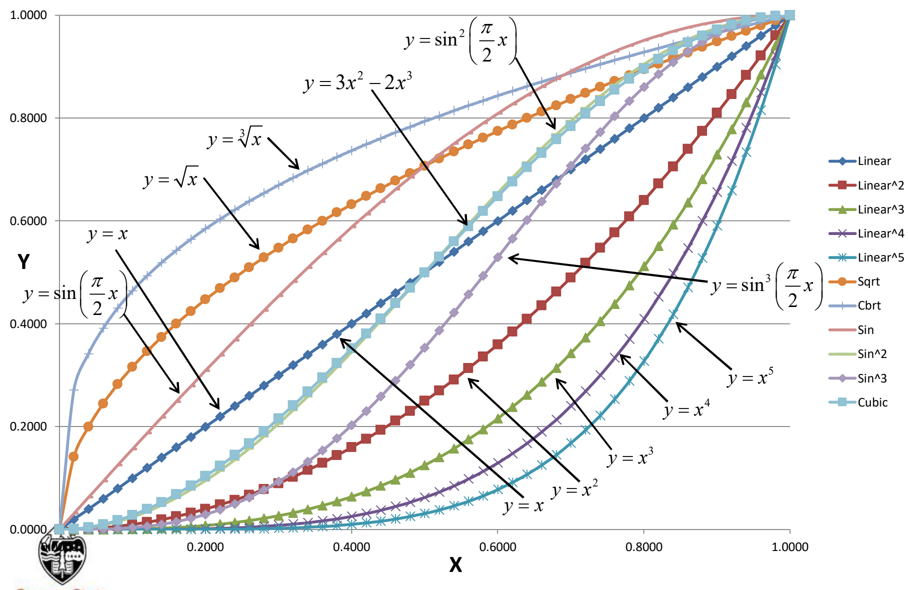
```
in float  vX, vY;
in vec3 vColor;
in float  vLightIntensity;

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. );
}
```




Oregon State
University
Computer Graphics

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



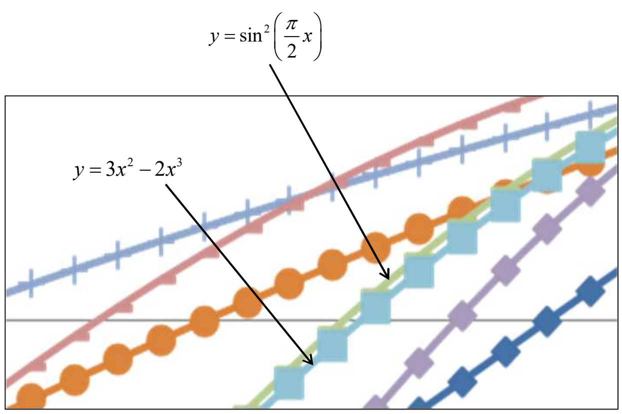



Oregon State University Computer Graphics



## Sidebar: Why Do These Two Curves Match So Closely?






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

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

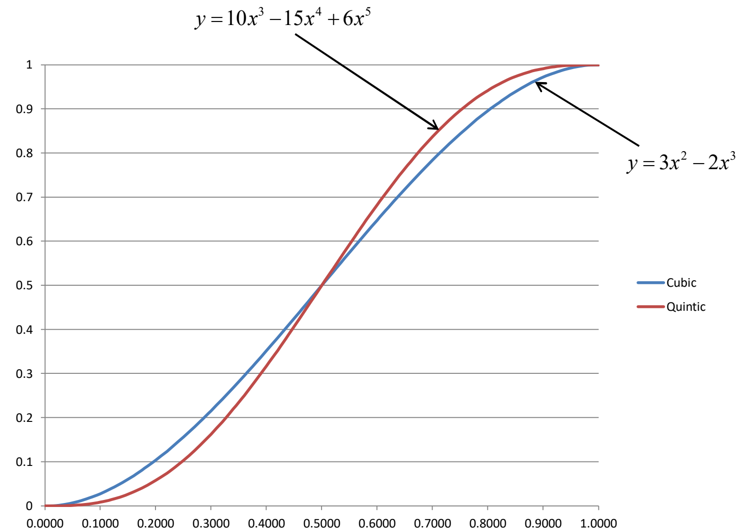
$$=.038-.37x+3.88x^2-2.58x^3$$

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

Oregon State University Computer Graphics

## Cubic vs. Quintic

7




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

Oregon State University
Computer Graphics

mjb – December 3, 2024