

Appendix C

Computer Scripts

Those readers who have access to computer systems running Maple©, Mathematica©, Derive©, or similar software can use these systems to facilitate gaining geometric intuition and imagination of the concepts of differential geometry. However, the current state-of-the-art technology for generally available computer graphing programs is not capable of producing what would be the most useful displays. For example, it is not currently possible, with widely useable programs, to view a curve on a surface and to use the mouse to dynamically move a point along the curve and see displayed the three curvature vectors—intrinsic (geodesic), extrinsic, and normal.

In this appendix we have included several computer exercises for Maple, and these and additional scripts are also available for downloading on-line at

`ftp://math.cornell.edu/pub/Henderson/diff_geom.`

The first section contains a file with the definitions of several functions used by the other scripts. The other scripts are labeled according to the problem in the text to which they are most connected.

Standard Functions

These are definitions of commonly used functions that can be called by other scripts, and referred in the other scripts as the file with name `diffgeo_defs`. If you save it as a file with a different name, then you will have to change the appropriate lines in the scripts.

```
with(plots):
with(linalg):
macro(medgreen = COLOR(RGB,0,0.8,0.5));
macro(medgrey = COLOR(RGB,0.6,0.6,0.6));
vecnorm:= (vec) -> sqrt(dotprod(vec,vec)):
vecnormalize:= (vec)->evalm((1/vecnorm(vec))*vec):
Tangent := proc(t,func)
    local Velocity, VelEval, VelLength;
        Velocity := map(diff, func(x), x);
        VelEval := map(evalf, (subs(x=t, Velocity)));
        VelLength := sqrt(dotprod(VelEval, VelEval));
        evalm((1/VelLength)*VelEval)
end:
Tanvec := proc(t,func)
    polygonplot3d([func(t), convert(evalm(func(t)+
        Tangent(t,func)), list)], color=medgreen)
end:
CNormal := proc(t,func)
    local TanPrime, TanPrimeEval,
        TanPrimeLength;
```