

Geophysics 223 Assignment 2 (2009)

This assignment will be due in class on **Wednesday March 4 2009**

Question 1

Use the equations in C2.1.1 to answer the following questions about the geomagnetic field in Edmonton.

- (a) Calculate the geomagnetic latitude for Edmonton
- (b) Calculate the change in F associated with moving north (magnetic) by 1 km in Edmonton.
- (c) Calculate the change in F associated with a 10 m increase in elevation in Edmonton.

The following data will be useful:

Inclination in Edmonton, $i = 75^\circ$

Dipole moment of geomagnetic field, $M = 7.94 \times 10^{22} \text{ Am}^2$

Average radius of Earth, $R_E = 6367 \text{ km}$

Note : You will need to differentiate the equation for F in (b) and (c)

Question 2

A magnetic survey was conducted as part of a search for a large buried iron object. The data can be found in the file **F60m_transect.xls** that can be downloaded from the class webpage.

The data show an anomaly in the total magnetic field near the middle of the transect.

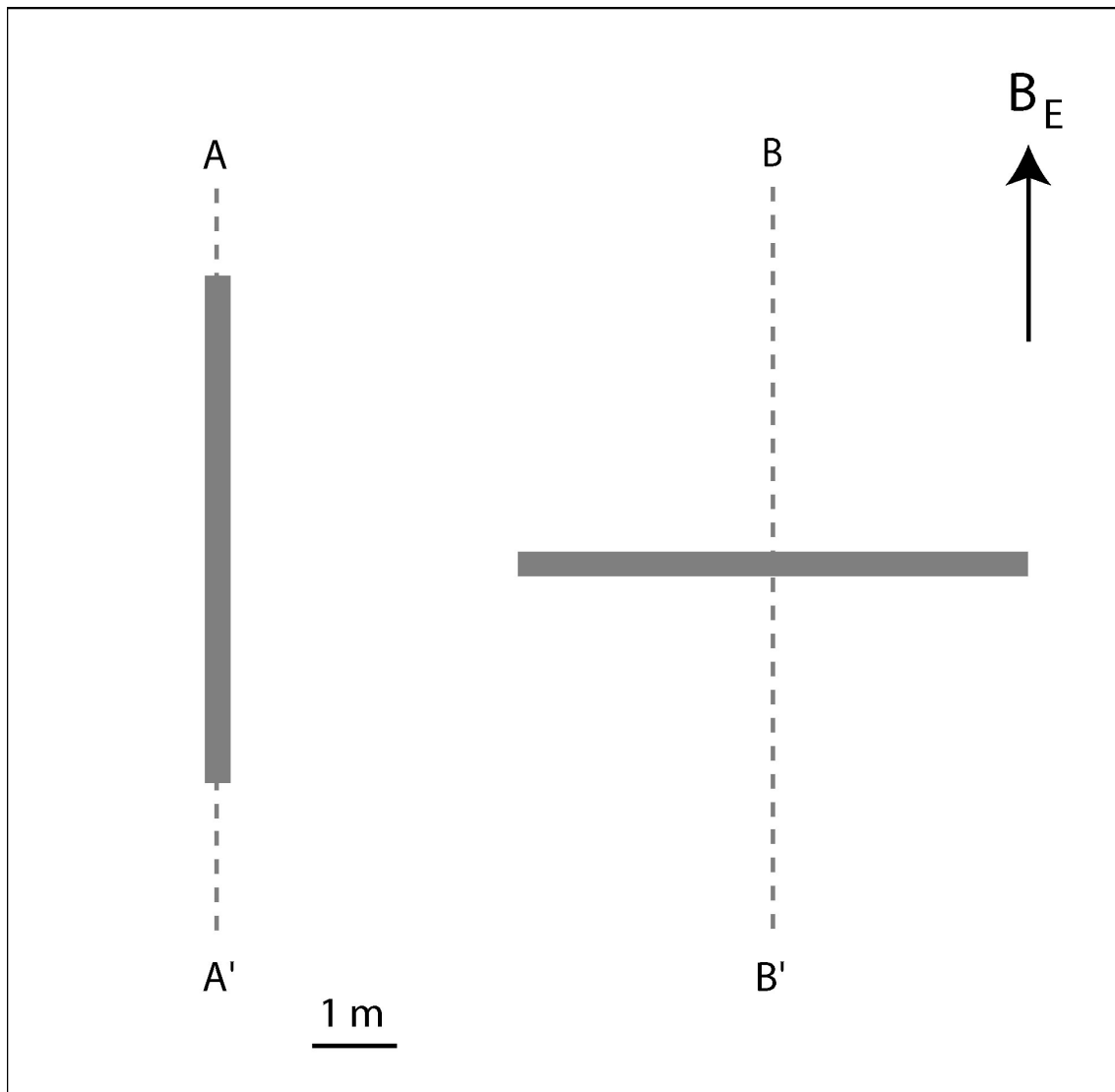
You are required to estimate the depth of the object causing the anomaly. Answer the following steps, using EXCEL if you wish. Include relevant plots in your assignment.

- (a) The data show a **strong regional trend**. Compute the magnitude of this trend in nT/m and remove it from the data.
- (b) Use a **half width technique** to estimate the depth as reliably as possible.
- (c) Use the **slope method** to estimate the depth as reliably as possible.
- (d) Would the half-width technique or slope method have worked if the regional trend was not removed? Explain your answer.

Question 3

A magnetic survey is being performed at a landfill close to the magnetic Equator using a proton precession magnetometer.

Several iron pipes are buried horizontally at the site at a depth of 1 m and the locations are shown below in grey.



- (a) Sketch the variation of $|F|$ along the transects AA' and BB'
- (b) Sketch a contour map of $|F|$ over the survey area in the box

Only consider induced magnetization.

Question 4

Another magnetic survey is investigating the location of buried drums in a landfill in Northern Canada.

The magnetic field is vertical with $B = B_E$

The drums have strong **remnant magnetization** that has a variable orientation.

Sketch the variation of $|F|$ on profiles AA', BB' and CC' (on next page)

Ignore the effect of induced magnetization

Show the vector addition of the magnetic fields in your solution

