

## LAB 02: ORTHOGRAPHIC PROJECTIONS OF LINES AND PLANES

The purpose of this lab is to develop your ability to visualize and describe lines and planes in three dimensions by conceptual, algebraic, and graphical means. See the Matlab help page for the syntax for sph2cart.

In the exercises below, consider north to be towards the top of the page for the top views. Label the points, show the projection lines, and label the right angles. Measure distances to the nearest 0.1 mm and angles to the nearest degree. The scoring is 1 pt for each correctly projected point, with half-credit for a point projected in the correct direction but with an incorrect projection distance, and 1 pt for each correct numerical answer.

- 1 Exercise 1: Complete adjacent views R, F, T of the lines (2 pts, 2 pts, 2 pts)
- 2 Exercise 2: Complete adjacent views A, A, B of the lines (2 pts, 4 pts)
- 3 Exercise 3: Complete the four views of the triangle (12 pts)
- 4 Exercise 4: Find the trend, plunge, and length of the lines (5 pts, 5 pts)
- 5 Exercise 5: Find the strike and dip of the planes. For each plane, label a line of strike in the top view and in a cross section view (7 pts, 7 pts, 9 pts)
- 6 For a plane with a strike of  $30^\circ$  and a dip of  $70^\circ$ , find the trend and plunge of the pole, and the direction cosines of the pole, using an x=north, y=east, and z=down convention. Solve using long-hand (show your work below or on an attached sheet) and check using the Matlab function sph2cart. Include a printout of your Matlab work. Scoring is 1 pt/box. (8 pts) (65 pts total)

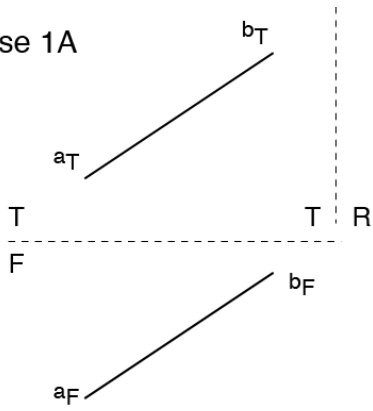
Longhand (5 pts; 1 pt per blank box)

Plane strike ( $^\circ$ )	Plane dip ( $^\circ$ )	Pole trend $\theta$ ( $^\circ$ )	Pole plunge $\phi$ ( $^\circ$ )	$\alpha$	$\beta$	$\gamma$
$30^\circ$	$70^\circ$					

Matlab (3 pts; 1 pt per blank box)

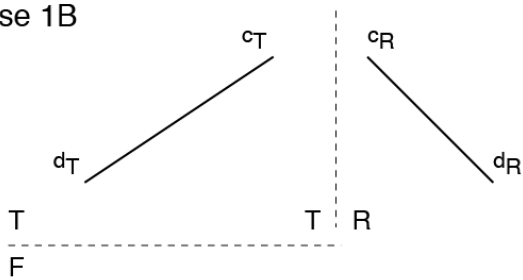
Plane strike ( $^\circ$ )	Plane dip ( $^\circ$ )	Pole trend $\theta$ ( $^\circ$ )	Pole plunge $\phi$ ( $^\circ$ )	$\alpha$	$\beta$	$\gamma$
$30^\circ$	$70^\circ$	As above	As above			

Exercise 1A



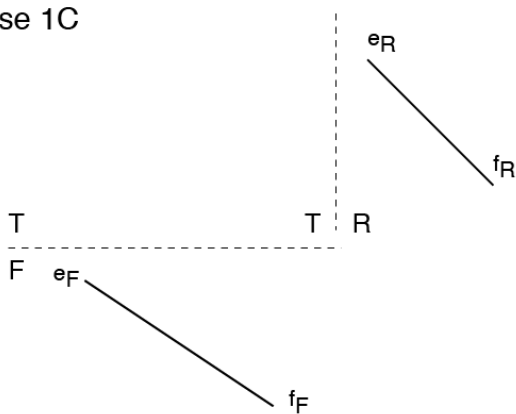
2 pts for correct projection of the two points. Make sure to connect the projected points with a line.

