3a)

Using:

$$\mu \gtrless 0\,,\, \eta \gtrless 0\,,\, \xi \gtrless 0$$

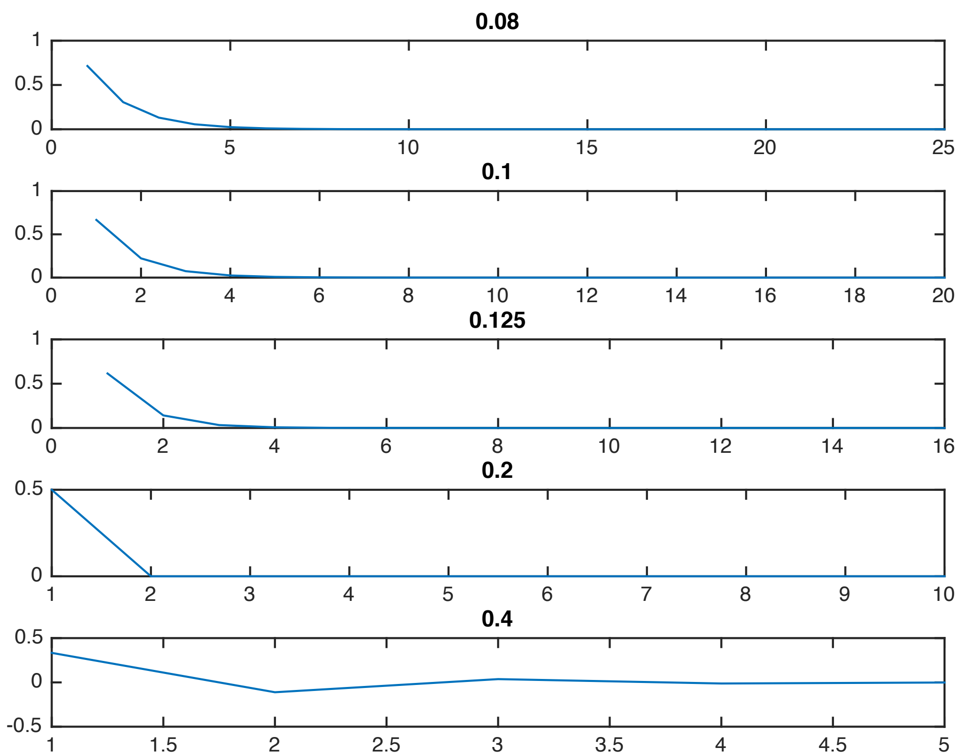
$$\psi_{ijk} = \frac{s_{ijk} + \frac{2}{(1\pm\alpha_i)}\frac{|\mu|}{\Delta_i}\bar{\psi}_{i\mp1/2} + \frac{2}{(1\pm\alpha_j)}\frac{|\eta|}{\Delta_j}\bar{\psi}_{j\mp1/2} + \frac{2}{(1\pm\alpha_k)}\frac{|\xi|}{\Delta_k}\bar{\psi}_{k\mp1/2}}{\Sigma_{ijk} + \frac{2}{(1\pm\alpha_i)}\frac{|\mu|}{\Delta_i} + \frac{2}{(1\pm\alpha_j)}\frac{|\eta|}{\Delta_j} + \frac{2}{(1\pm\alpha_k)}\frac{|\xi|}{\Delta_k}}\,,$$

$$\psi_{i\pm1/2} = \frac{2}{(1\pm\alpha_i)}\psi_{ijk} - \frac{(1\mp\alpha_i)}{(1\pm\alpha_i)}\bar{\psi}_{i\mp1/2}\,,$$

