

5. Stereonets

I Main Topics

A Plotting a plane

B Plotting a line

C Measuring the angle between two lines

D Plotting the pole to a plane

E Measuring the angle between two planes

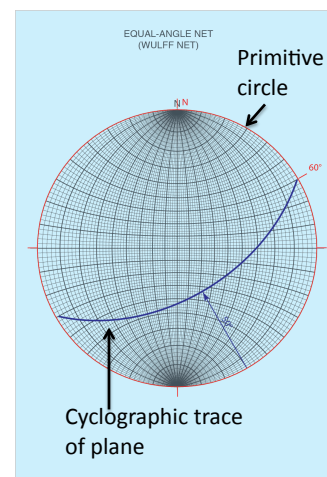
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Plotting a Plane: Overview

- Key concepts
 - An inclined plane plots along a great circle.
 - The endpoints of the cyclographic trace of a plane with a non-zero dip are at diametrically opposed points on the primitive circle; these points define the line of strike for the plane.
 - Visualization of the plane.



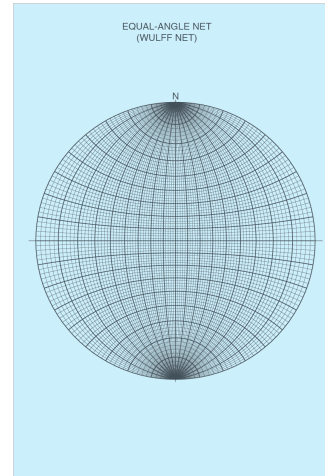
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Plotting a Plane: Step 1

- Lay tracing paper (blue) over stereonet
- In the example here, the plane plotted will strike 60° and dip 50°



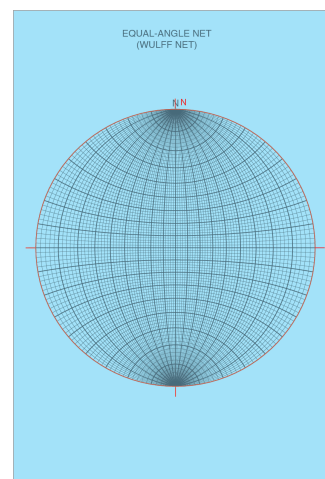
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Plotting a Plane: Step 2

- Trace primitive circle with a compass
- Add tick marks at 0° , 90° , 180° , and 270° for reference.
- Label the tick mark at 0° with an "N" to represent "north".



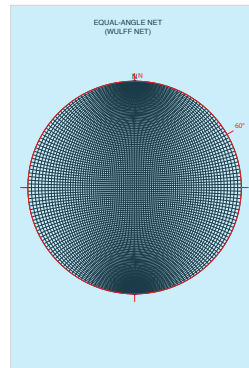
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Plotting a Plane: Step 3

- Plot a tick mark in on the primitive circle in the direction of the strike of the plane
- In the the example here, the strike is 60°



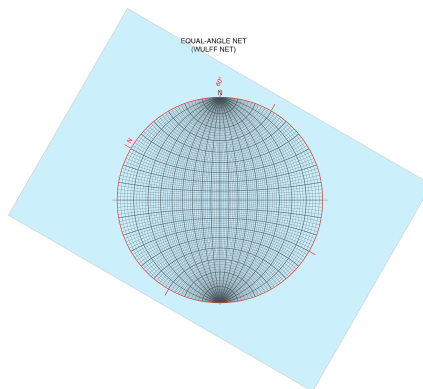
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Plotting a Plane: Step 4

- Now rotate the tracing paper such that the tick mark for the strike lies at the "north pole". This is where all the great circles converge.



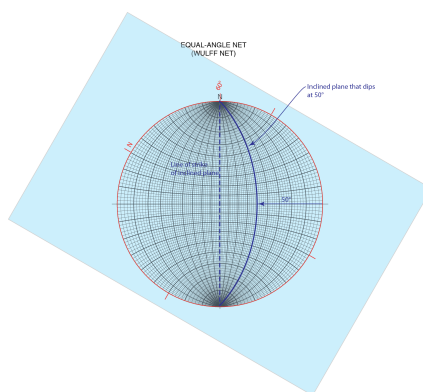
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Plotting a Plane: Step 5

- Draw the plane along the great circle with the appropriate dip (in the example here, the solid violet curve is a plane with a dip of 50°).
- The dashed construction line shows the strike of the plane; it is shown here for illustration only. It does not need to be plotted.



