Exercises

1. Compute the eccentricity squared for the Clarke Spheroid of 1866. Use the two different equations (each is algebraically correct) and make sure you understand the reason for the difference. One answer has 10 correct digits, the other answer only 8 corrrect digits.

Given: Clarke Spheroid of 1866, a = 6,378,206.4 m & b = 6,356,583.8 m

$$e^2 = \frac{a^2 - b^2}{a^2} = 1 - \frac{b^2}{a^2} =$$

$$f = \frac{a - b}{a}; \quad e^2 = 2f - f^2 =$$

2. Compute the polar radius of curvature, c, for the GRS 1980:

a = 6,378,137.000 & 1/f = 298.2572221008827 (e^2 = 0.006694380023)

$$c = \sqrt{\frac{a^2}{b}} = \frac{a}{\sqrt{1 - e^2}} =$$

3. Compute the radius of curvature on the GRS 1980 at latitude 45° 20' 10" in the meridian section plane and in the prime vertical plane (perpendicular to each other). Also find the geometrical mean radius at that latitude.

$$N = \frac{a}{\sqrt{1 - e^2 \sin^2 \phi}}; \quad M = \frac{a(1 - e^2)}{\left(1 - e^2 \sin^2 \phi\right)^{3/2}}; \quad R_m = \sqrt{M\ N} = \frac{a\sqrt{1 - e^2}}{\left(1 - e^2 \sin^2 \phi\right)}$$

N =

M =

R_m =

4. Compute geocentric X/Y/Z coordinates on the GRS 80 ellipsoid for the point ϕ = 40° 26' 21."335469 N, λ = 268° 42' 55."221342 E (91° 17' 04."778658 W), & h = 231.446 m.

X = (N + h) cos ϕ cos λ

Y = (N + h) cos ϕ sin λ

Z = (N(1 - e^2) + h) sin ϕ

