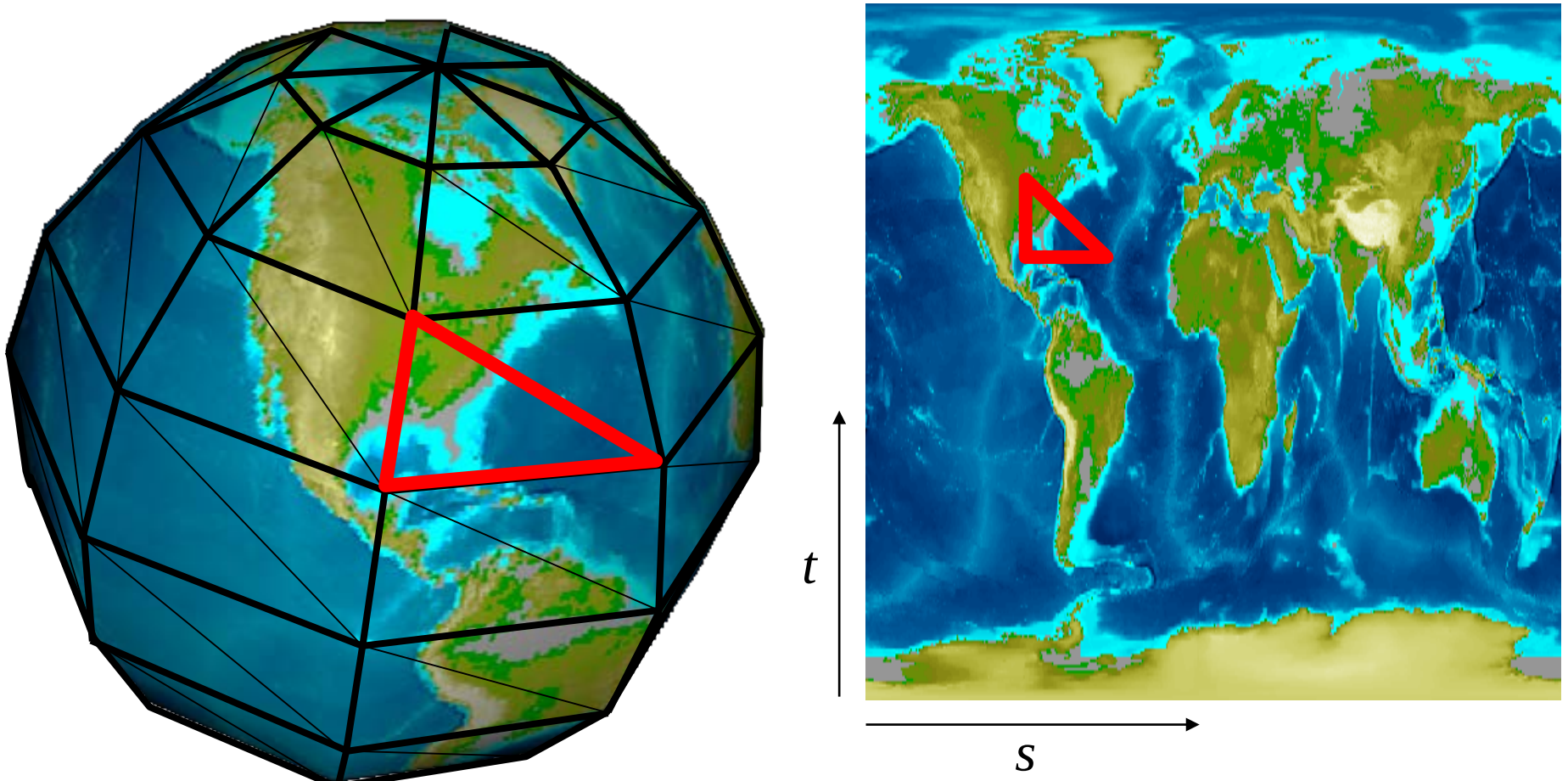
Perspective Correction

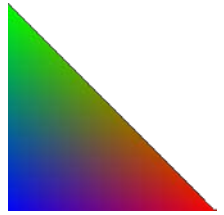
CS418 Computer Graphics

John C. Hart

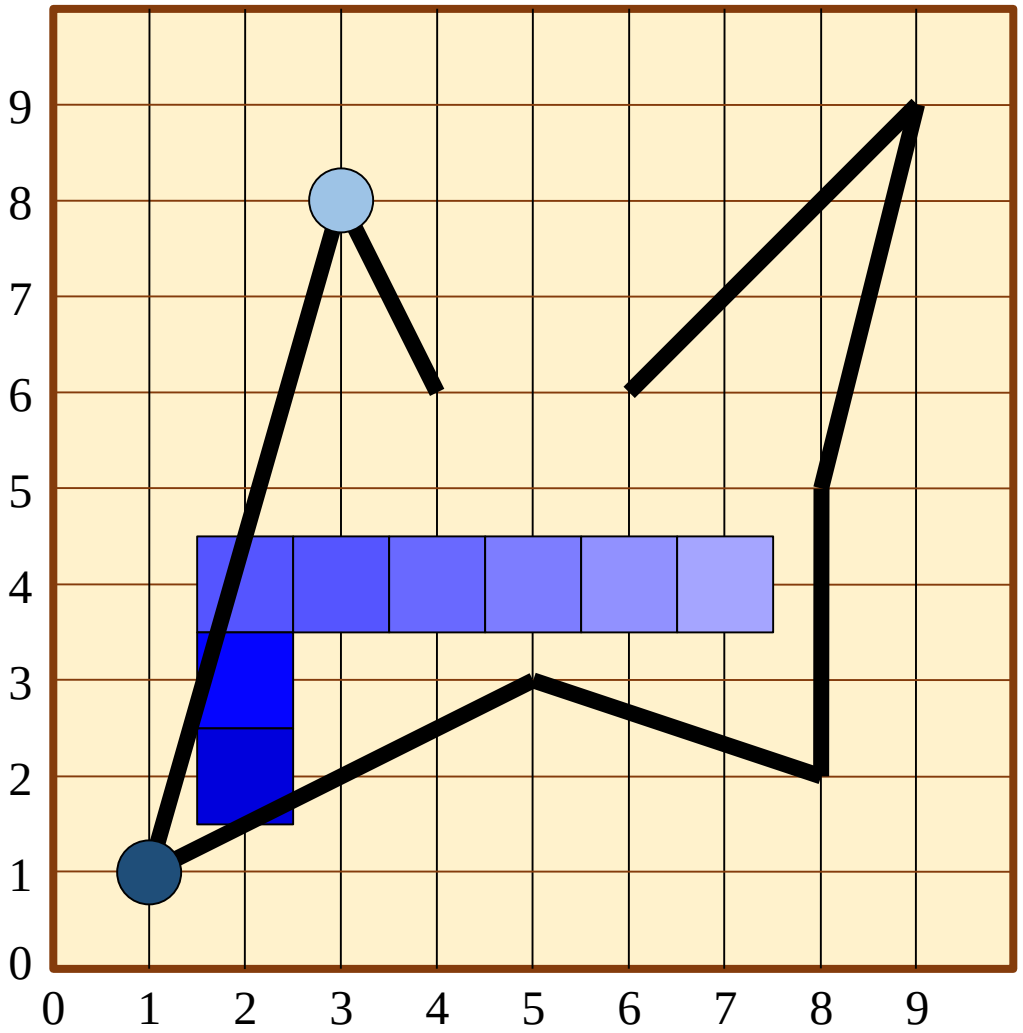
Texture Mapping



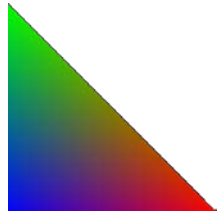
Interpolation



- Rasterization interpolates texture coordinates (s,t) defined