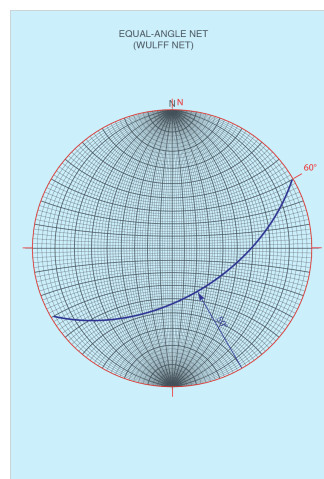
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Plotting a Plane: Step 6

- Remove the stereonet to see the results
- Visualize the results, and check to see if they make sense.
- In the example,
 - The violet curve represents a plane that strikes 60° and dips 50° .



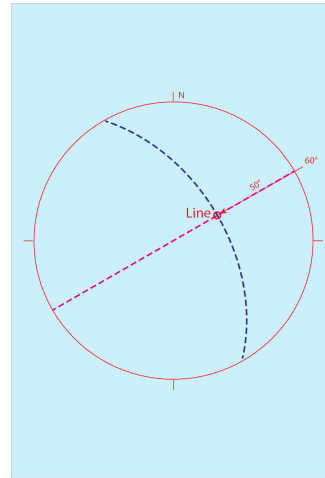
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Plotting a Line: Overview

- Key concepts
 - A line lies at the intersection of two planes:
 - A vertical plane (magenta) with a strike that matches the trend of the line.
 - An inclined plane (violet) with a dip that matches the plunge of the line and that dips in the direction the line plunges
 - Visualization



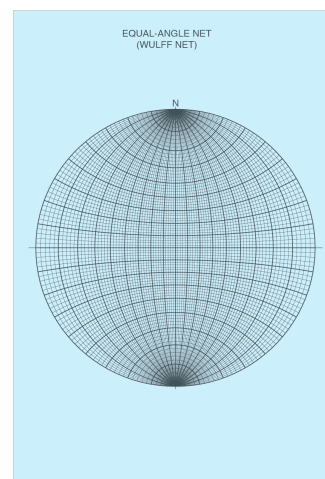
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Plotting a Line: Step 1

- Lay tracing paper over stereonet
- In the example here, the line plotted will trend 60° and plunge 50°



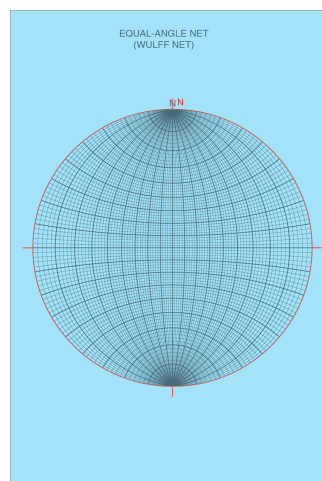
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Plotting a Line: Step 2

- Trace primitive circle with a compass
- Add tick marks at 0° , 90° , 180° , and 270° for reference.
- Label the tick mark at 0° with an “N” to represent “north”.



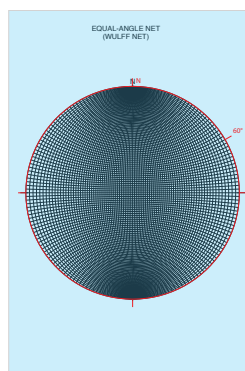
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Plotting a Line: Step 3

- Plot a tick mark in on the primitive circle in the direction of the trend of the line.
- In the the example here, the line trends 60° .



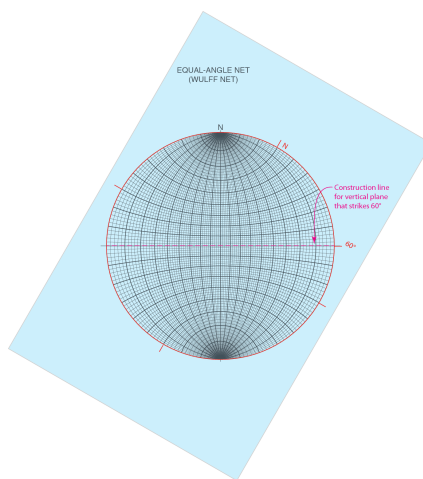
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Plotting a Line: Step 4

