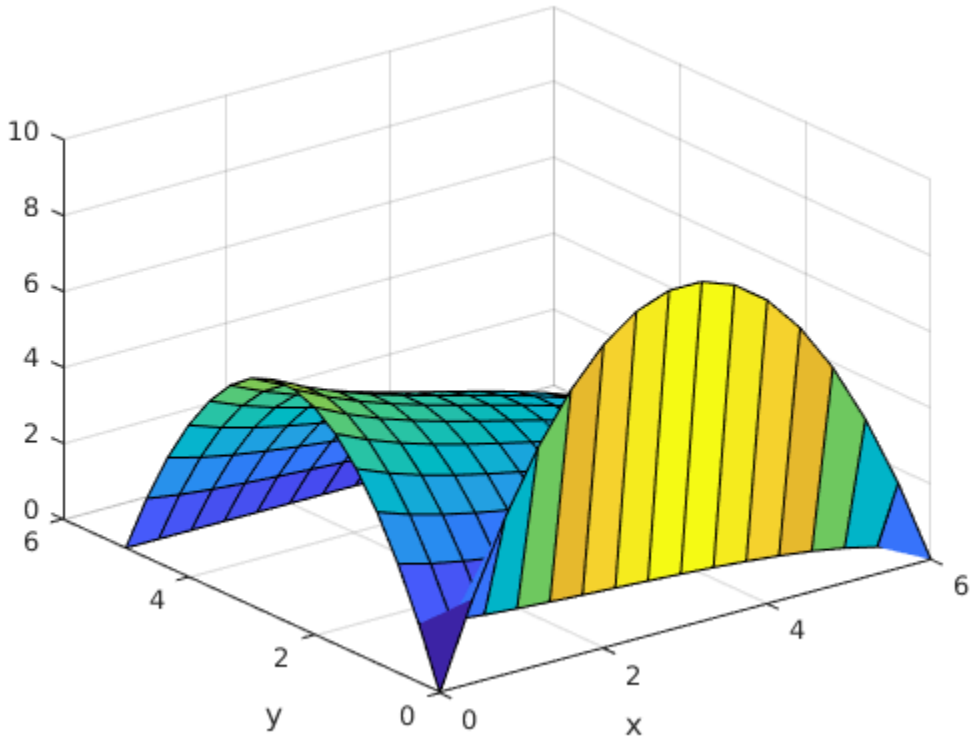
```
%number 1
fprintf("Number 1\n");
n = 15;
m = 15;
a = 0;
b = 6;
c = 0;
d = 5;
fun = @(x, y) (-1.5/1.04);
gxl = @(x) (x*(6-x));
gxr = @(x) (0);
gyl = @(y) (y*(5-y));
gyr = @(y) (0);
MAX = 1000;
tol = 10^-3;
w = poissonfinitedifference(a, b, c, d, fun, gxl, gxr, gyl, gyr, n, m,
 MAX, tol)';

%plotting approximations
h = .4;
k = 1/3;
x = (a+h):h:(b-h);
y = (c+k):k:(d-k);
[xx, yy] = meshgrid(x, y);
surf(xx, yy, w);

v1 = zeros(1, n-1);
v2 = zeros(1, n-1);
for i = 1: n-1
   v1(i) = gxl(a+i*h);
   v2(i) = gxr(a+i*h);
end
w = vertcat(v1, w);
w = vertcat(w, v2);

v3 = zeros(m+1, 1);
v4 = zeros(m+1, 1);

for i = 1:m+1
    v3(i) = gyl(c + (i-1)*k);
    v4(i) = gyr(c + (i-1)*k);
end
w = horzcat(v3, w);
w = horzcat(w, v4);


x = a:h:b;
y = c:k:d;
[xx, yy] = meshgrid(x, y);
surf(xx, yy, w);
xlabel('x');
ylabel('y');
```

Number 1

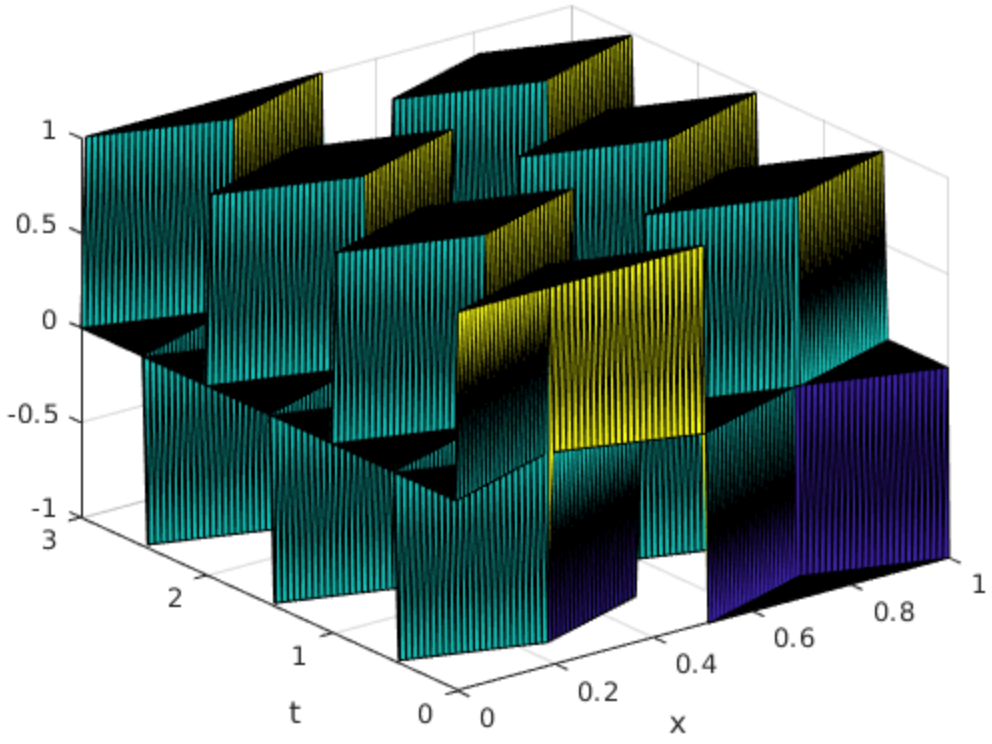



```
%number 2
fprintf("Number 2\n");
L = 1;
m = 100;
tMax = 3;
n = 300;
alpha = 1;
t_left = @(t) (0);
t_right = t_left;
g = @(x) (0);
w = wavefinitediff(L, m, tMax, n, alpha, @f, t_left, t_right, g);
h = .01;
x = 0:h:L;
for i = 1: length(w)