at vertices to provide texture coordinates at each fragment

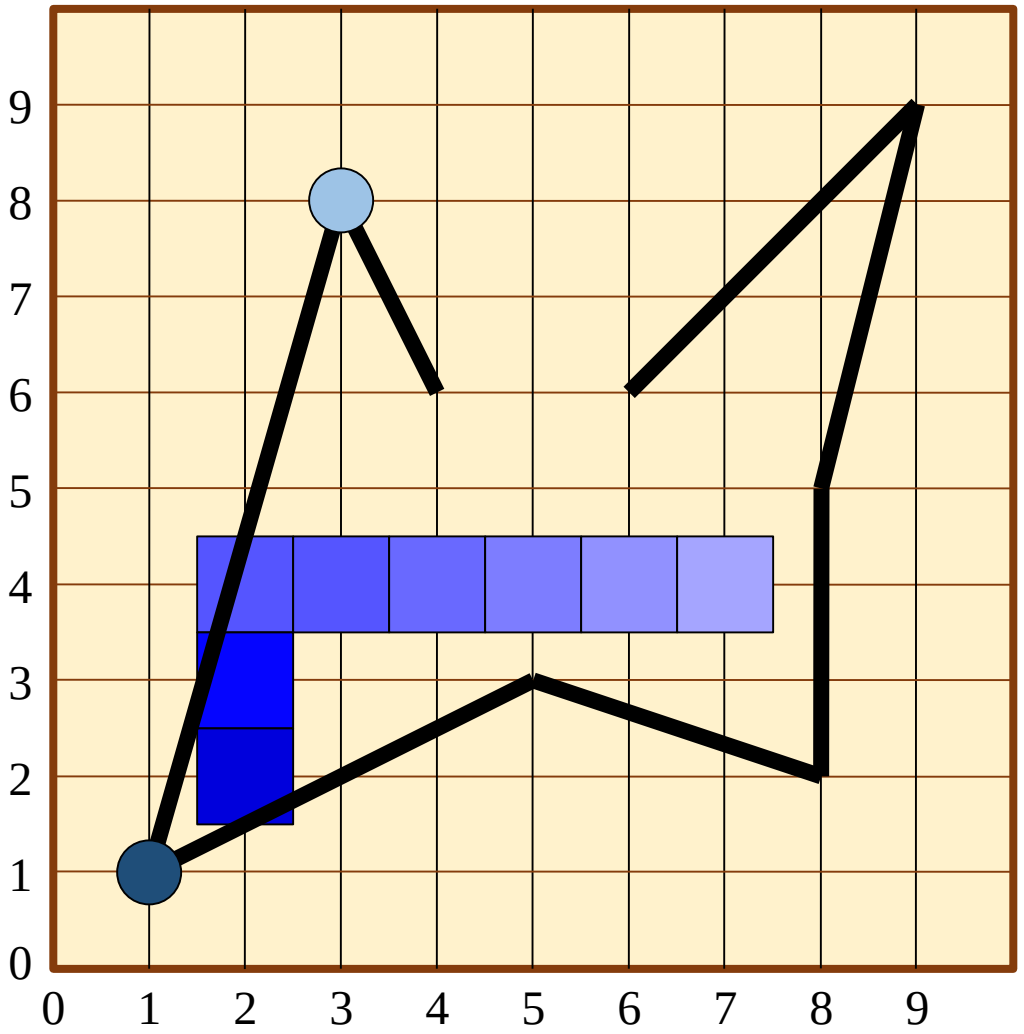


Interpolation

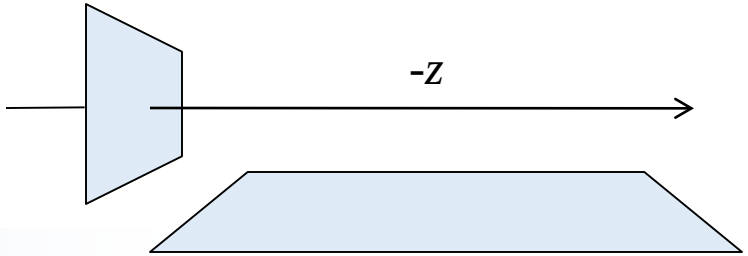


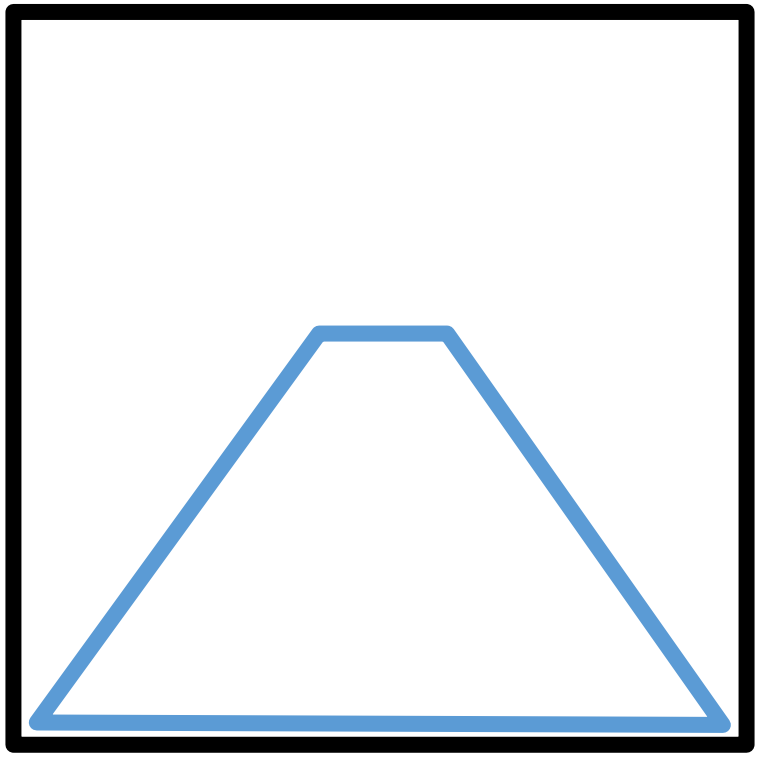
- Rasterization interpolates texture coordinates (s,t) defined at vertices to provide texture coordinates at each fragment