Exercise 1B



2 pts for correct projection of the two points. Make sure to connect the projected points with a line.

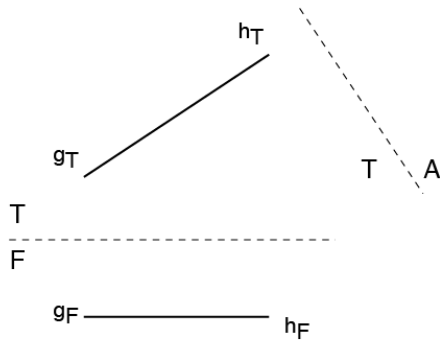
Exercise 1C



2 pts for correct projection of the two points. Make sure to connect the projected points with a line.

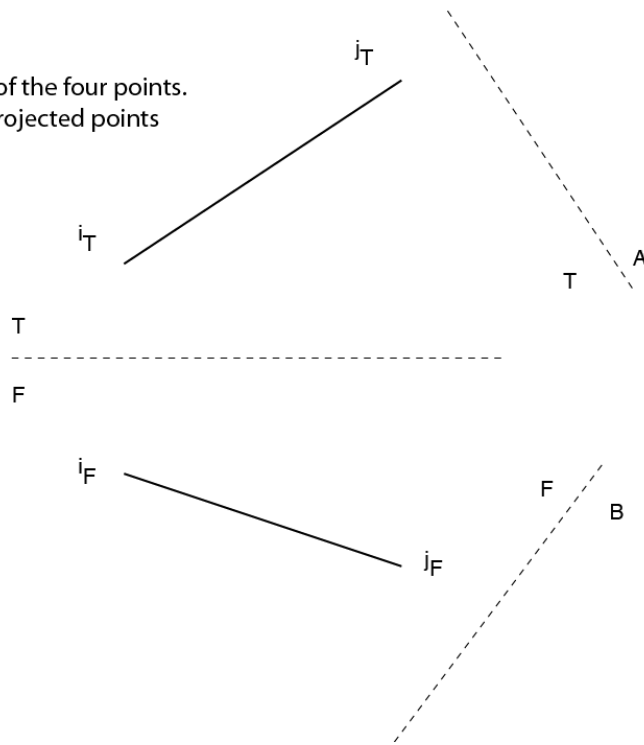
2 pts for correct projection of the two points.  
Make sure to connect the projected points  
with a line.