Code:

```
alpha = 0;
mu = .1;
q = 0;
tSigma = 1;
sSigma = 0;
phi = 2;

pos = 0;
neg = phi;

h = [.08, .1, .125, .2, .4];

for m = 1:5
    spaces = 2/h(m);
    qin = zeros(spaces,1);
    qout = zeros(spaces,1);
    fluxIN = zeros(spaces,1);
    fluxOUT = zeros(spaces,1);
    fluxP = zeros(spaces,1);
    fluxM = zeros(spaces,1);
    sourceHolder = zeros(spaces,1);
    sourceHolder(1)=1;

    for i = 1:spaces
        fluxIN(i) = ((2*mu/((1+alpha)*h(m)))*neg+sSigma*neg+q)/(tSigma
+ (2*mu/((1+alpha)*h(m))));

        fluxP(i) = (2/(1+alpha))*fluxIN(i)-((1-alpha)/(1+alpha))*neg;

        neg = fluxP(i);
    end

     pos = neg;

    for n = spaces:-1:1
        fluxIN(i) = ((2*mu/((1-alpha)*h(m)))*pos+sSigma*neg+q)/(tSigma
+ (2*mu/((1-alpha)*h(m))));
```

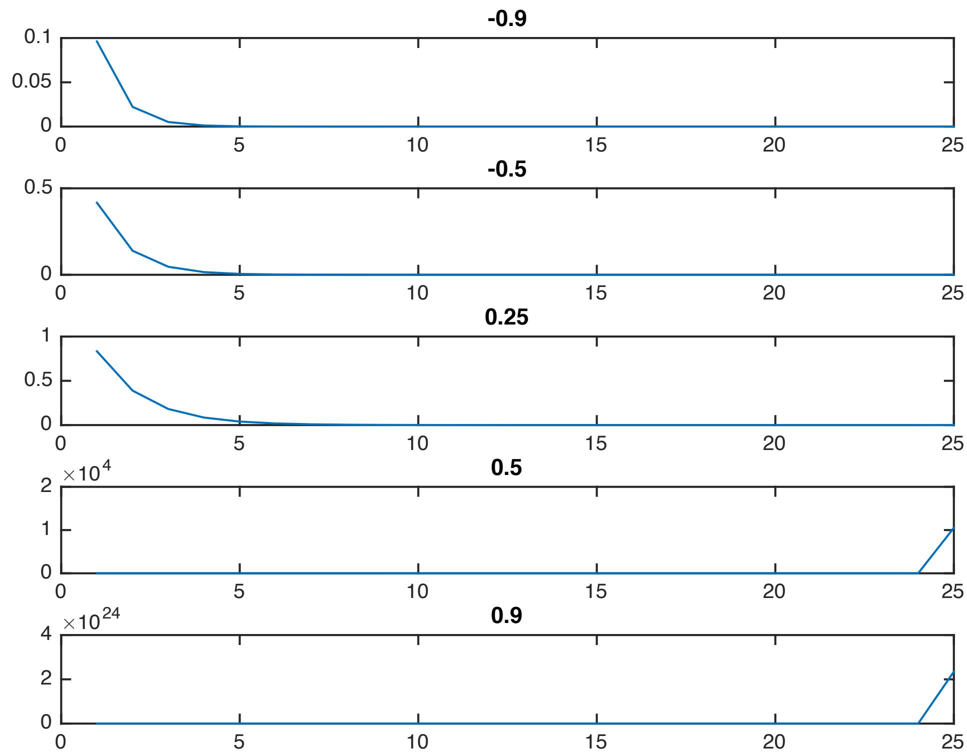
```
        fluxM(n) = 2/(1-alpha)*fluxOUT(n)-(1+alpha)/(1-alpha)*pos;

        pos = fluxM(n);
    end

    scalFlux = 0.5*(fluxIN +fluxOUT);

    subplot(5,1,m)
    plot(scalFlux)
    title(h(m))
    hold on

    neg = phi;
end
```



As the mesh size got larger the flux became worse and we can see the point where it becomes negative from the mesh size becoming too large.

3b)