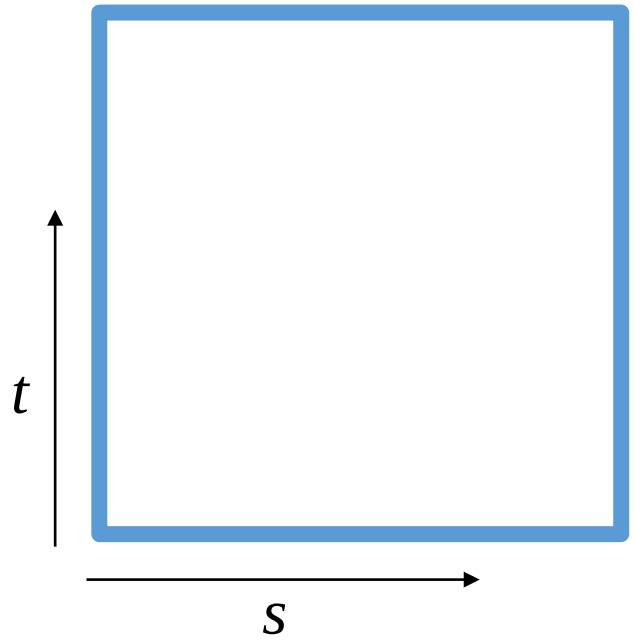
- Interpolation is NOT LINEAR



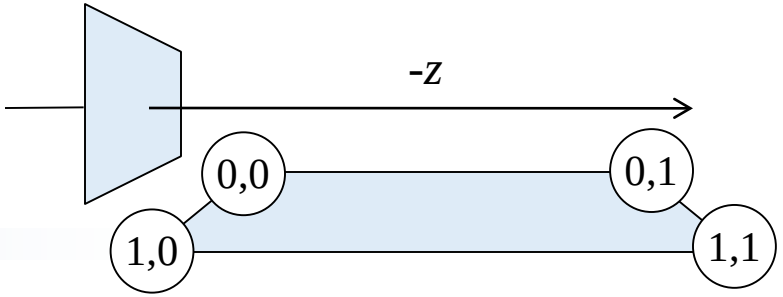
Receding Sidewalk

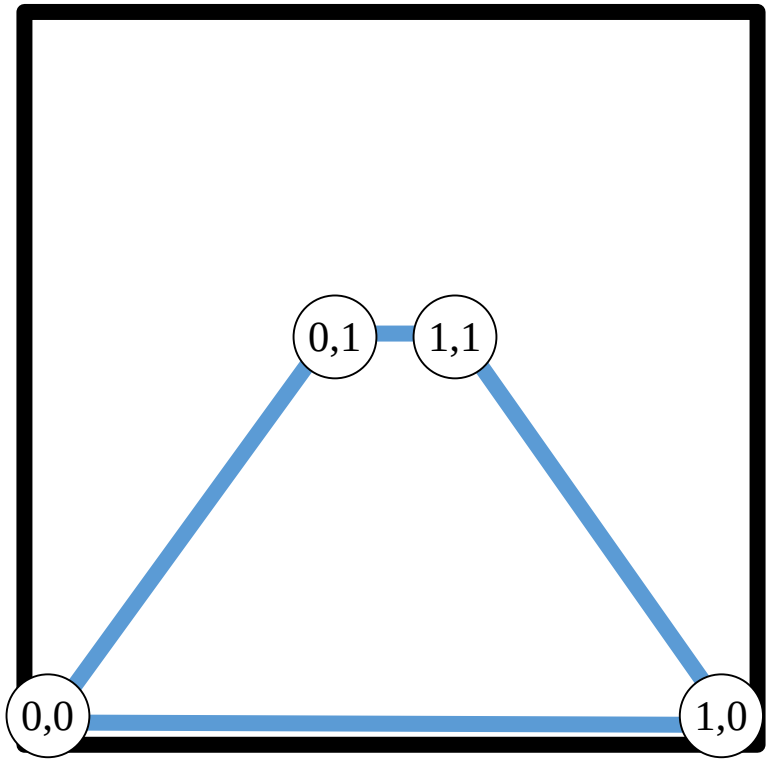


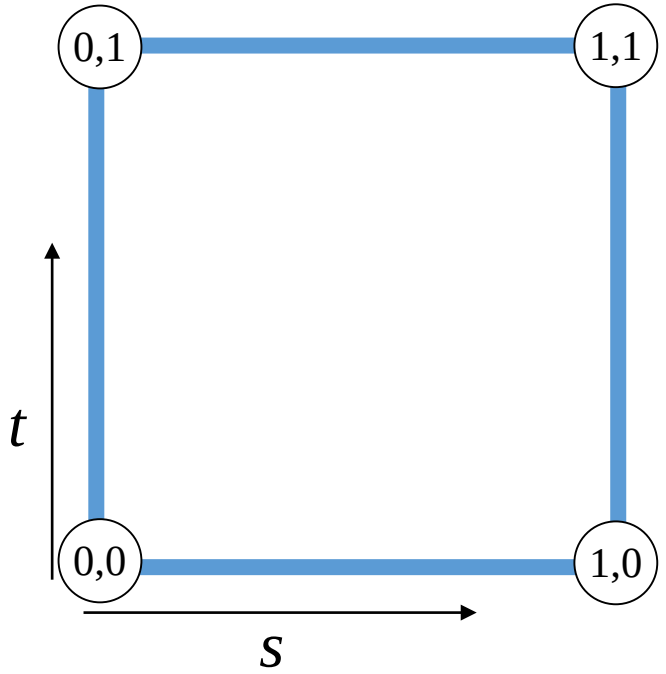




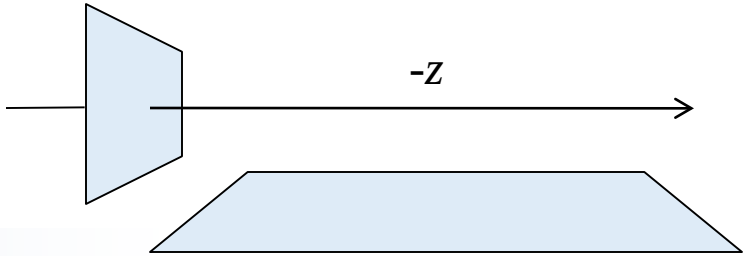
Texture Coordinates

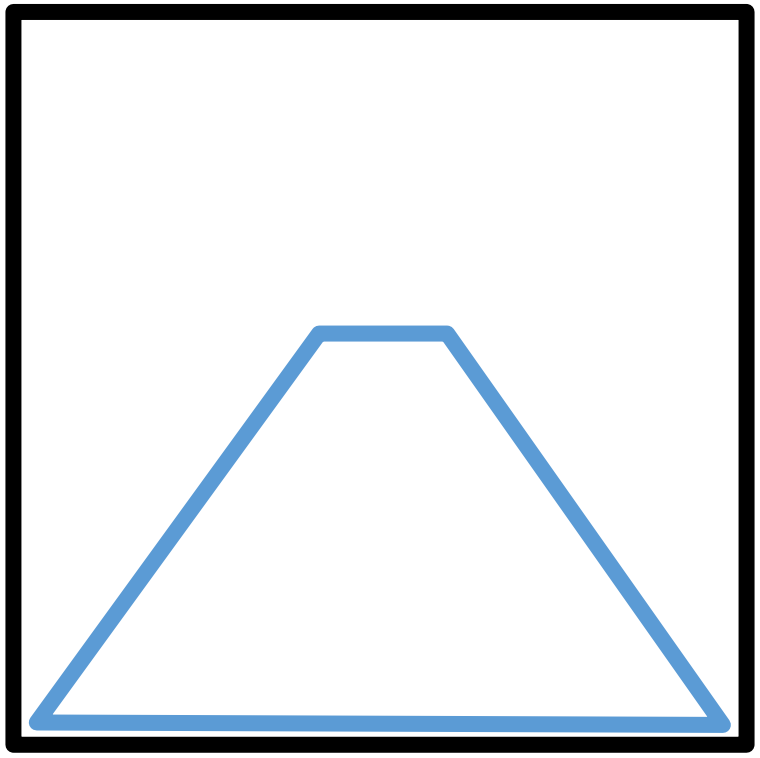


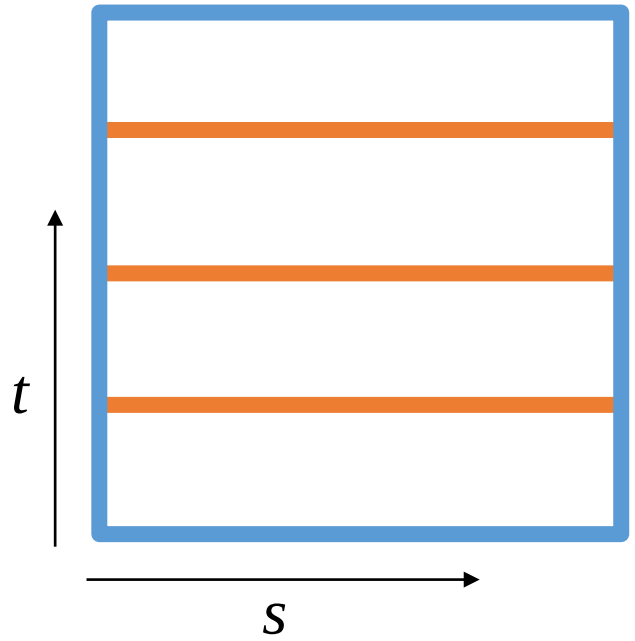




