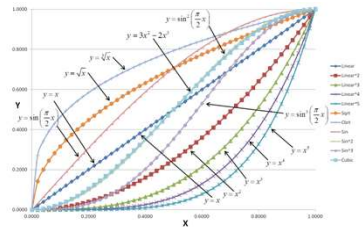
1

# Mixing

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






Oregon State University
Computer Graphics

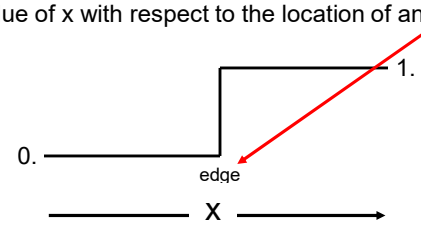


## Getting a Mixing Parameter

2

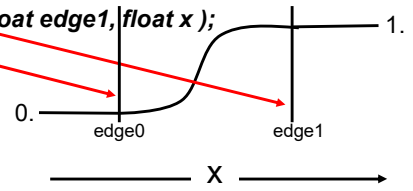
// create a value of **0. or 1.** from the value of x with respect to the location of an edge:

***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 );***




Oregon State University
Computer Graphics

## Using that Mixing Parameter to Blend Two Quantities

3

// 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, …

$$out = (1.-t) * value_0 + t * value_1$$

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.

Oregon State University
Computer Graphics

mjb – December 21, 2023

## "SmoothPulse" in a Fragment Shader

4

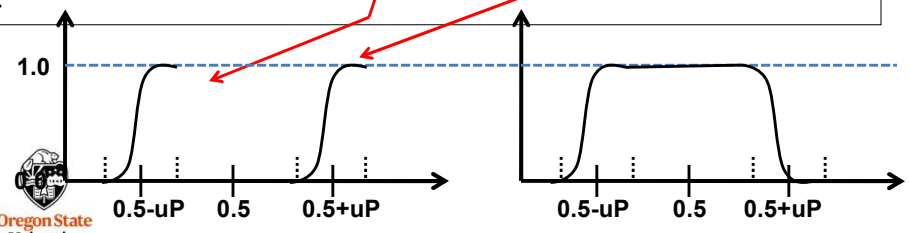
```
in float  vX, vY;
in vec3 vColor;
in float  vLightIntensity;

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. );
}
```

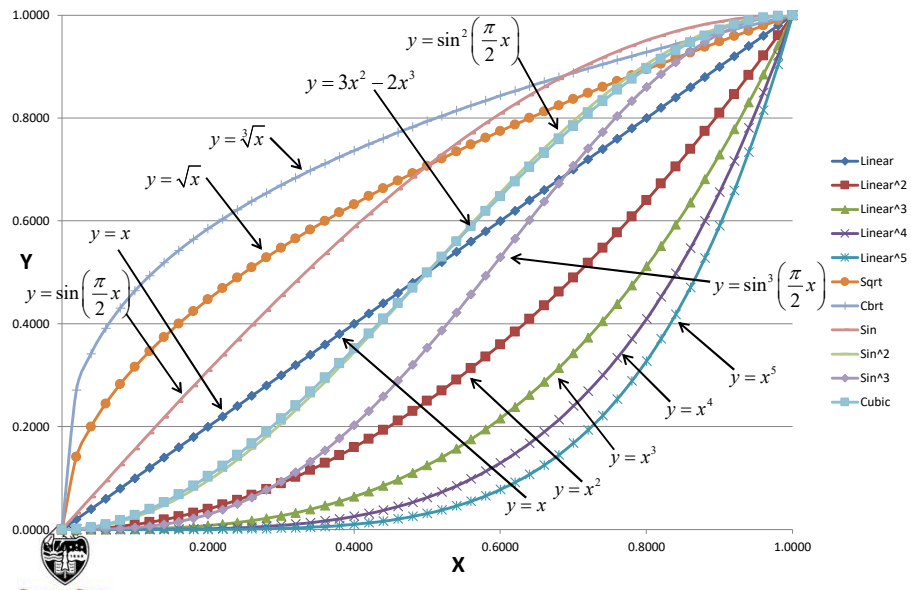



Oregon State University
Computer Graphics

mjb – December 21, 2023

## Fun With One

5



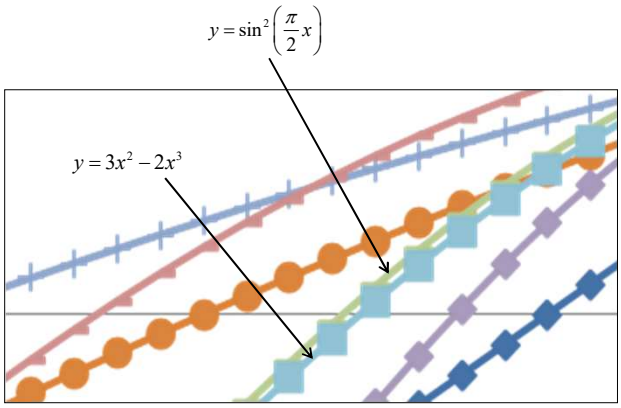

Oregon State

Moral: There are many ways to turn [ 0. - 1. ] into [ 0. - 1. ]

mjb – December 21, 2023

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

6




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

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

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

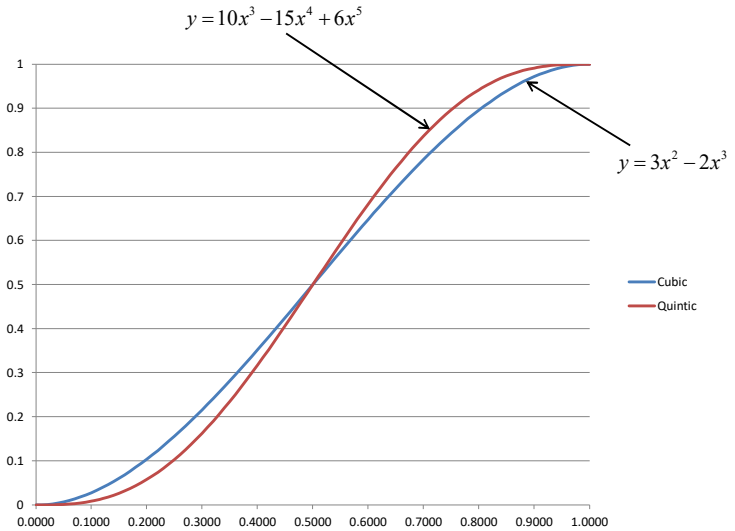
which is pretty close to: $y = 3x^2 - 2x^3$

Oregon State University
Computer Graphics

mjb – December 21, 2023

## Cubic vs. Quintic

7




Oregon State University
Computer Graphics

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

mjb – December 21, 2023