

MAE561/471 Fall 2013 HW0B Matlab code (prepared by HPH)

```

clear
dx5 = [0.1 0.03 0.01 0.003 0.001];
dy5 = [0.1 0.03 0.01 0.003 0.001];
f = inline('exp(y-x^2)', 'x', 'y');
fxy = inline('(4*x^2-2)*exp(y-x^2)', 'x', 'y');
x = 1; y = 1.5;
for id = 1:5
    dx = dx5(id); dy = dy5(id);
    fxy_1st = ( f(x+2*dx,y+dy)-2*f(x+dx,y+dy)+f(x,y+dy) ...
               -f(x+2*dx,y)+2*f(x+dx,y)-f(x,y) ) / (dx*dx*dy);
    fxy_2nd = ( 0.5*f(x-dx,y+dy)-0.5*f(x-dx,y-dy)-f(x,y+dy) ...
               +f(x,y-dy)+0.5*f(x+dx,y+dy)-0.5*f(x+dx,y-dy) ) / (dx*dx*dy);
    fxy_exact = fxy(x,y);
    error_1st = abs(fxy_1st - fxy_exact);
    error_2nd = abs(fxy_2nd - fxy_exact);
    logerror_1st(id) = log(error_1st);
    logerror_2nd(id) = log(error_2nd);
    log_ds(id) = log(dx);
end
slope1 = polyfit(log_ds,logerror_1st,1);
slope2 = polyfit(log_ds,logerror_2nd,1);
fprintf('Slope for 1st order scheme is %6.4f \r',slope1(1))
fprintf('Slope for 2nd order scheme is %6.4f \r',slope2(1))
hold on
plot(log_ds,logerror_1st,'^k','MarkerFaceColor','r')
plot(log_ds,logerror_2nd,'ok','MarkerFaceColor','b')
xlabel('log(\Delta s)');ylabel('log(error)')
legend('1st order','2nd order','Location','SouthEast')
hold off

```

Slope for 1st order scheme is 0.9590

Slope for 2nd order scheme is 2.0068