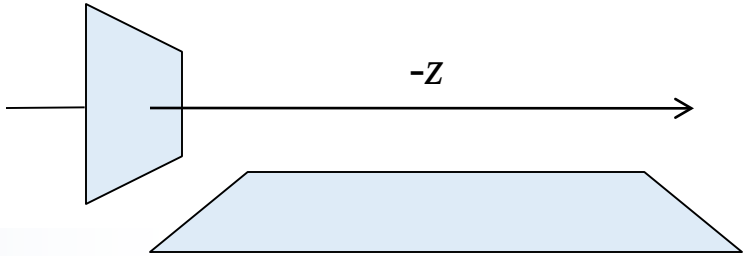
Sidewalk Seams

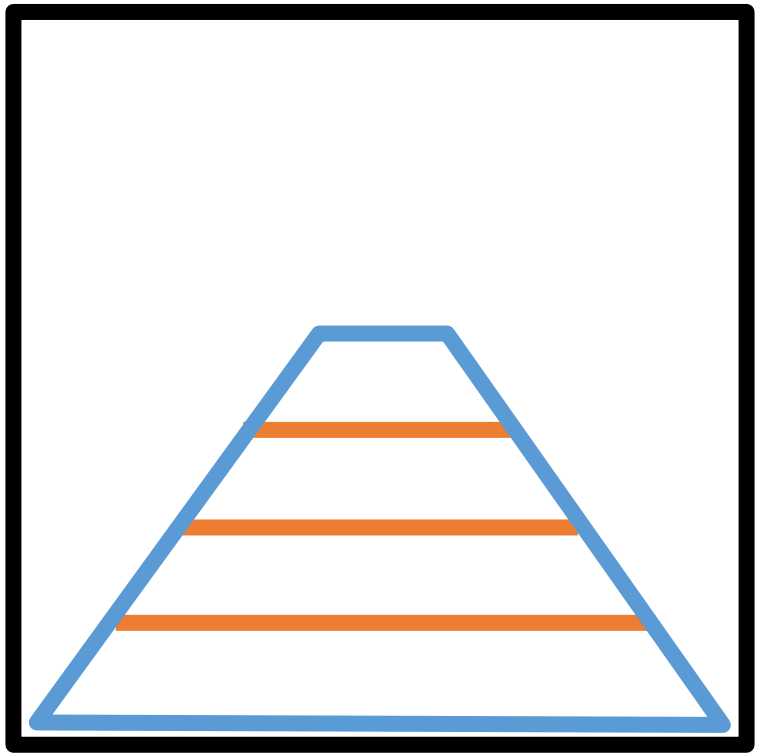


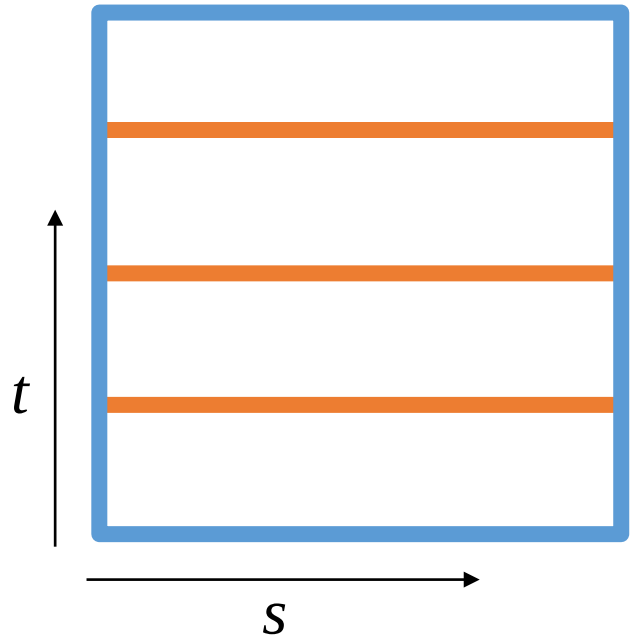




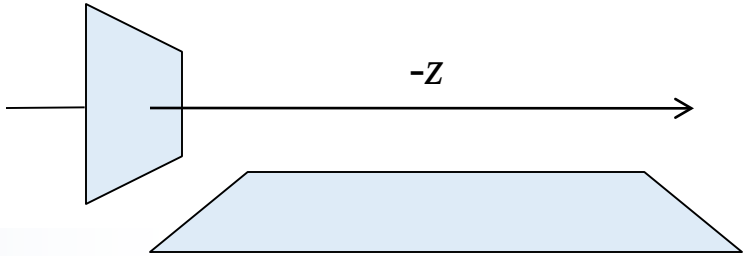
Linear Interpolation

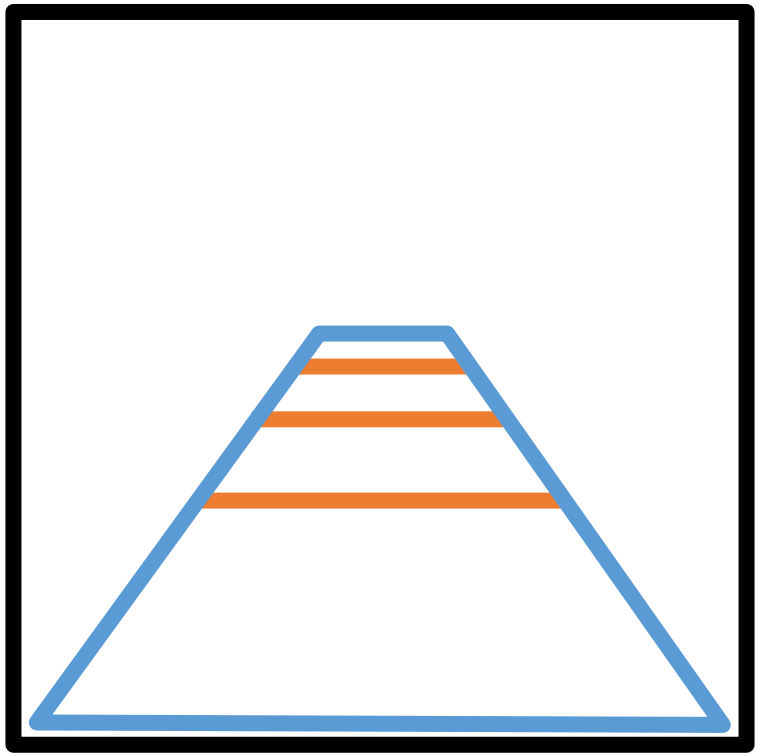


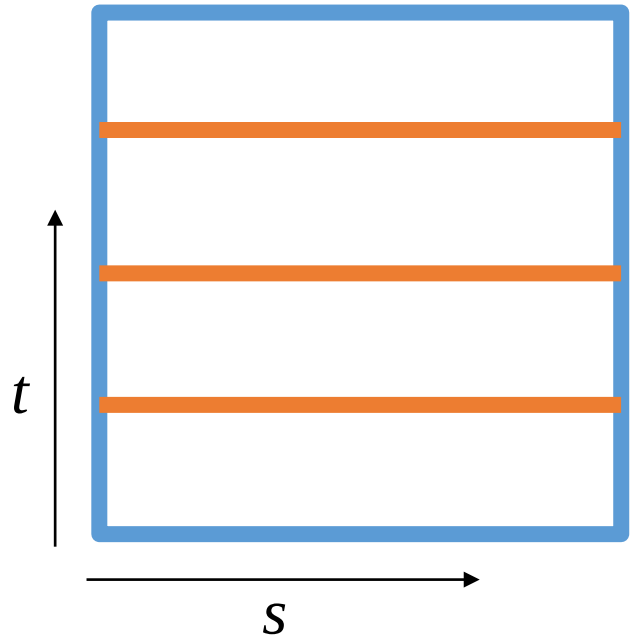




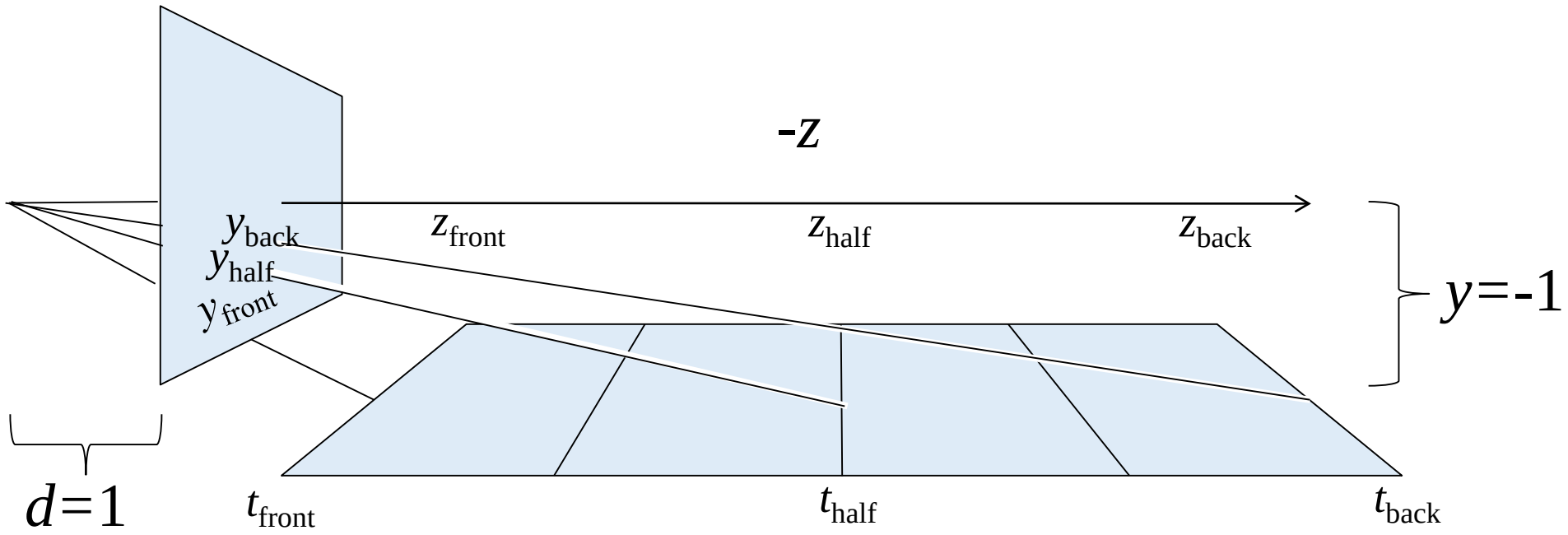
Perspective Correct







Perspective Correction