Increasing alpha seems to dampen the flux




```
alpha = [-0.9; -0.5; 0.25; 0.5; 0.9];
mu = .1;
q = 0;
tSigma = 1;
sSigma = 0;
phi = 2;

pos = 0;
neg = phi;

h = .08;

for m = 1:5
    spaces = 2/h;
    qin = zeros(spaces,1);
    qout = zeros(spaces,1);
    fluxIN = zeros(spaces,1);
    fluxOUT = zeros(spaces,1);
    fluxP = zeros(spaces,1);
    fluxM = zeros(spaces,1);
```

```
    sourceHolder = zeros(spaces,1);
    sourceHolder(1)=1;

    for i = 1:spaces
        fluxIN(i) = ((2*mu/((1+alpha(m))*h))*neg+sSigma*neg+q)/(tSigma
+ (2*mu/((1+alpha(m))*h)));

        fluxP(i) = (2/(1+alpha(m)))*fluxIN(i)-((1-
alpha(m))/(1+alpha(m)))*neg;

        neg = fluxP(i);
    end

     pos = neg;

    for n = spaces:-1:1
        fluxIN(i) = ((2*mu/((1-alpha(m))*h))*pos+sSigma*neg+q)/(tSigma
+ (2*mu/((1-alpha(m))*h)));

        fluxM(n) = 2/(1-alpha(m))*fluxOUT(n)-(1+alpha(m))/(1-
alpha(m))*pos;

        pos = fluxM(n);
    end

    scalFlux = 0.5*((1+alpha(m))*fluxIN +(1-alpha(m))*fluxOUT);

    subplot(5,1,m)
    plot(scalFlux)
    title(alpha(m))
    hold on

    neg = phi;
end
```

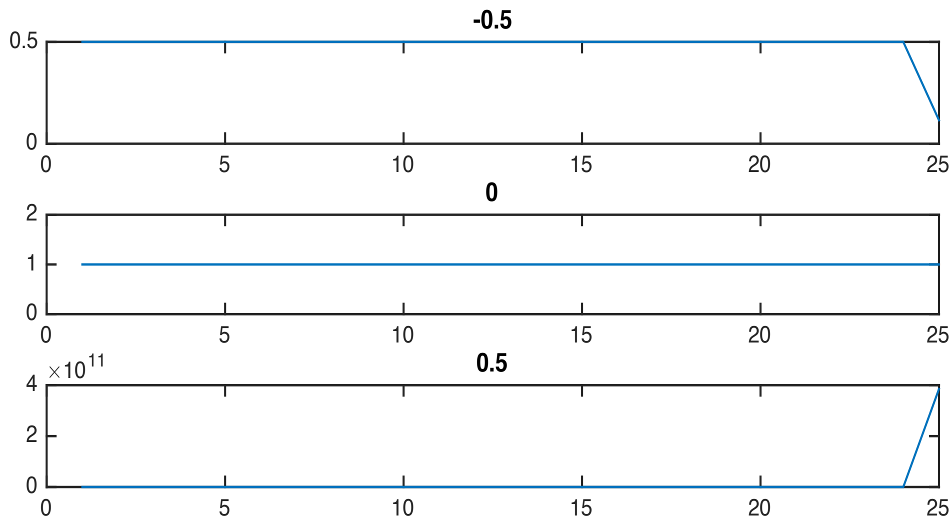
3c)

Having a continuous source seems to make the transport constant throughout the slab.