Exercise 2A



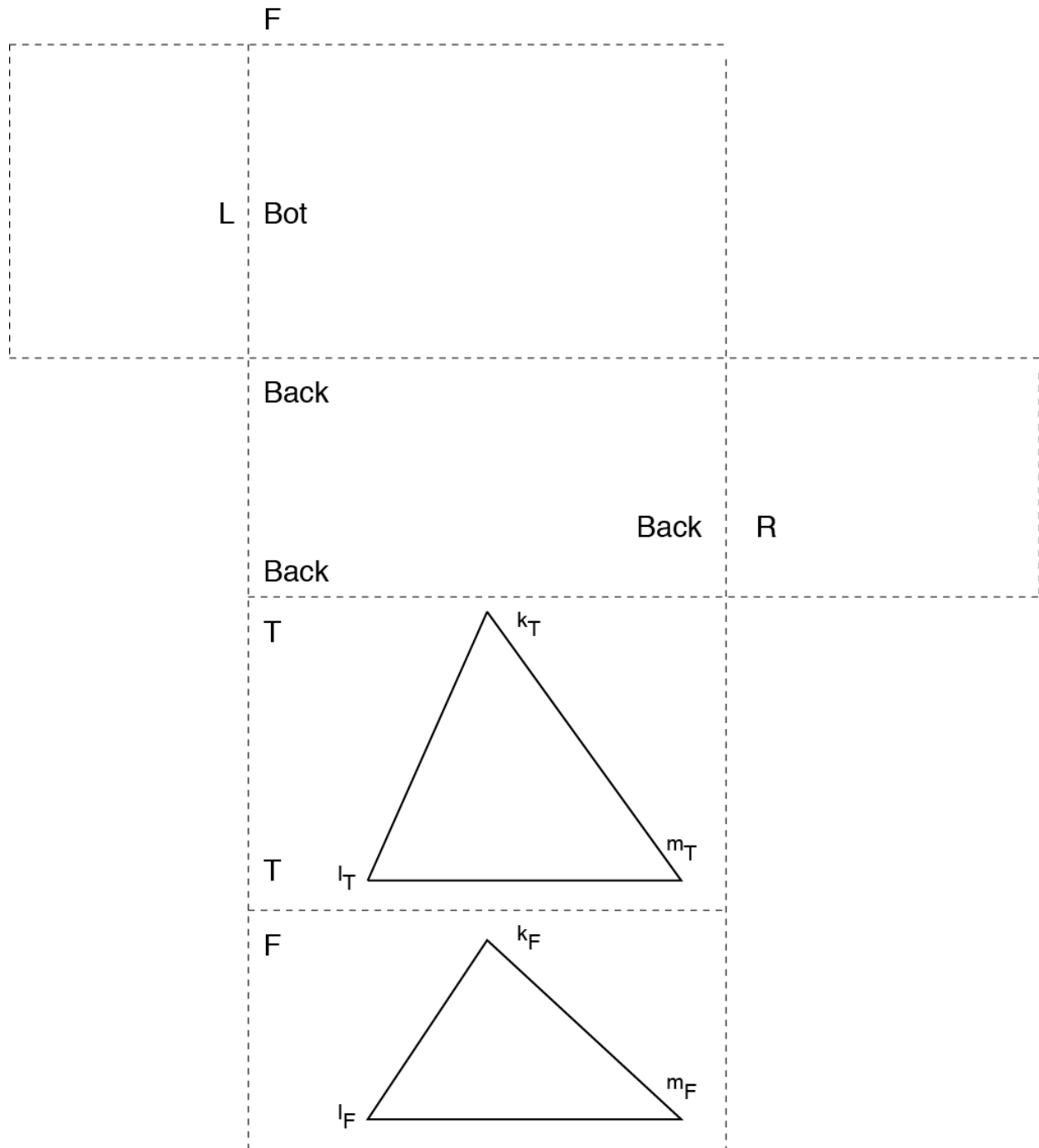
Exercise 2B

4 pts for correct projection of the four points.  
Make sure to connect the projected points  
with a line.

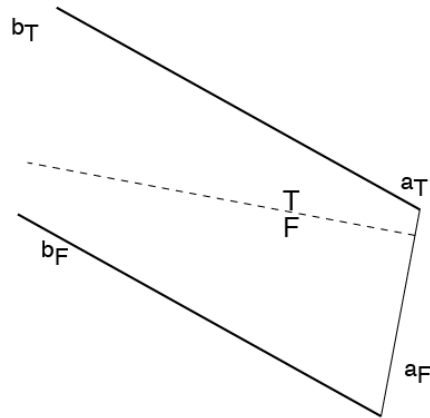


Exercise 3

12 points for correct projection of 12 points.  
Make sure to connect the points properly,  
to draw the right angle symbols on the projection lines,  
and to correctly label the various distances.