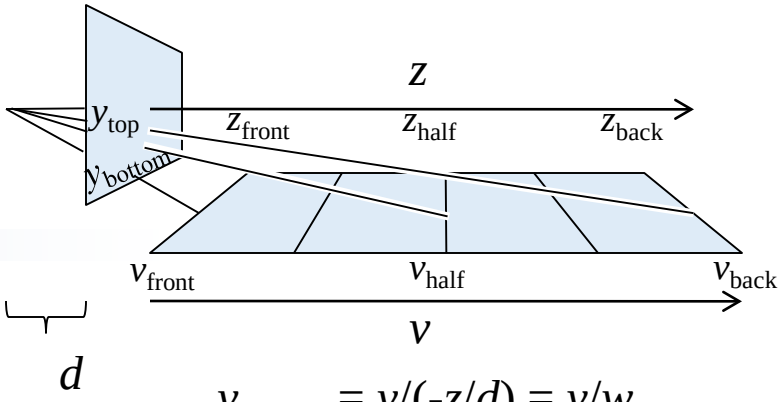


$y_{canvas} = y/w = y/(-z/d)$

$y_{front} = -1/(-z_{front}), \quad y_{half} = -1/(-z_{half}), \quad y_{back} = -1/(-z_{back})$

(vertical positions vary by interpolating denominator)

Perspective Correction



$y_{canvas} = y/(-z/d) = y/w$

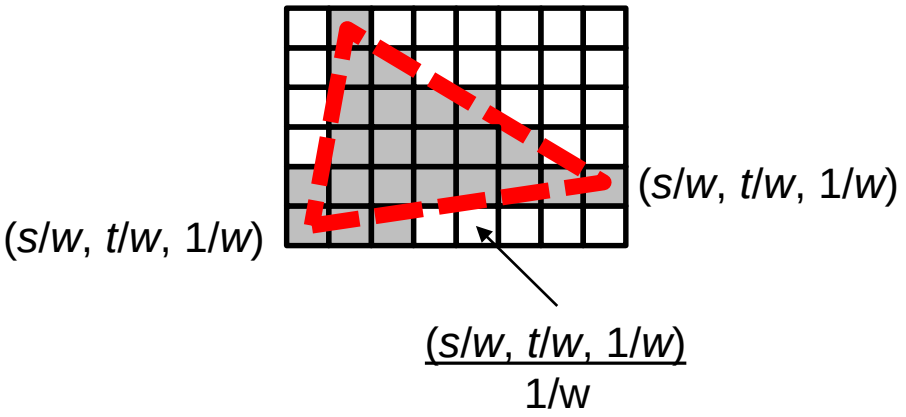
- Clip coordinate vertex attributes:

