1)

$\phi = 0$
$(0,1)$

$\phi = 1$
$(1,1)$

$(.8)(.4)$

$(.2)(.4)$

P

$(.2)(.1)$

$(.8)(.1)$

.1

$(0,0)$

.8

$(1,0)$

$\phi = 1$

$\phi = 0$

bilinear $(P) = (.2)(.4)(1) + (.8)(.4)(0)$
$+ (.2)(.1)(0) + (.8)(.1)(1) = \boxed{.26}$

Using $\text{mix}(\text{mix}(\phi_{00}, \phi_{10}, \alpha), \text{mix}(\phi_{01}, \phi_{11}, \alpha), \beta)$:

$\text{mix}(\phi_{00}, \phi_{10}, \alpha) = \phi_{00}(1-\alpha) + \phi_{10}(\alpha) = (1)(.2) + (0)(.8) = .2$

$\text{mix}(\phi_{01}, \phi_{11}, \alpha) = \phi_{01}(1-\alpha) + \phi_{11}(\alpha) = (0) + (1)(.8) = .8$

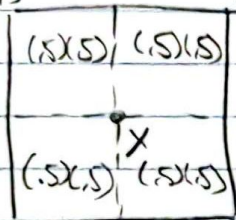$\text{mix}(.2, .8, \beta) = (.2)(1-\beta) + (.8)(\beta) = (.2)(.9) + (.8)(.1) = \boxed{.26}$

2)   1. floor $(x) = (0,0)$
        fract $(x) = (.5, .5)$
     2. You need nodes $(0,0), (1,0), (0,1)$, and $(1,1)$
     3. $(0,1)$ _____ $(1,1)$

Each node has the same
weight of $(.5)(.5)$, or $.25$
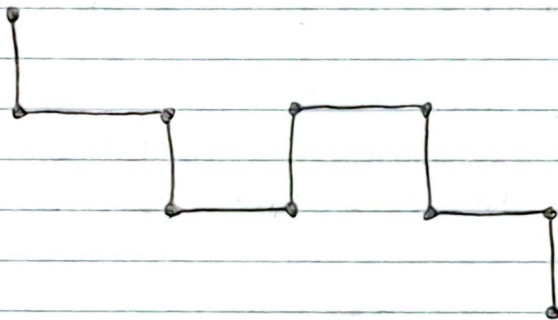
$(0,0)$ $(1,0)$

     4. $F_s(x) = F(x) + \frac{1}{2}F(2x) + \frac{1}{4}F(4x) + \frac{1}{8}F(8x)$

3. Iteration 1: F--F+F
   Iteration 2: F--F+F--F--F+F+F--F+F

4. 1. $x(t) = t$ for $t \geq -2$
$y(t) = 0$

2. Plugging $x(t)$ into x and $y(t)$ into y in the ellipsoid equation,
$$t^2 + \frac{0}{4} = 1 \rightarrow t^2 = 1 \rightarrow t = \pm 1$$
We choose the value of $t = -1$ because that is where the first intersection will happen based on the direction of the ray.

3. $x(-1) = -1$
$y(-1) = 0$ $\rightarrow$ $(-1, 0)$