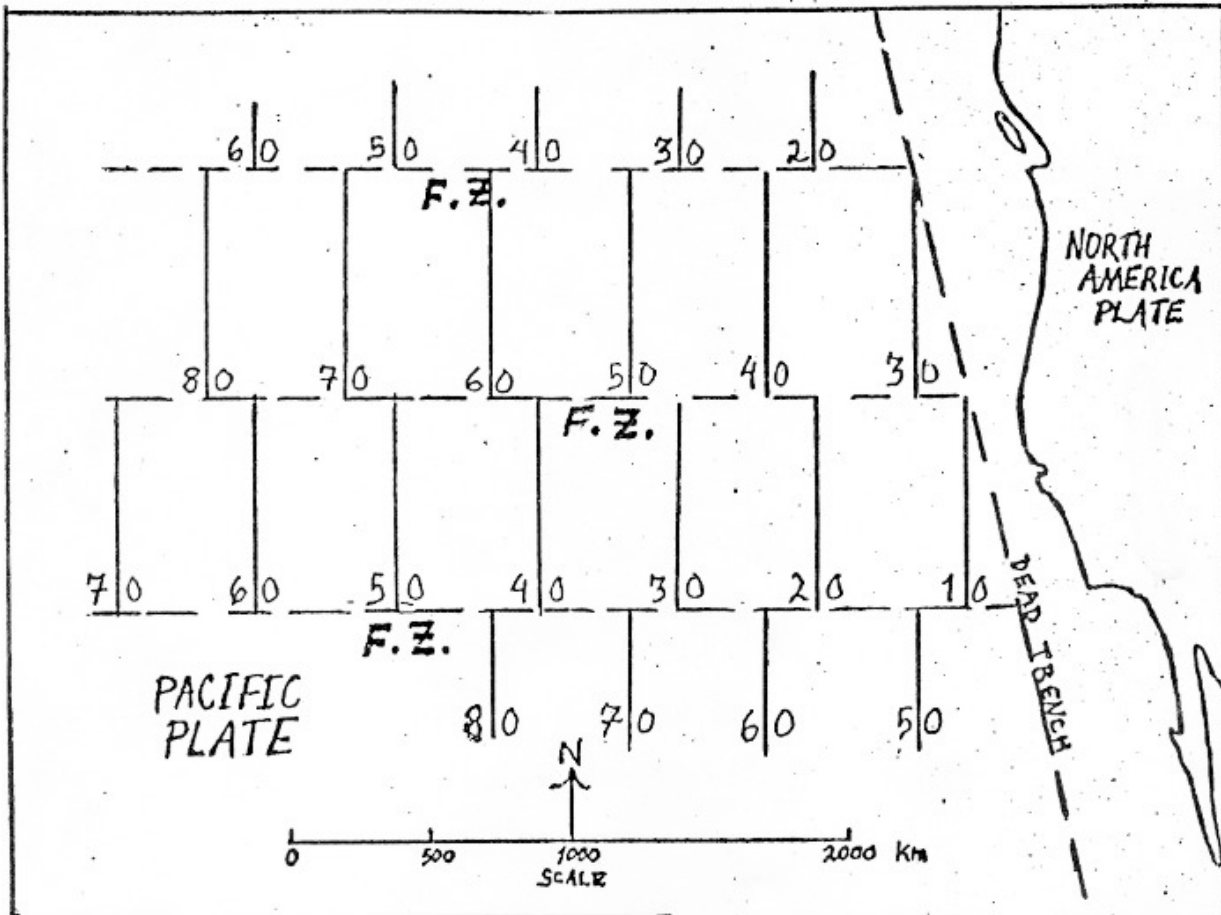


EPSC 353: Earth Forces
 PROBLEM SET #1
 DUE: Jan 30, 2008

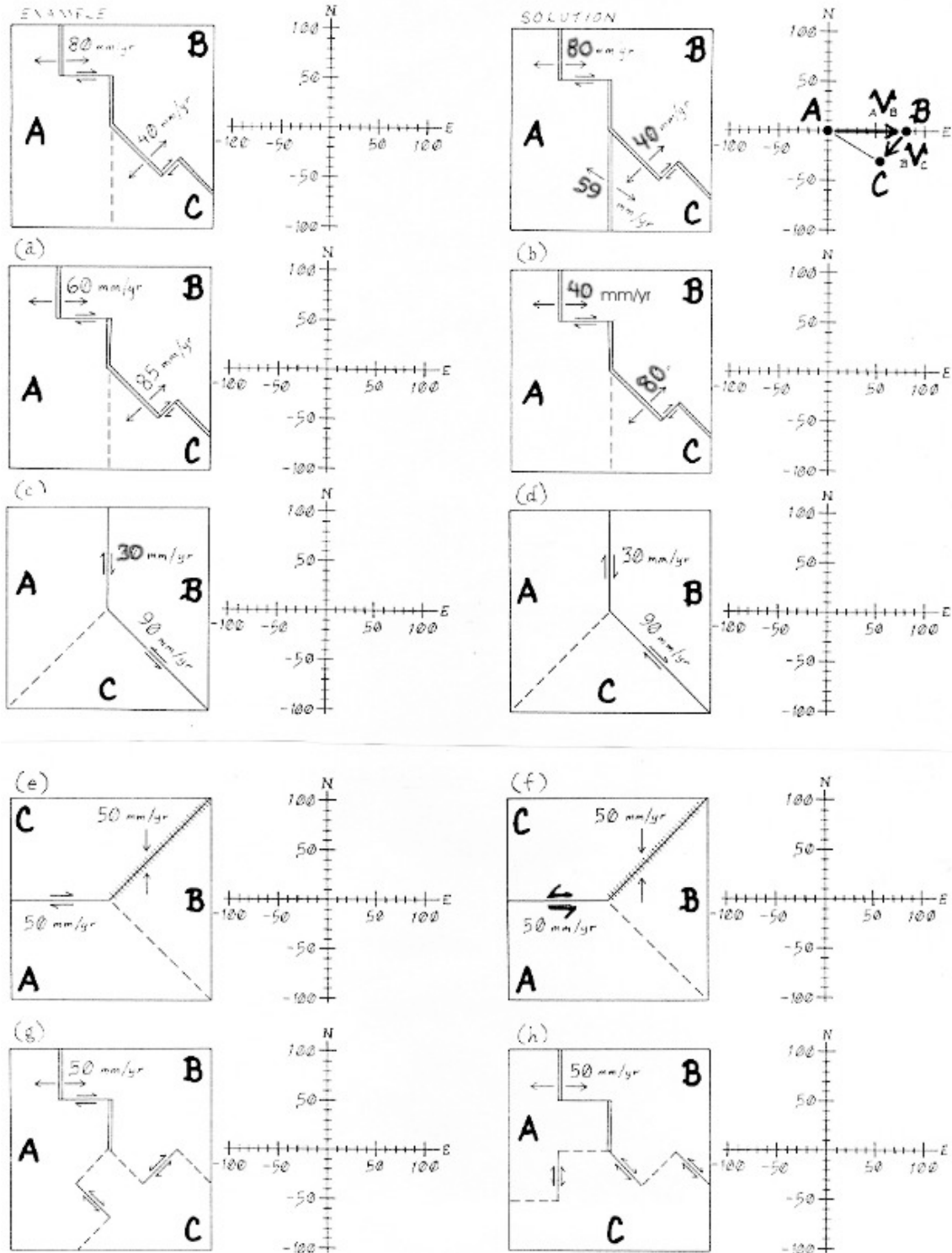
1. The N-S magnetic lineations over the Pacific Ocean off the coast of the western U.S. gives excellent isochrons which are offset along E-W fracture zones as shown on the figure. Oddly enough, these isochrons get younger towards the present N. American coastline. To explain this, an ancient trench that is no longer active has been postulated. Work out a tectonic history which will account for the pattern of anomalies and fracture zones. Assume (incorrectly) that the Pacific Plate and the North American plates have not moved relative to each other.
 - A. Make a series of maps showing the pattern of plates at times $t=10$ Ma., 20 Ma., and 50 Ma.
 - B. Show all ridges, transforms, and active trenches with symbols. Show the direction of motion on the transforms.
 - C. Make a table listing the rates of relative motion between all the plates and between the ridges and the plates.



2. At the Cocos-North American-Pacific triple junction in the Gulf of California, the spreading rate on the Cocos-Pacific ridge is 10.2 cm/yr at azimuth N80E. The spreading rate between the Pacific and N. American plates is 5.7 cm/yr at azimuth N50W in the Gulf of California. Solve graphically for the convergence rate in the Mexican Subduction Zone.
3. a) What is the velocity of Yellowstone Park with respect to the Hotspot Reference Frame? Use the table of Euler vectors of the plates with respect to the Hotspot reference frame given enclosed in this problem set.

b) How about Kenya, Africa?