  $(x,y,z,w,s,t,1)$

- Window coordinate vertex attributes:

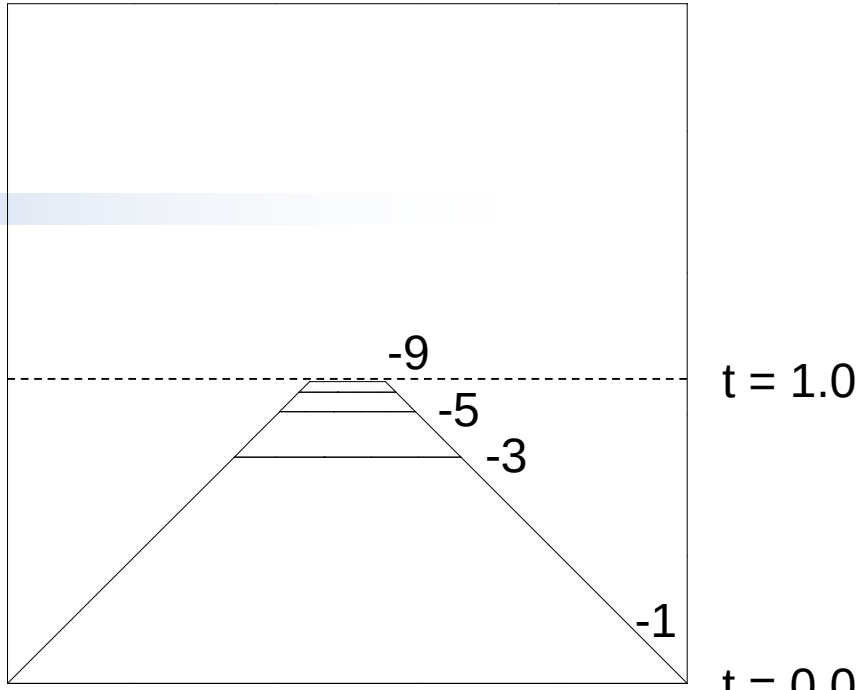
  $(x/w, y/w, z/w, 1, s/w, t/w, 1/w)$

- Window vertices at $(x/w, y/w)$
- Rasterization linearly interpolates $(s/w, t/w, 1/w)$ from vertex attribute values to find fragment values
- Divide *per-fragment* by $1/w$ to get perspective correct interpolated texture coordinates (s,t)