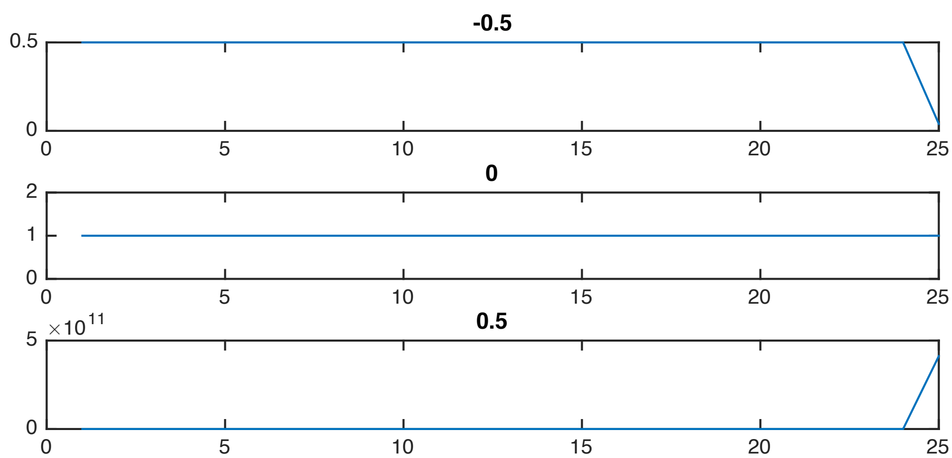
This is likely an error in the code. Reality should show a concentration near the reflective boundary.

```
alpha = [-0.5; 0; 0.5;];
mu = .2;
q = 1;
tSigma = 1;
sSigma = .5;
phi = 2;

pos = 0;
neg = phi;
```

```
h = .08;

for m = 1:5
    spaces = 2/h;
    qin = zeros(spaces,1);
    qout = zeros(spaces,1);
    fluxIN = zeros(spaces,1);
    fluxOUT = zeros(spaces,1);
    fluxP = zeros(spaces,1);
    fluxM = zeros(spaces,1);
    sourceHolder = zeros(spaces,1);
    sourceHolder(1)=1;

    for i = 1:spaces
        fluxIN(i) = ((2*mu/((1+alpha(m))*h))*neg+sSigma*neg+q)/(tSigma
+ (2*mu/((1+alpha(m))*h)));

        fluxP(i) = (2/(1+alpha(m)))*fluxIN(i)-((1-
alpha(m))/(1+alpha(m)))*neg;

        neg = fluxP(i);
    end

     pos = neg;

    for n = spaces:-1:1
        fluxIN(i) = ((2*mu/((1-alpha(m))*h))*pos+sSigma*neg+q)/(tSigma
+ (2*mu/((1-alpha(m))*h)));

        fluxM(n) = 2/(1-alpha(m))*fluxOUT(n)-(1+alpha(m))/(1-
alpha(m))*pos;

        pos = fluxM(n);
    end

    scalFlux = 0.5*((1+alpha(m))*fluxIN +(1-alpha(m))*fluxOUT);

    subplot(5,1,m)
    plot(scalFlux)
    title(alpha(m))
    hold on

    neg = phi;
end
```



for mu = +/-.2



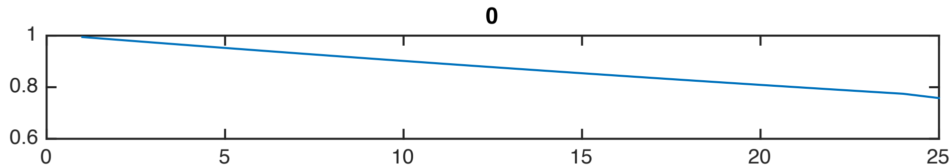
For mu = +/-.7

3d)

The flux seems to decrease as the transport goes into the slab, this makes sense as scattering of .9 is high.

```
alpha = [0];
```

```
mu = .7;
q = 0;
tSigma = 1;
sSigma = .9;
phi = 2;

pos = 0;
neg = phi;

h = .08;

for m = 1:5
    spaces = 2/h;
    qin = zeros(spaces,1);
    qout = zeros(spaces,1);
    fluxIN = zeros(spaces,1);
    fluxOUT = zeros(spaces,1);
    fluxP = zeros(spaces,1);
    fluxM = zeros(spaces,1);
    sourceHolder = zeros(spaces,1);
    sourceHolder(1)=1;

    for i = 1:spaces
        fluxIN(i) = ((2*mu/((1+alpha(m))*h))*neg+sSigma*neg+q)/(tSigma
+ (2*mu/((1+alpha(m))*h)));

        fluxP(i) = (2/(1+alpha(m)))*fluxIN(i)-((1-
alpha(m))/(1+alpha(m)))*neg;

        neg = fluxP(i);
    end

     pos = neg;

    for n = spaces:-1:1
        fluxIN(i) = ((2*mu/((1-alpha(m))*h))*pos+sSigma*neg+q)/(tSigma
+ (2*mu/((1-alpha(m))*h)));

        fluxM(n) = 2/(1-alpha(m))*fluxOUT(n)-(1+alpha(m))/(1-
alpha(m))*pos;

        pos = fluxM(n);
    end

    scalFlux = 0.5*((1+alpha(m))*fluxIN +(1-alpha(m))*fluxOUT);

    subplot(5,1,m)
    plot(scalFlux)
    title(alpha(m))
    hold on

    neg = phi;
end
```


0
1
0.8
0.6
0
5
10
15
20
25