4. Use the table of Euler vectors wrt the hotspot reference frame to find the Euler vectors ω (lat, long, rate) for the following pairs of plates:
 - a) Pacific - North America
 - b) Pacific - Eurasia
5. From your results for #4, find the approximate relative plate velocities at the San Andreas Fault and at the Japan Trench (you can estimate δ , the distance in degrees).
6. Do the exercises on the following page.
7. Analyze the triple junctions in velocity space to determine if the triple junctions are stable. For stable triple junctions, determine the velocity vector of the triple junction relative to plate C.

Make a velocity diagram for each set of plates and determine whether the dashed boundary is a ridge, transform, or trench; then show the relative velocity across the boundary, giving both the direction (small arrows) and the magnitude (in units of mm/yr). In (g) and (h) double-headed arrows are used to show that the boundary is a transform, but it's up to you to determine whether it's left-lateral or right-lateral.



Rotation vectors relative to the hotspot reference frame

	λ	ϕ	ω	ω_x	ω_y	ω_z
	N°Lat.	E°Long.	deg./m.y.	deg./m.y.	deg./m.y.	deg./m.y.
AFRC	18.8	-21.8	0.139	.1222	-.0489	.0448
ANTA	21.8	75.6	0.054	.0125	.0486	.0201
ARAB	27.3	-3.9	0.388	.3440	-.0235	.1780
CARB	-42.8	66.8	0.129	.0373	.0870	-.0876
COCO	21.9	-115.7	1.422	-.5722	-1.1889	.5304
EURA	0.7	-23.2	0.038	.0349	-.0150	.0005
INDI	19.2	35.6	0.716	.5498	.3936	.2355
NAZC	48.0	-93.8	0.585	-.0259	-.3906	.4347
NOAM	-58.3	-40.7	0.247	.0984	-.0846	-.2102
PCFC	-61.7	97.2	0.967	-.0575	.4548	-.8514
SOAM	-82.3	75.7	0.285	.0094	.0370	-.2824