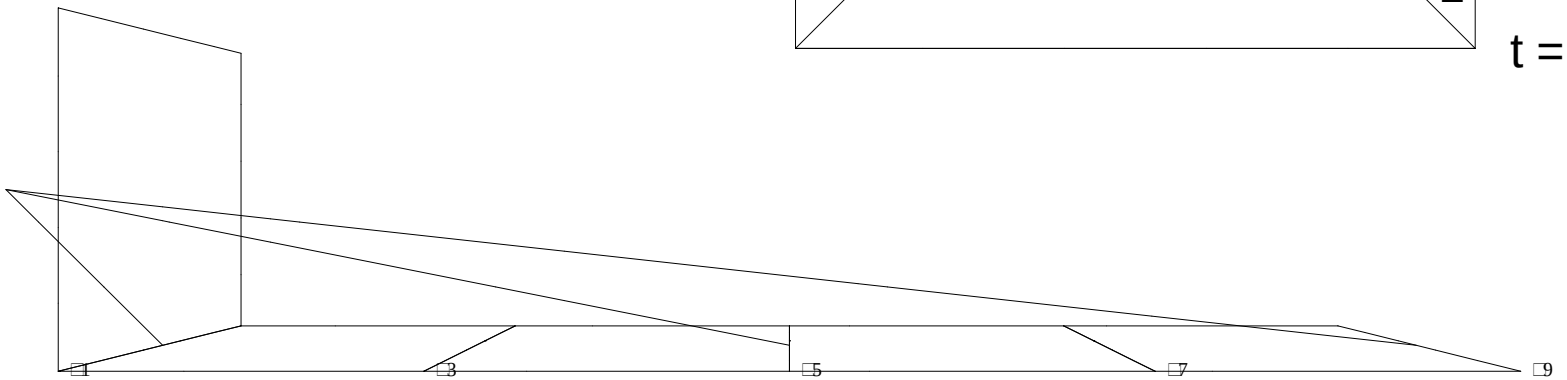


Example

$y_{canvas} = y/(-z/d) = y/w$



(0,0,0)



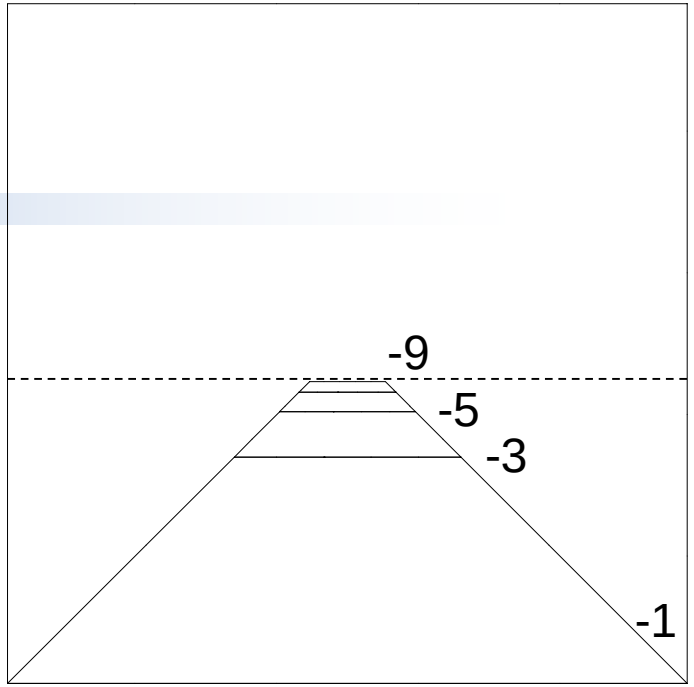
z = -1	-3	-5	-7	-9
y = -1	-1	-1	-1	-1
w = 1	3	5	7	9
t = 0	.25	.5	.75	1

Example

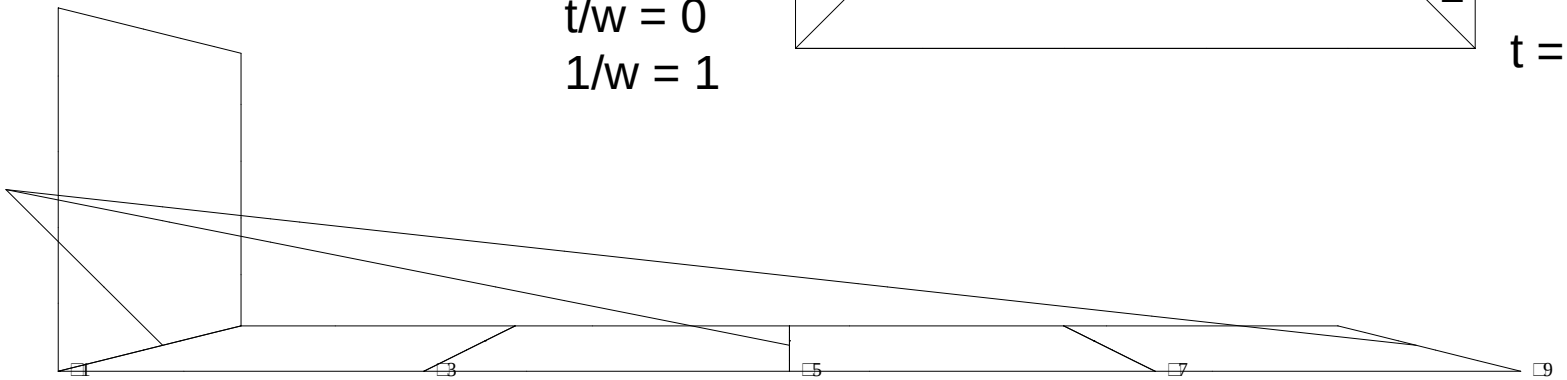
$y_{canvas} = y/(-z/d) = y/w$

t/w = 1/9
1/w = 1/9

t/w = 0
1/w = 1



(0,0,0)