   fprintf("w(%.2f, %.2f) = %.10f\n", x(i), tMax, w(i));
end
```

Number 2
w(0.00, 3.00) = 0.0000000000
w(0.01, 3.00) = 1.0000000000
w(0.02, 3.00) = 1.0000000000
w(0.03, 3.00) = 1.0000000000
w(0.04, 3.00) = 1.0000000000
w(0.05, 3.00) = 1.0000000000
w(0.06, 3.00) = 1.0000000000

```
w(0.07, 3.00) = 1.0000000000
w(0.08, 3.00) = 1.0000000000
w(0.09, 3.00) = 1.0000000000
w(0.10, 3.00) = 1.0000000000
w(0.11, 3.00) = 1.0000000000
w(0.12, 3.00) = 1.0000000000
w(0.13, 3.00) = 1.0000000000
w(0.14, 3.00) = 1.0000000000
w(0.15, 3.00) = 1.0000000000
w(0.16, 3.00) = 1.0000000000
w(0.17, 3.00) = 1.0000000000
w(0.18, 3.00) = 1.0000000000
w(0.19, 3.00) = 1.0000000000
w(0.20, 3.00) = 1.0000000000
w(0.21, 3.00) = 1.0000000000
w(0.22, 3.00) = 1.0000000000
w(0.23, 3.00) = 1.0000000000
w(0.24, 3.00) = 1.0000000000
w(0.25, 3.00) = 1.0000000000
w(0.26, 3.00) = 1.0000000000
w(0.27, 3.00) = 1.0000000000
w(0.28, 3.00) = 1.0000000000
w(0.29, 3.00) = 1.0000000000
w(0.30, 3.00) = 1.0000000000
w(0.31, 3.00) = 1.0000000000
w(0.32, 3.00) = 1.0000000000
w(0.33, 3.00) = 1.0000000000
w(0.34, 3.00) = 1.0000000000
w(0.35, 3.00) = 1.0000000000
w(0.36, 3.00) = 1.0000000000
w(0.37, 3.00) = 1.0000000000
w(0.38, 3.00) = 1.0000000000
