MATLAB EXERCISE 1.26 **Symbolic gradient in different coordinate systems.** Based on Eqs.(1.39)–(1.41), write functions `gradCar()`, `gradCyl()`, and `gradSph()` in MATLAB that take as input the symbolic expression for a function $f(x, y, z)$ and return its gradient (∇f) in the Cartesian, cylindrical, and spherical coordinate systems, respectively, as a symbolic vector function. *(gradCar.m, gradCyl.m, and gradSph.m on IR)*

SOLUTION:

```
%
%   Book: MATLAB-Based Electromagnetics (Pearson Prentice Hall)
%   Author: Branislav M. Notaros
%   Instructor Resources
%   (c) 2011
%
%   This MATLAB code or any part of it may be used only for
%   educational purposes associated with the book
%
%
%


%    Symbolic gradient in Cartesian coordinates


function [Ax, Ay, Az] = gradCar(f)
syms x y z
Ax = diff(f,x);
Ay = diff(f,y);
Az = diff(f,z);
```

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%   Symbolic gradient in cylindrical coordinates


function[Ar,Aphi,Az] = gradCyl(f)
syms r phi z
Ar = diff(f,r);
Aphi = 1/r*diff(f,phi);
Az = diff(f,z);
```

```
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%    Symbolic gradient in spherical coordinates


function[Ar,Atheta,Aphi] = gradSph(f)
syms r theta phi
Ar = diff(f,r);
Atheta = 1/r*diff(f,theta);
Aphi = 1/r/sin(theta)*diff(f,phi);
```