- Now rotate the tracing paper such that the tick mark at the trend lies along the small circle that projects as a straight line (i.e., the “equatorial line”)
- The dashed pink line represents a vertical plane containing the line



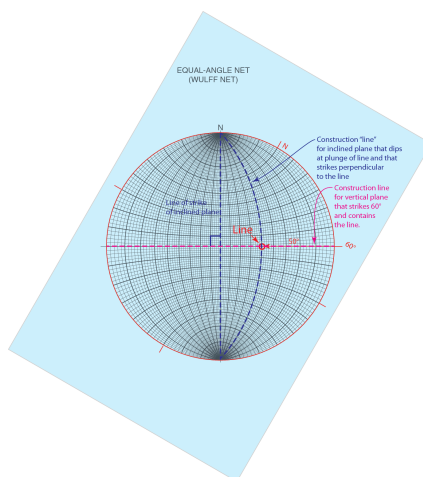
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Plotting a Line: Step 5

- Mark off the plunge, counting from the primitive circle towards the center of the plot.
- The dashed violet curve is a plane with a dip that matches the plunge of the line. This plane dips in the direction the line trends, and it strikes perpendicular to the trend of the line.
- The line of interest is at the intersection of the vertical pink plane and the plunging violet plane.
- The dashed construction lines are shown here for illustration only. They do not need to be plotted.



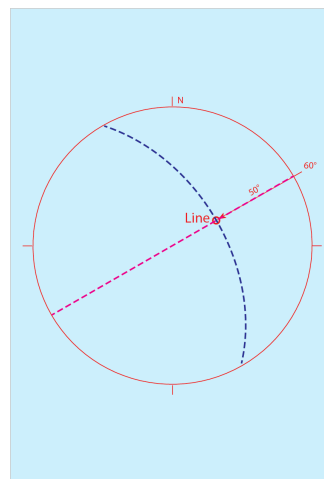
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Plotting a Line: Step 6

- Remove the stereonet to see the results.
- Visualize the results, and check to see if they make sense.
- In the example,
 - The line (marked by the small red circle) trends 60° and plunges 50° .
 - The dashed pink line represents a plane that strikes 60° and dips 90° .
 - The violet dashed curve represents a plane that strikes 330° and dips 50° towards the northeast.
 - The planes intersect at the line.
 - The planes (dashed) are shown for illustration purposes only. They typically would not be shown if only the line is off interest.



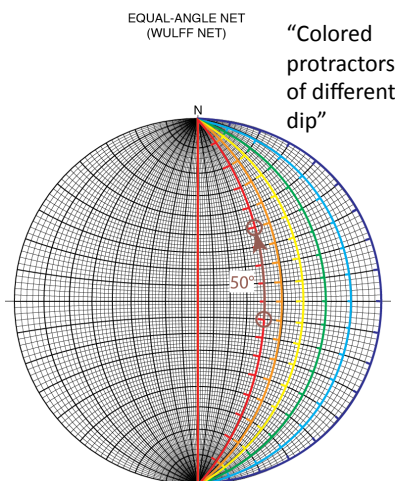
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Measuring the Angle Between Two Lines

- Key concepts
 - The angle between the lines is measured along the cyclographic trace of the plane that contains the lines.
 - The procedure is exactly analogous to measuring the angle between two lines with a protractor.



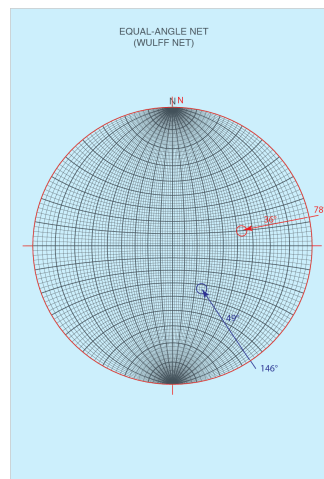
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Measuring the Angle Between Two Lines

- Plot the lines
- In the example, one line trends 78° and plunges 36° ; the red circle marks this line.
- The other line trends 146° and plunges 49° ; the blue circle marks this line.