w(0.39, 3.00) = 1.0000000000
w(0.40, 3.00) = 1.0000000000
w(0.41, 3.00) = 1.0000000000
w(0.42, 3.00) = 1.0000000000
w(0.43, 3.00) = 1.0000000000
w(0.44, 3.00) = 1.0000000000
w(0.45, 3.00) = 1.0000000000
w(0.46, 3.00) = 1.0000000000
w(0.47, 3.00) = 1.0000000000
w(0.48, 3.00) = 1.0000000000
w(0.49, 3.00) = 1.0000000000
w(0.50, 3.00) = -1.0000000000
w(0.51, 3.00) = -1.0000000000
w(0.52, 3.00) = -1.0000000000
w(0.53, 3.00) = -1.0000000000
w(0.54, 3.00) = -1.0000000000
w(0.55, 3.00) = -1.0000000000
w(0.56, 3.00) = -1.0000000000
w(0.57, 3.00) = -1.0000000000
w(0.58, 3.00) = -1.0000000000
w(0.59, 3.00) = -1.0000000000
w(0.60, 3.00) = -1.0000000000
```

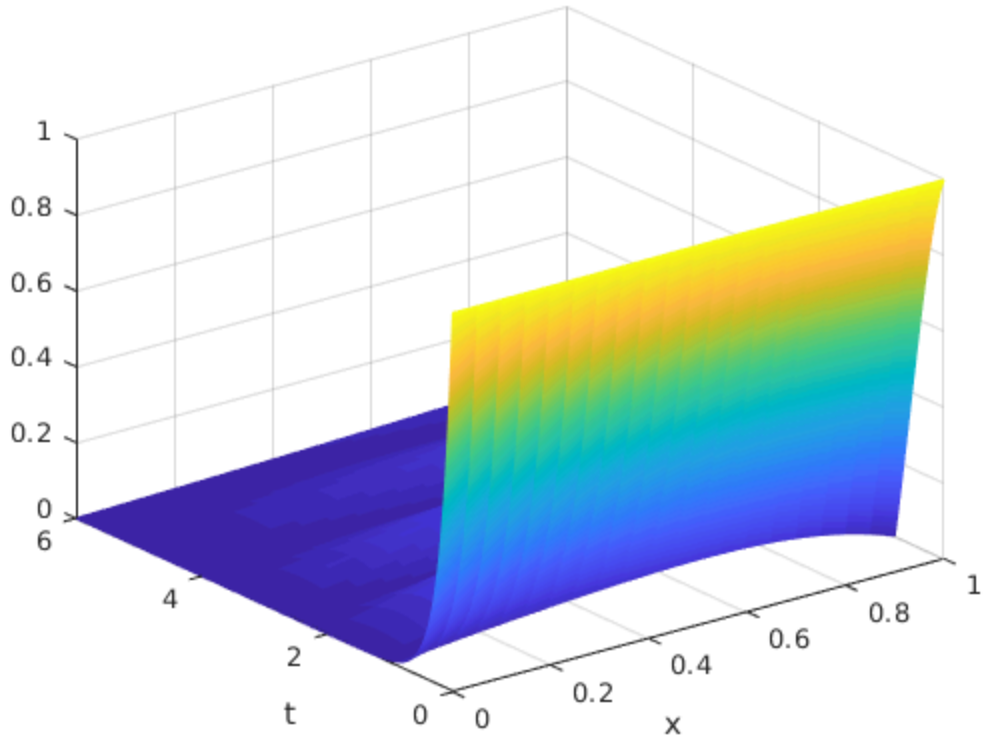
```
w(0.61, 3.00) = -1.0000000000
w(0.62, 3.00) = -1.0000000000
w(0.63, 3.00) = -1.0000000000
w(0.64, 3.00) = -1.0000000000
w(0.65, 3.00) = -1.0000000000
w(0.66, 3.00) = -1.0000000000
w(0.67, 3.00) = -1.0000000000
w(0.68, 3.00) = -1.0000000000
w(0.69, 3.00) = -1.0000000000
w(0.70, 3.00) = -1.0000000000
w(0.71, 3.00) = -1.0000000000
w(0.72, 3.00) = -1.0000000000
w(0.73, 3.00) = -1.0000000000
w(0.74, 3.00) = -1.0000000000
w(0.75, 3.00) = -1.0000000000
w(0.76, 3.00) = -1.0000000000
