Exercise 5 - Displacement stability calculations

Part 1
List the assumptions behind Dietz stability analysis

Part 2
The Dietz stability equation is

$$tan\beta = \frac{1 - M_e}{M_e N_{ge} cos\alpha} + tan\alpha$$

where the end point gravity number is defined as

$$N_{ge} = \frac{k'_{ro}}{\mu_o} \frac{Ak(\rho_w - \rho_o)g}{q_{inj}}$$

and the end point mobility ratio is

$$M_e = \left(\frac{k'_{rw}}{\mu_w}\right) \Big/ \left(\frac{k'_{ro}}{\mu_o}\right)$$

Make a sketch of a dipping system where water is displacing oil, and explain the concept of a stable displacement front. In terms of the equation above, what is the stability criterion? How does the end point mobility ratio affect stability?

Part 3
For a dip angle of 10 degrees, determine if the water displacement process in Exercise 4 is stable for the two oil viscosities. If not, determine the maximum displacement velocity for stability.
(let $u = 0,0005$ cm/s, $k = 1$ D)

NB: Make sure units are consistent!