

Intro to Geophysics, Fall 1998 – Final Exam. Your name: _____

1. For each of the following equations, define the variables and explain the use/meaning of the equation:

a. $T(z) = \frac{A}{k} * (H * z - \frac{z^2}{2}) + \frac{qb}{k} * z + T(0); _ _ \text{and} _ _ q = k * \frac{dT}{dz}$

b. $BA = g_{\text{obs}} - g_{\text{th}} + \text{FAC} - \text{BC} + \text{TC}$

c. $Me = 6 * 10^{24} \text{ kg} = \int_0^{2\pi} \int_0^{\pi} \int_0^{\text{Re}} (a * (r - \text{Re}) + 3000 \text{ kg}) r^2 \sin(\mathbf{q}) dr d\mathbf{q} d\mathbf{f}$

2. Here's some short answer questions (use equations if necessary):

a. Some Cambrian (525 Ma) rocks have (well-averaged) Dec = 25°, Inc = -62°. What can you say about their place of formation and subsequent history?

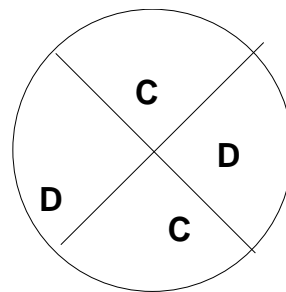
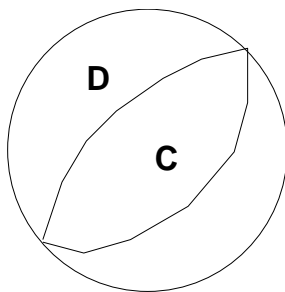
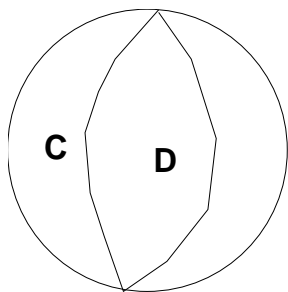
b. The crust/mantle boundary, who discovered it, how, and about how long ago?

c. What is meant by frequency domain versus time domain?

d. How would you tell if Proterozoic plate tectonic rates were about like Phanerozoic rates?

e. How do deep sources affect gravity? How about crustal temperatures?

2. Label the three fault-plane solution diagrams below as to whether they indicate normal, reverse, or strike-slip motion. Explain your thinking. If one of the diagrams represents an impossible situation just say so:



A _____

B _____

C. _____

Strike of fault:

A _____

B _____

C _____

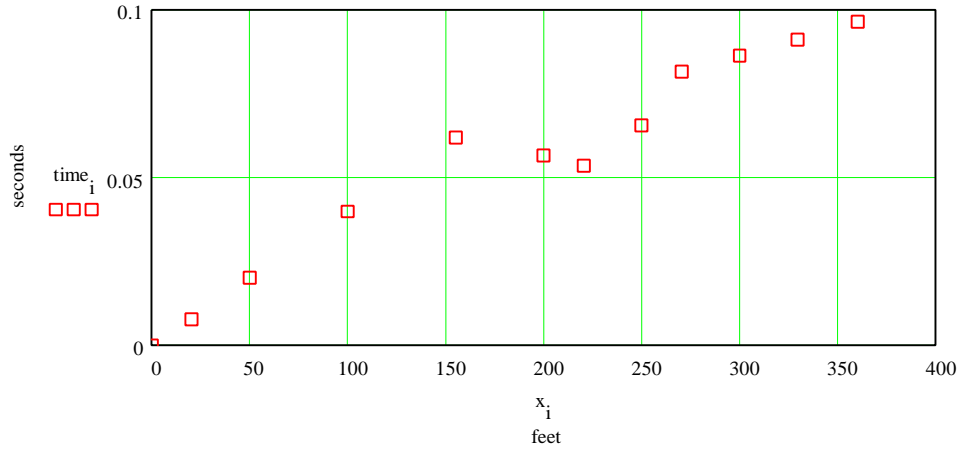
How do the above diagrams relate to Anderson's theory of faulting? (Anderson related principal stresses to fault types).

3. Here are some seismic refraction data (first arriving P-waves) from a one-way survey assume that a reversed line would show the same structures. Assuming the divergence from linearity is due to topography on the V1/V2 interface, calculate V1, V2, Z, and the amplitude of the topography as best you can. Distance is in feet, time in seconds. Start by drawing visual best-fits for Td and Tr on the graph. Provide an outline or explanation of your thinking (so I can tell what you're doing).

i := 0.. 11

$x_i :=$ $time_i :=$

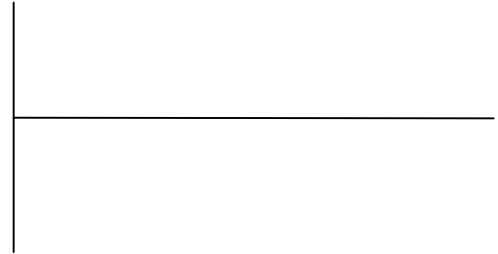
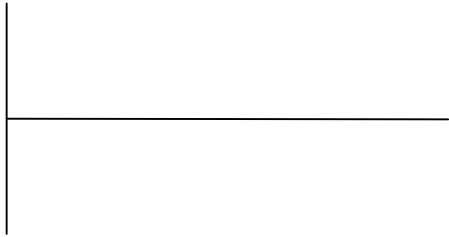
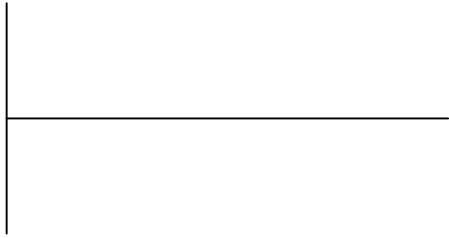
0	0
20	.008
50	.02
100	.04
155	.062
200	.0568
220	.0533
250	.0652
270	.0814
300	.0864
330	.091
360	.0964



$$t(d) = \frac{x}{v_1} \quad t(r) = \frac{x}{v_2} + 2 \cdot z \cdot \frac{\sqrt{(v_2)^2 - (v_1)^2}}{v_2 \cdot v_1} \quad z = \frac{T_i}{2} \left[\frac{v_2 \cdot v_1}{\sqrt{(v_2)^2 - (v_1)^2}} \right]$$

4. Suppose you work for a cheap, but entertaining, geophysical research institute. You are in an area where you want to know the dip (if any) on the crust-mantle interface. You only have money for a one-shot (**big** explosion source) seismic refraction survey but you have all the geophones, cables and recorders you need. How will you design a refraction survey to test for a dipping crust/mantle interface? Carefully explain how your expected results will solve the problem.

5. Below are cross sections of two mountain ranges. Their topography is identical. The one on the left is 100% isostatically compensated by local, Airy compensation; the one to the right is completely supported by the lithosphere. For each sketch the expected Bouguer anomaly, free air anomaly, and isostatic anomaly. Explain your reasoning as necessary.



6. While visiting an alien world one of the inhabitants told you their mantle had constant seismic velocity, but their liquid core ($0.5 * \text{radius}$) had $1/2$ that velocity. Sketch the travel paths of P and S-waves through that planet and their T-delta diagram; explain your thinking.