w(0.77, 3.00) = -1.0000000000
w(0.78, 3.00) = -1.0000000000
w(0.79, 3.00) = -1.0000000000
w(0.80, 3.00) = -1.0000000000
w(0.81, 3.00) = -1.0000000000
w(0.82, 3.00) = -1.0000000000
w(0.83, 3.00) = -1.0000000000
w(0.84, 3.00) = -1.0000000000
w(0.85, 3.00) = -1.0000000000
w(0.86, 3.00) = -1.0000000000
w(0.87, 3.00) = -1.0000000000
w(0.88, 3.00) = -1.0000000000
w(0.89, 3.00) = -1.0000000000
w(0.90, 3.00) = -1.0000000000
w(0.91, 3.00) = -1.0000000000
w(0.92, 3.00) = -1.0000000000
w(0.93, 3.00) = -1.0000000000
w(0.94, 3.00) = -1.0000000000
w(0.95, 3.00) = -1.0000000000
w(0.96, 3.00) = -1.0000000000
w(0.97, 3.00) = -1.0000000000
w(0.98, 3.00) = -1.0000000000
w(0.99, 3.00) = -1.0000000000
w(1.00, 3.00) = 0.0000000000
```




```
%number 3 approximations look right graph looks bad
L = 1;
m = 20;
n = 4800;
T = 6;
x_low = @(x) (1);

t_left = @(t) exp(-5*t);
t_right = @(t) (abs(cos(2*t))*exp(-(1/2)*t));
alpha = 1;

w = cranknicolson(L, m, T, n, alpha, t_left, t_right,
 x_low); %calculating approximation
h = .05;
x = 0:h:L;
%displaying results

fprintf("Crank nicolson method for problem 3 on final exam\n");
for i=1:length(x)
    fprintf("w(%.2f, %.2f) = %.10f\n", x(i), T, w(i));