## Exercise 4A



Trend

Plunge

Length

Note that

$$\text{trend} = \tan^{-1} (\Delta E / \Delta N)$$

$$\text{plunge} = \tan^{-1} (\Delta V / \Delta H)$$

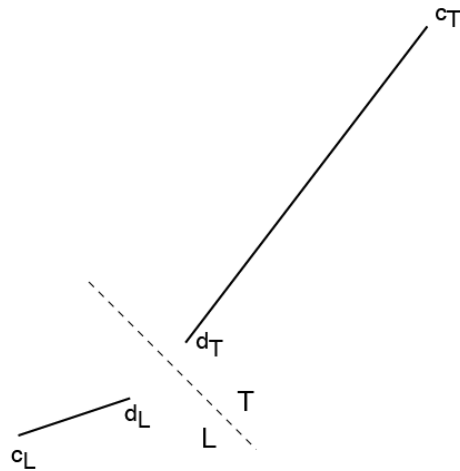
2 pts for correct projection of two points.

1 pt for correct trend.

1 pt for correct plunge.

1 pt for correct length.

## Exercise 4B



Trend

Plunge

Length

2 pts for correct projection of two points.

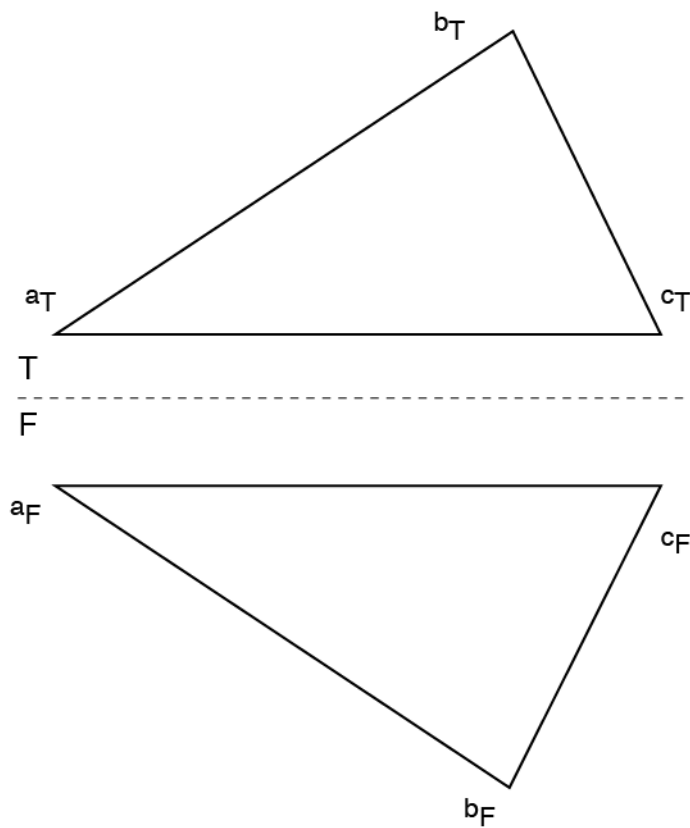
1 pt for correct trend.

1 pt for correct plunge.

1 pt for correct length.

