HOMEWORK #1
Due date: Jan 20, 2016

1. How many decimal places does Elizabeth the First need to provide for latitude and longitude to describe one's position to $10\,\mathrm{cm}$? Does the accuracy depend on either latitude or longitude itself, i.e. is $\sigma_\phi \equiv \sigma_\phi(\phi, \lambda)$ and $\sigma_\lambda \equiv \sigma_\lambda(\phi, \lambda)$?

2. Nick decides to set the world record in free swimming and he sets off Cape May, USA to Dakar, Senegal. What is the shortest length of his swimming path? Given that Nick can swim $1\,\mathrm{m}$ per second, how long will he be swimming? Sketch his swimming path and compute all angles and sides. Look up geographic coordinates of Cape May and Dakar online.

3. Two ships, USS Elizabeth the Second and USS Lucas, are steaming along the parallels of latitude $48°\,\mathrm{N}$ and $15°\,\mathrm{S}$ respectively, in such a way that at any given moment the two ships are on the same meridian of longitude. If the speed of USS Elizabeth is 15 knots, find the speed of USS Lucas.

4. RMS Titanic sunk at $\phi = 41°43'32''\,\mathrm{N}$, $\lambda = 49°56'49''\,\mathrm{W}$. It traveled from Southampton ($\phi = 50°54'18''\,\mathrm{N}$, $\lambda = 1°24'12''\,\mathrm{W}$) to New York ($\phi = 40°16'12''\,\mathrm{N}$, $\lambda = 73°58'48''\,\mathrm{W}$). Liam was wondering if this point was on the shortest path between the two cities. What say you?

5. Queen Mary steams from $\phi = 39°20'00''\,\mathrm{S}$, $\lambda = 110°10'00''\,\mathrm{E}$ to $\phi = 44°30'00''\,\mathrm{S}$, $\lambda = 46°20'00''\,\mathrm{W}$. What is the shortest possible route between those two points if Queen Mary cannot cross the $62°\,\mathrm{S}$ parallel?

6. *Extra credit:* In a spherical triangle ABC, $C = 90°$, $a = 119°46'36''$ and $B = 52°25'38''$. Compute the values of b, c and A.

PS. Don't forget the assignments from class: (a) derive the planar law of cosines; (b) derive the spherical law of sines; and (c) redo the derivation of the spherical law of cosines. Good luck!