end

fprintf("\n\n");
```

```
Crank nicolson method for problem 3 on final exam
w(0.00, 6.00) = 0.0000000000
```

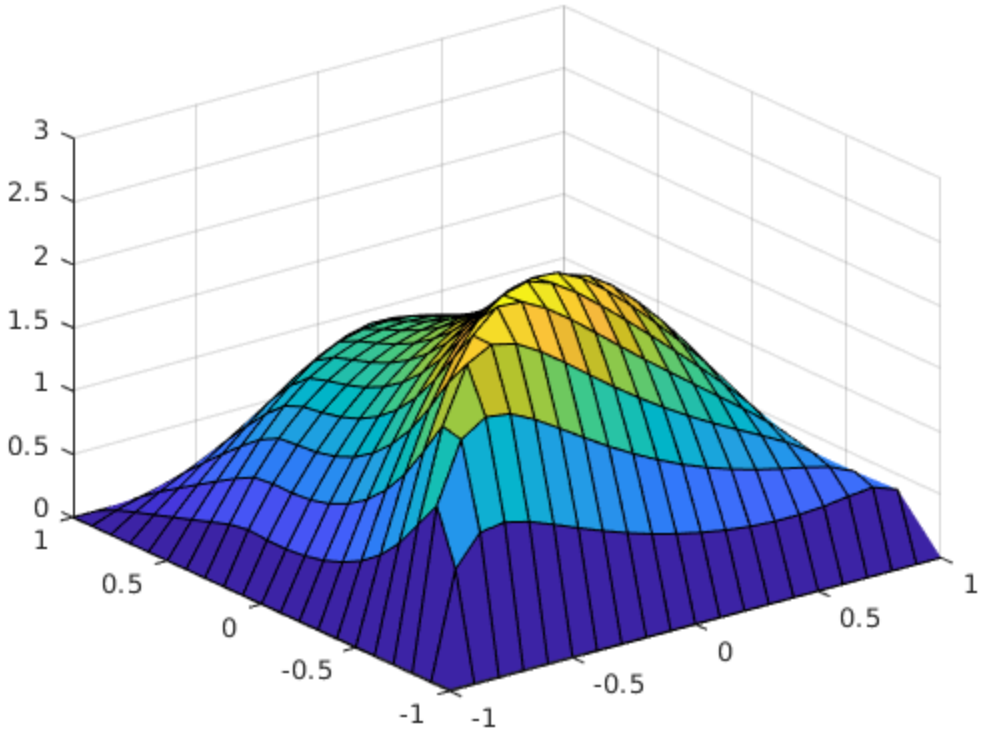
```
w(0.05, 6.00) = 0.0016479227
w(0.10, 6.00) = 0.0033037475
w(0.15, 6.00) = 0.0049753242
w(0.20, 6.00) = 0.0066703974
w(0.25, 6.00) = 0.0083965532
w(0.30, 6.00) = 0.0101611645
w(0.35, 6.00) = 0.0119713353
w(0.40, 6.00) = 0.0138338437
w(0.45, 6.00) = 0.0157550819
w(0.50, 6.00) = 0.0177409959
w(0.55, 6.00) = 0.0197970217
w(0.60, 6.00) = 0.0219280197
w(0.65, 6.00) = 0.0241382076
w(0.70, 6.00) = 0.0264310903
w(0.75, 6.00) = 0.0288093880
w(0.80, 6.00) = 0.0312749630
w(0.85, 6.00) = 0.0338287445
w(0.90, 6.00) = 0.0364706522
w(0.95, 6.00) = 0.0391995193
w(1.00, 6.00) = 0.0420130147
```



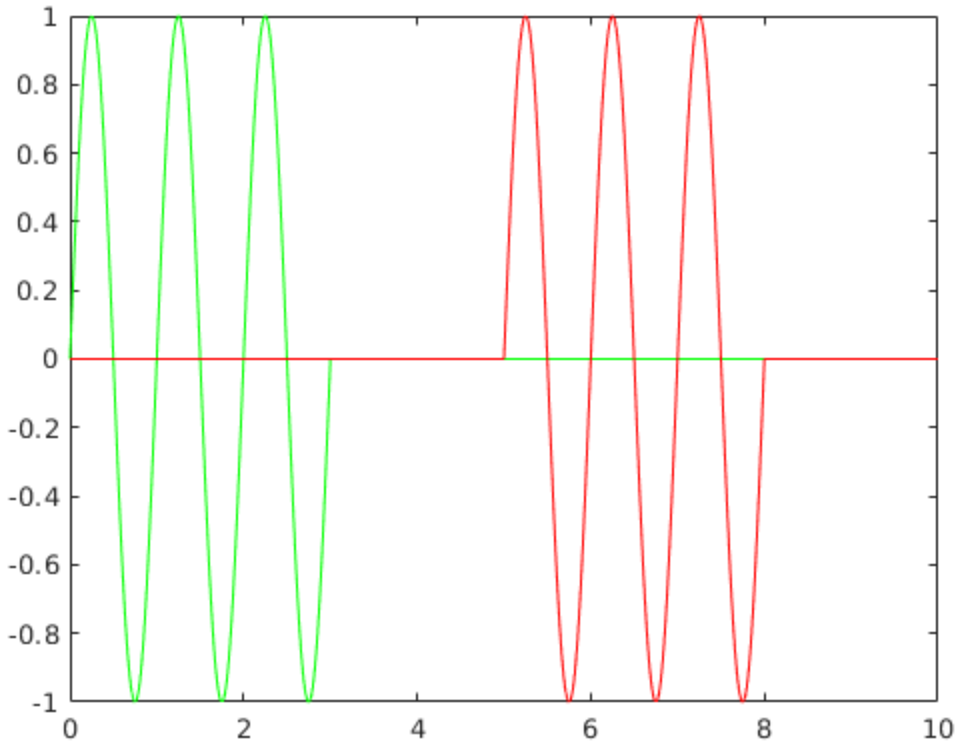

```
%Number 4
fprintf("Number 4\n");
a = -1;
```

```
b = 1;
h = .1;
func = @(x,y) (-exp(2.5*(x^2 + y^2)));
w = poissonninepoint(a, b, h, func);
```

Number 4




```
%Number 5
alpha = 0;
beta = 10;
tMax = 5;
x_bc = @(x) (sin(2*pi*x));
h = .005;
k = .005;
A = 1;
w = laxwendroff(alpha, beta, h, k, tMax, x_bc, A);
```



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