z = -1	-3	-5	-7	-9
y = -1	-1	-1	-1	-1
w = 1	3	5	7	9
t = 0	.25	.5	.75	1

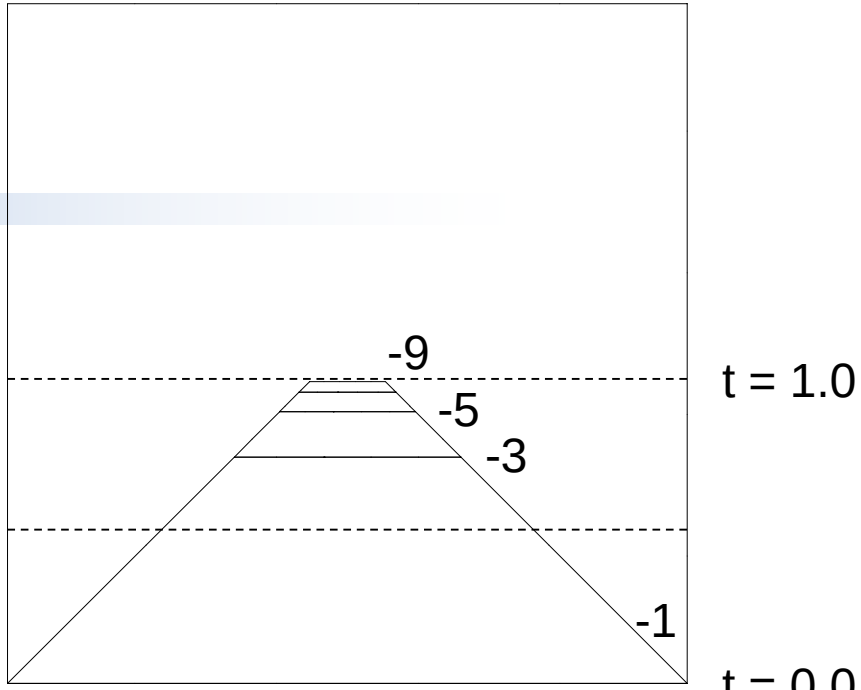
Example

$y_{canvas} = y/(-z/d) = y/w$

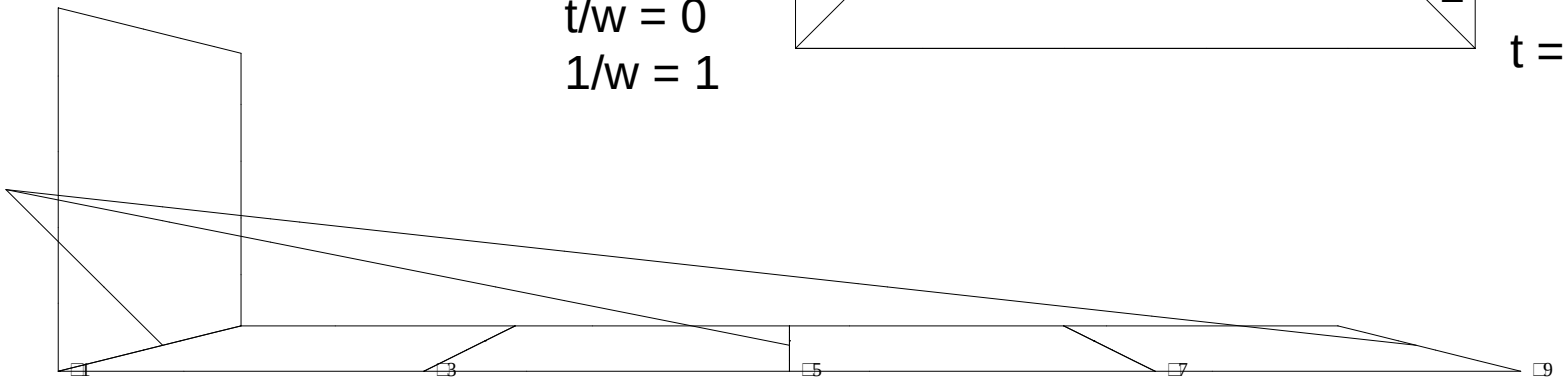
t/w = 1/9
1/w = 1/9

t/w = .5/9
1/w = 5/9

t/w = 0
1/w = 1



(0,0,0)



z = -1	-3	-5	-7	-9
y = -1	-1	-1	-1	-1
w = 1	3	5	7	9
t = 0	.25	.5	.75	1

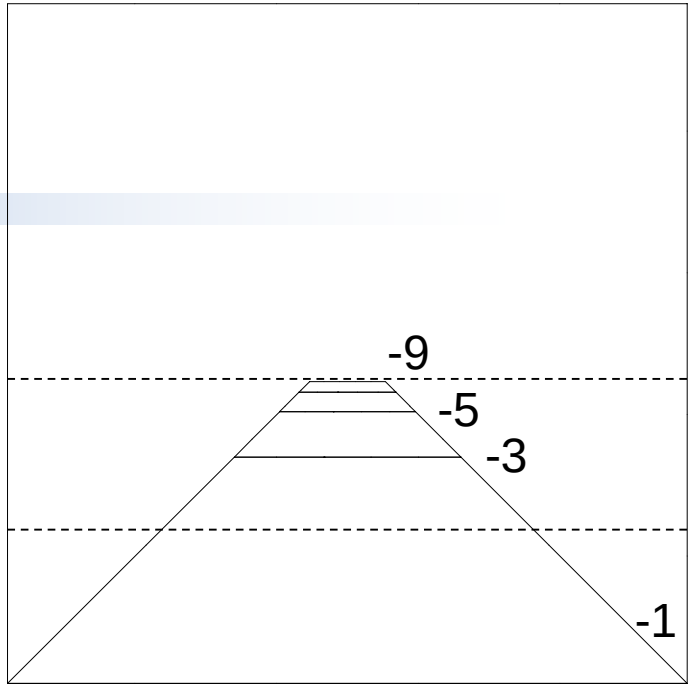
Example

$y_{canvas} = y/(-z/d) = y/w$

t/w = 1/9
1/w = 1/9

t/w = .5/9
1/w = 5/9

t/w = 0
1/w = 1

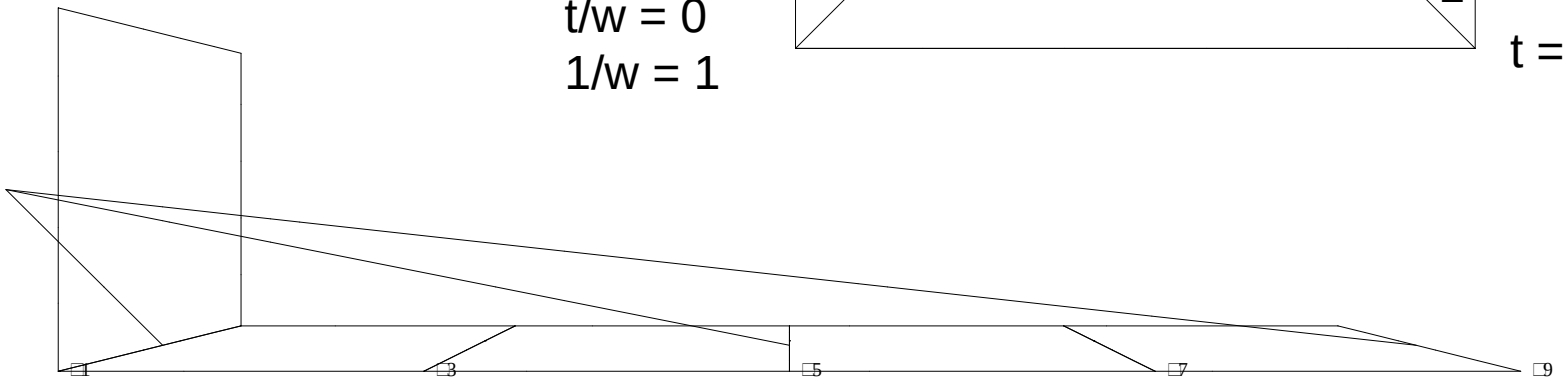


t = 1.0

t = 0.1

t = 0.0

(0,0,0)



z = -1	-3	-5	-7	-9
y = -1	-1	-1	-1	-1
w = 1	3	5	7	9
t = 0	.25	.5	.75	1