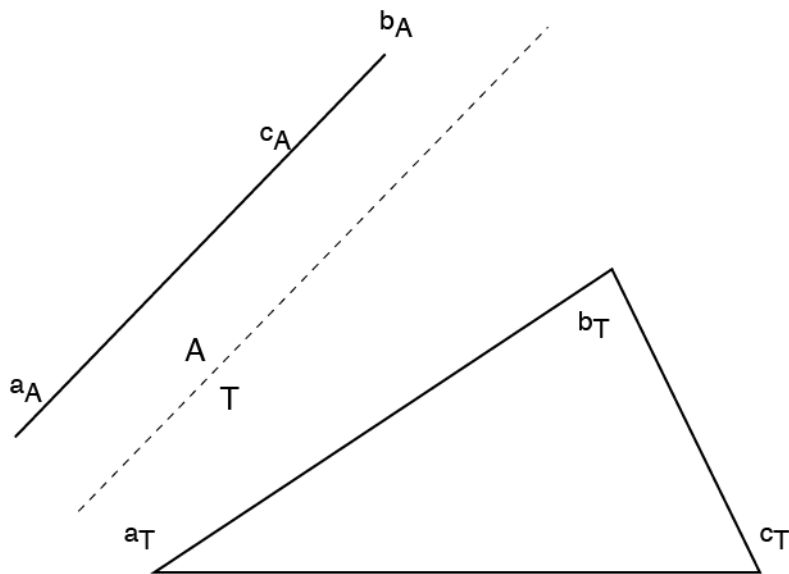
## Exercise 5A

Strike:  
Dip:



- 1 pt for correct label of line of strike in front view.
- 1 pt for correct label of line of strike in top view.
- 3 pts for correct projection of three points.
- 1 pt for correct strike.
- 1 pt for correct dip.

## Exercise 5B

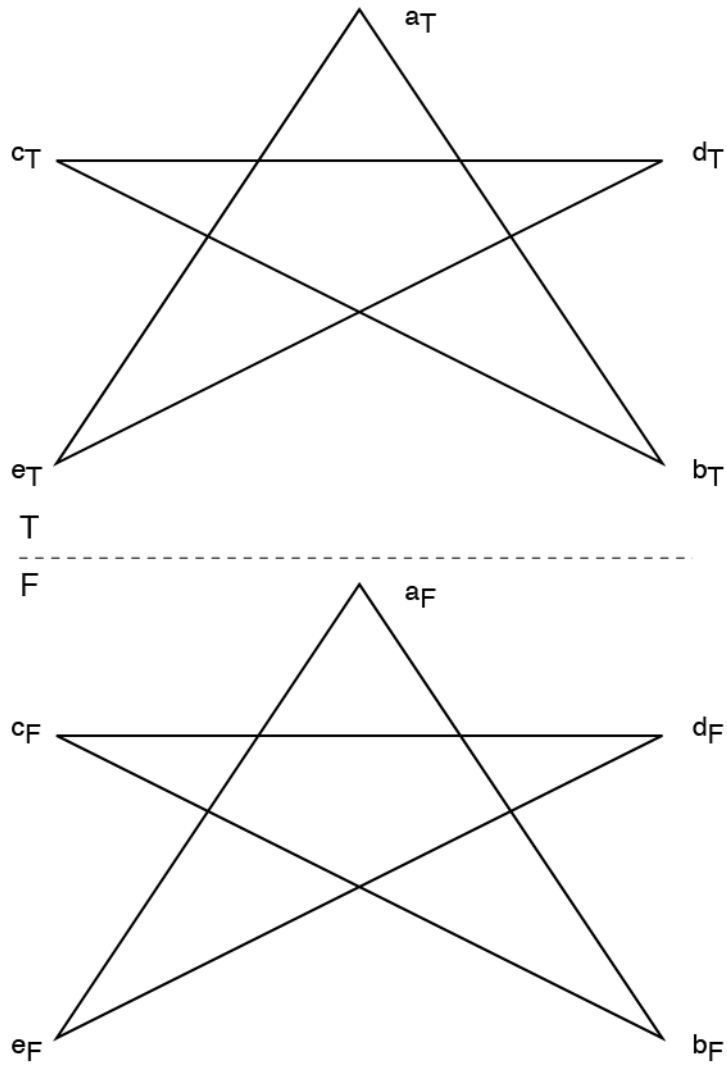


Strike:

Dip:

- 1 pt for correct label of line of strike in front view.
- 1 pt for correct label of line of strike in top view.
- 3 pts for correct projection of three points.
- 1 pt for correct strike.
- 1 pt for correct dip.

## Exercise 5C



Strike:  
Dip:

- 1 pt for correct label of line of strike in front view.
- 1 pt for correct label of line of strike in top view.
- 5 pts for correct projection of five points.
- 1 pt for correct strike.
- 1 pt for correct dip.