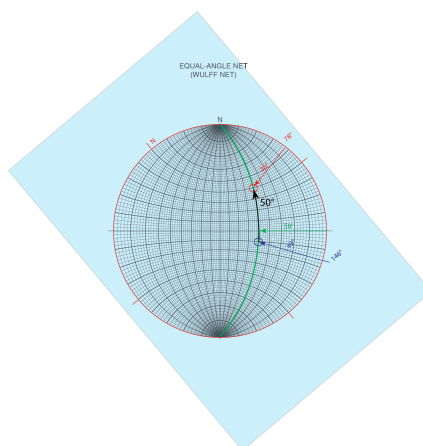
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Measuring the Angle Between Two Lines

- Find the plane that contains both lines
 - Rotate the tracing paper such that both lines lie on a single great circle. This requires care.
 - Measure the angle along the great circle between the two lines. Here, the angle is 50° .
 - By coincidence, the common plane (green) dips 50° .



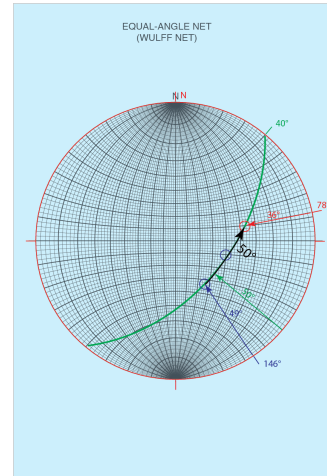
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Measuring the Angle Between Two Lines

- Here is the plot restored to its original orientation.
- The common plane (green) has a strike of 40° .



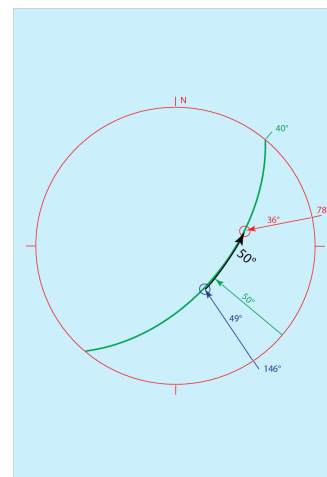
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Measuring the Angle Between Two Lines

- Here is the plot without the stereonet
 - Check to see whether the plot looks correct (i.e., visualize).



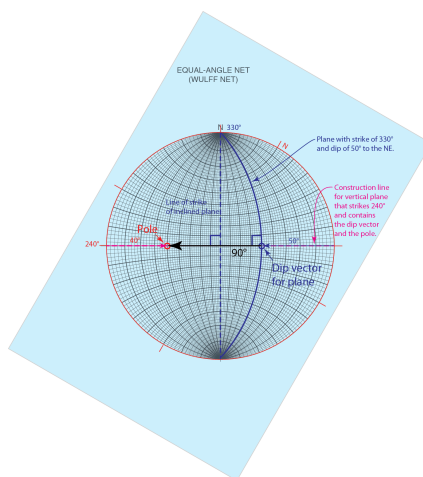
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Plotting the Pole to a Plane

- Key concepts
 - The pole to a plane is a line that can be plotted like any other line.
 - The pole to a plane of interest lies in a vertical plane perpendicular to the plane of interest.
 - The pole also makes a 90° angle (as measured in the vertical plane) with respect to the “dip vector” of the plane of interest.



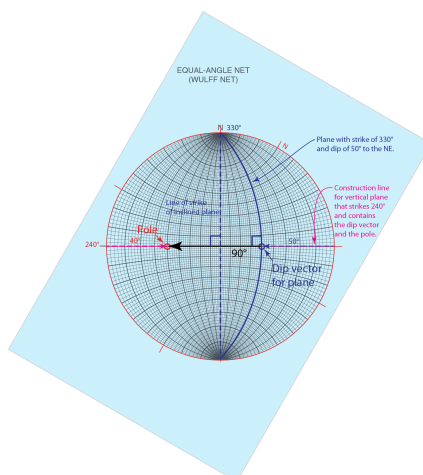
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Plotting the Pole to a Plane

- Example
- Consider a plane of interest that strikes 330° and dips 50° to the NE. It is plotted in blue.
- Its pole can be found by simple calculations. The pole trends 240° and plunges 40° . This is plotted at the red circle.
- The pole to a plane lies in a vertical plane perpendicular to the plane of interest.
- The pole also makes a 90° angle (as measured in the vertical plane) with respect to the “dip vector” of the plane of interest.



