3D Transformation Calculations

Set up a spreadsheet to do the 3D transformation between ITRF(epoch 1997) and NAD83(ITRF89):

$$\begin{bmatrix} X_{NAD83} \\ Y_{NAD83} \\ Z_{NAD83} \end{bmatrix} = \begin{bmatrix} TX \\ TY \\ TZ \end{bmatrix} + \begin{bmatrix} 1 & -RZ(t) & RY(t) \\ RZ(t) & 1 & -RX(t) \\ -RY(t) & RX(t) & 1 \end{bmatrix} \begin{bmatrix} X_{ITRF96} \\ Y_{ITRF96} \\ Z_{ITRF96} \end{bmatrix}$$

Where

The estimated transformation parameters from ITRF96 at epoch 1997.0 to NAD83(ITRF89) are:

TX(1997.0)	=	0.9910 m
TY(1997.0)	=	–1.9072 m
TZ(1997.0)	=	–0.5129 m
RX(1997.0)	=	–25.79 mas
RY(1997.0)	=	–9.65 mas
RZ(1997.0)	=	–11.66 mas
DS(1997.0)	=	6.62 ppb (not used, set to 0)

By convention, the R's are reported in milla-arcseconds (thousands of an arc-second), the calculations must be done in radians. The conversion is
1 mas = 4.8481368×10^{-9} radians

Use the spreadsheet to calculate the ITRF coordinates for an NGS well-surveyed point with NAD83(ITRF89) coordinates of:

X = -251,132.682
Y = -4,511,459.574
Z = 4,486,877.498

What is the vector distance from the NAD83 X, Y, Z coordinate to the ITRF X, Y, Z coordinate, according to the formula

Vector distance = square root ($\Delta X^2 + \Delta Y^2 + \Delta Z^2$) where Δ is the difference along the axis, e.g., $\Delta X = X_{NAD} - X_{ITRF}$

Do the same conversion and vector distance for a point in Miami, Florida:
X = 972,941.973
Y = -5,653,257.872
Z = 2,778,911.669