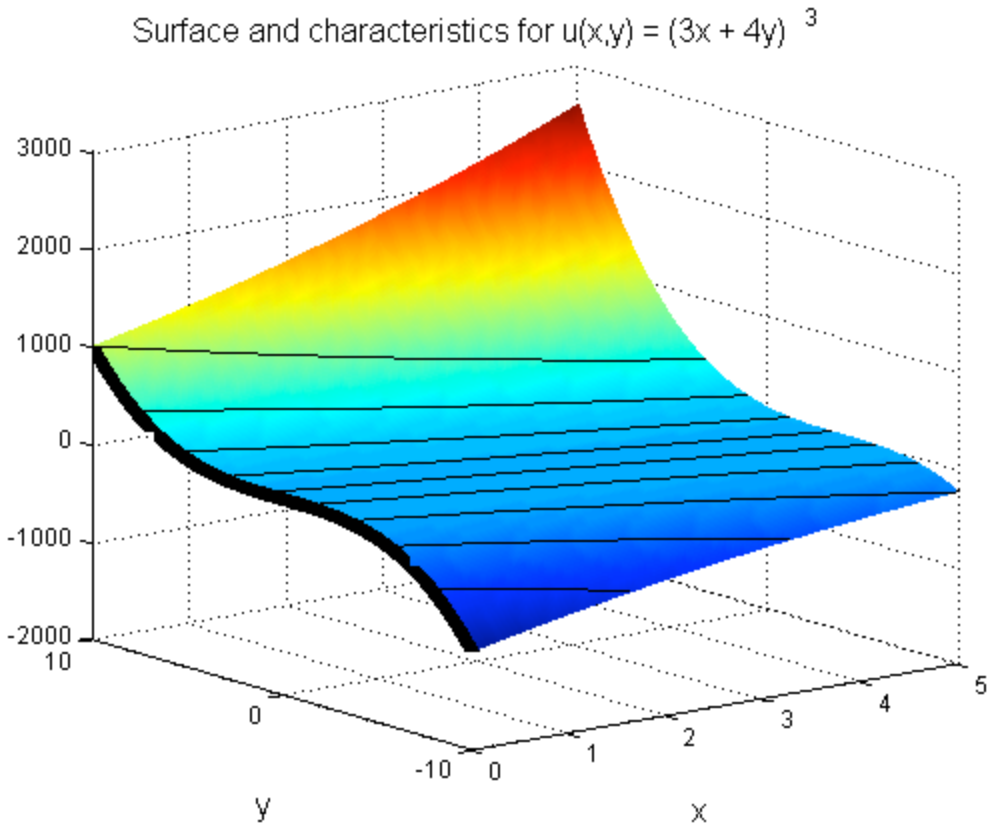
Mini-Matlab Lesson 14: Characteristics

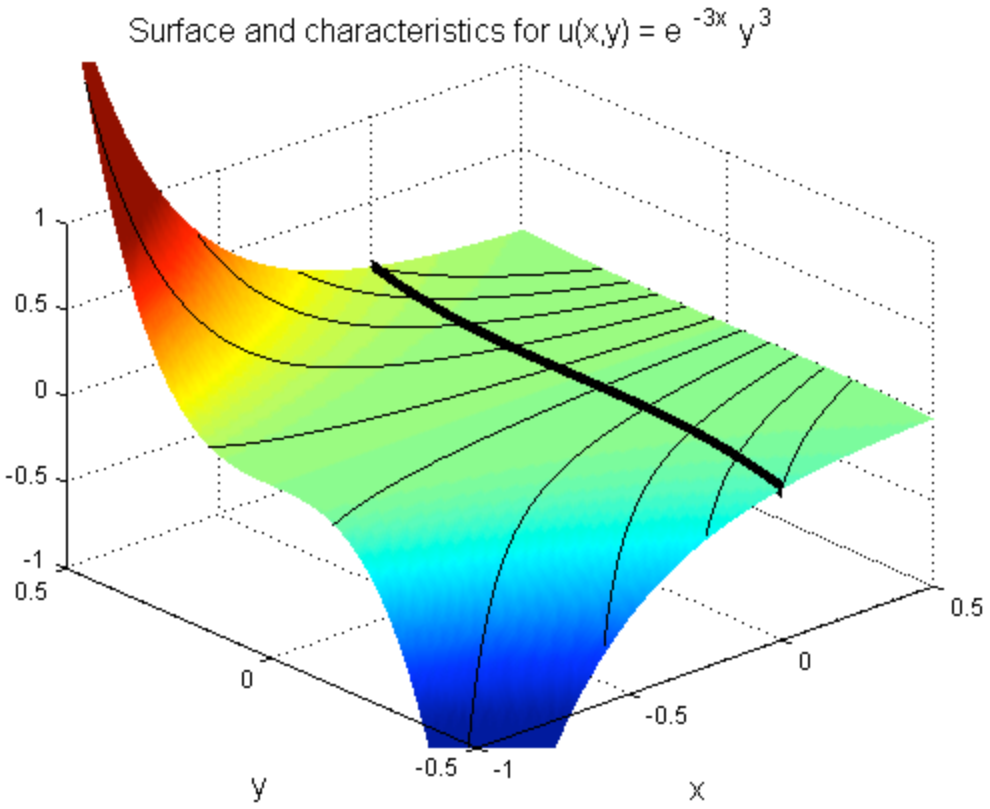
This Matlab code plots the surfaces and characteristics we will discuss in the lecture.

```
clear;
close all;

x = linspace(0, 5, 50);
y = linspace(-10, 10, 50);
[X,Y] = meshgrid(x, y);
f = @(X,Y) (3*X+4*Y).^3/64;

figure;
S = surf(X,Y,f(X,Y));
set(S, 'EdgeColor', 'none', 'FaceColor', 'interp');

hold on;
plot3(0*y, y, y.^3, 'k', 'LineWidth', 6);

C = linspace(y(1), y(end), 10);
for j = 1:length(C)
   ys = -4/3*x + C(j);
   us = f(x, ys);

   % This is a trick in order to kill any lines past the end of the domain
   us(abs(ys) > 10) = NaN;

   plot3(x, ys, us, 'k');
end

hold off;

axis([0 5 -10 10 -2000 3000])
view([-38 16]);
title('Surface and characteristics for u(x,y) = (3x + 4y)^3', 'FontSize', 16);
xlabel('x', 'FontSize', 16);
ylabel('y', 'FontSize', 16);
set(gcf, 'Color', 'w');
```




```
x = linspace(-1, 0.5, 100);
y = linspace(-0.5, 0.5, 100);
[X,Y] = meshgrid(x, y);
f = @(x,y) exp(-3*x).*y.^3;

figure;
S = surf(X,Y,f(X,Y));
set(S, 'EdgeColor', 'none', 'FaceColor', 'interp');

hold on;

% Plot the initial condition
plot3(0*y, y, y.^3, 'k', 'LineWidth', 6);

% Plot 10 characteristics
C = linspace(y(1), y(end), 10);
for j = 1:length(C)
   ys = C(j)*exp(-x);
   us = f(x, ys);
   us(abs(ys) > 0.5) = NaN;

   plot3(x, ys, us, 'k');
end
hold off;

axis([-1 0.5 -0.5 0.5 -1 1])
view([-42 35]);
caxis([-1 1]);
```

```
xlabel('x', 'FontSize', 16);
ylabel('y', 'FontSize', 16);
title('Surface and characteristics for u(x,y) = e^{-3x} y^3', 'FontSize', 16);
set(gcf, 'Color', 'w');
```



Published with MATLAB® 7.12