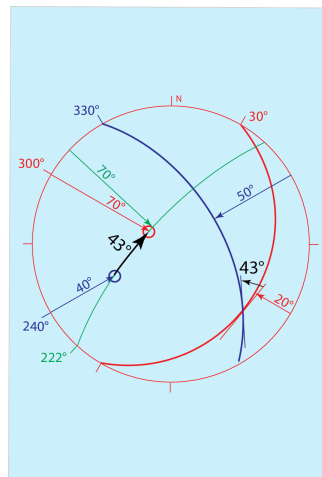
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Measuring the Angle Between Two Planes

- Key concepts
 - The angle between two planes (blue and red) is the angle between the poles to the planes.
 - The angle between the planes is measured in the plane (green) containing the poles.
 - The angle between tangents to the cyclographic traces on an equal area projection also gives the angle between the planes, but drawing the tangents accurately is difficult.



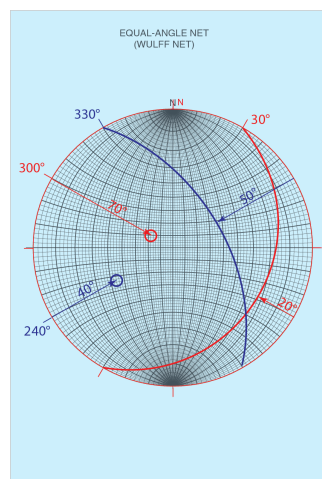
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Measuring the Angle Between Two Planes

- Plot the planes and the poles
- Example
 - The blue plane strikes 330° and dips 50° to the NE.
 - The red plane strikes 30° and dips 20° to the SE.
 - The blue pole trends 240° and plunges 40° to the SW.
 - The red pole trends 300° and plunges 70° to the NW.



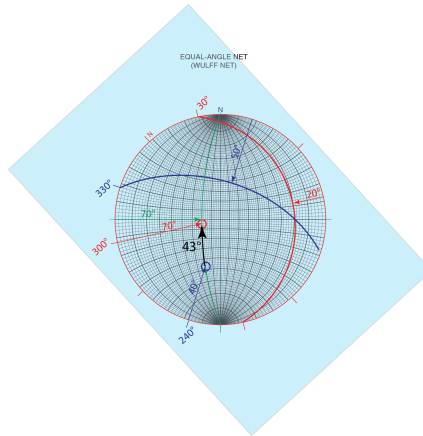
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Measuring the Angle Between Two Planes

- Measure the angle between the poles in the plane containing the poles
 - Rotate the tracing to find the common plane (green) that contains the two poles.
 - The angle between the planes is measured in the plane (green) containing the poles.
 - The angle determined graphically is 43° (measured to the nearest degree).



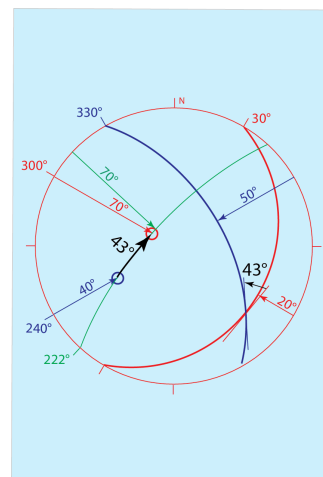
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Measuring the Angle Between Two Planes

- Appearance of plot without stereonet
 - The plot is busy.
 - The angle between tangents to the cyclographic traces on an equal are projection also gives the angle between the planes, but drawing the tangents accurately is difficult.



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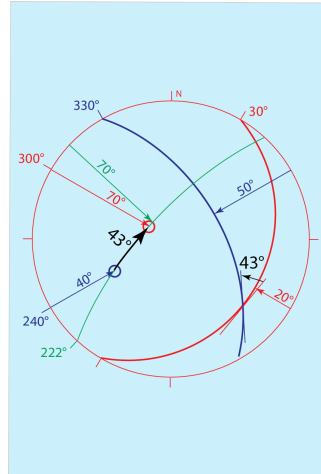
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Measuring the Angle Between Two Planes

Accuracy

```
>> Tr = 300*pi/180;
>> Tb = 240*pi/180;
>> Pr = 70*pi/180;
>> Pb = 40*pi/180;
>> [bx, by, bz] = sph2cart(Tb,Pb,1);
>> [rx, ry, rz] = sph2cart(Tr,Pr,1);
>> blue = [bx, by, bz];
>> red = [rx, ry, rz];
>> angle = acos(dot(blue,red))*180/pi
angle =
    42.6907
```



This angle is consistent with the graphical solution

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