Learning Objectives

Monday, March 2, 2020 9:39 AM

Learning objectives

Homework Assignment 5

7.1
7.2
7.3
7.4
7.6
7.7
7.8
7.9
7.15
7.26 Use https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml?#igrfwmm
7.39

Angles, Azimuths & Bearings

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Introduction

Determining the locations of points and orientations of lines frequently depends on the observation of angles and directions. In surveying, directions are given by azimuths and bearings

Angles

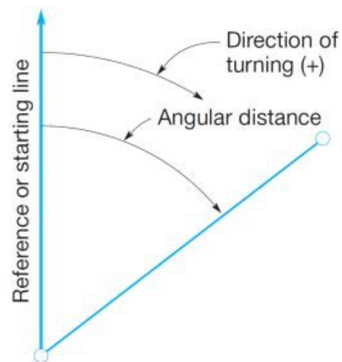

Figure 7.1 Basic requirements in determining an angle.

Types of Angles

1. Interior Angles
2. Angles to the Right
3. Deflection Angles

1. Interior Angles and Angles to the Right

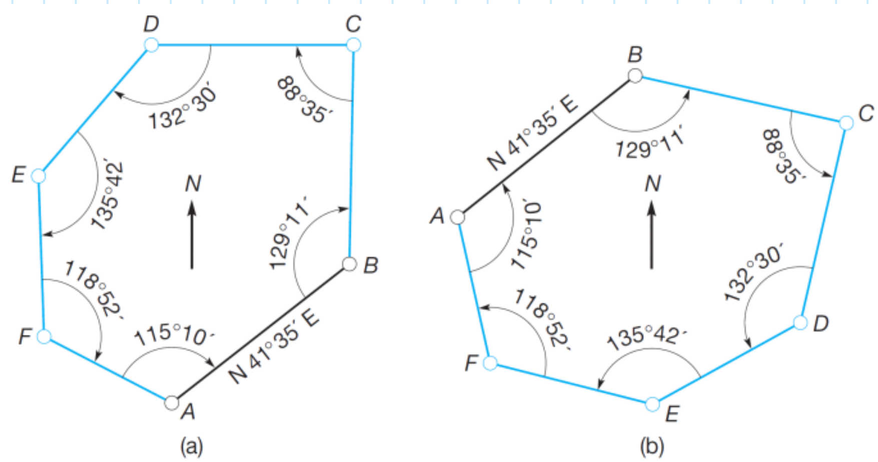

Figure 7.2 Closed polygon. (a) Clockwise interior angles (angles to the right). (b) Counterclockwise interior angles (angles to the left).

Angles, Azimuths & Bearings (cont.)

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Deflection Angles

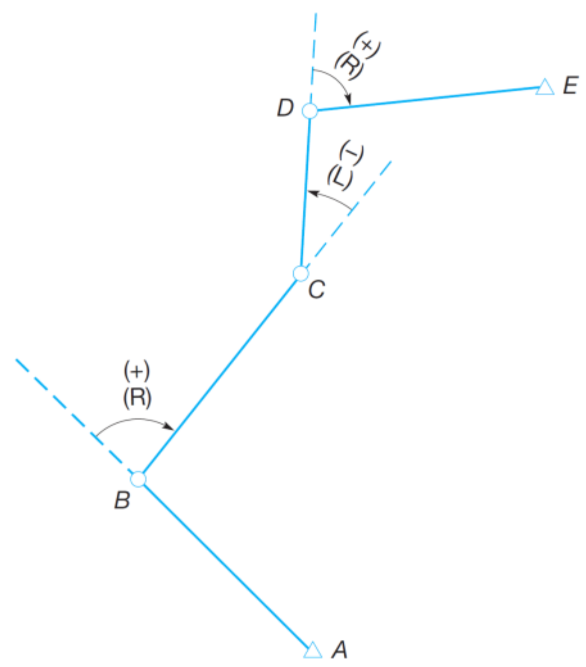

Figure 7.3
Deflection angles.

The direction of a Line

The direction of a line is defined by the horizontal angle between the line and an arbitrarily chosen reference line called a meridian. Different meridians are used for specifying directions including (a) **geodetic** (also often called true), (b) **astronomic**, (c) **magnetic**, (d) **grid**, (e) **record**, and (f) **assumed**.

The **geodetic meridian** is the north-south reference line that passes through a mean position of the Earth's geographic poles .The positions of the poles defined as their mean locations between the period of 1900 and 1905 (see Section 19.3).

The **astronomic meridian** is the north-south reference line that passes through the instantaneous position of the Earth's geographic poles. Astronomic meridians derive their name from the field operation to obtain them, which consists in making observations on the celestial objects like the Polaris (north star).

Compass, Azimuths & Bearings (cont.)

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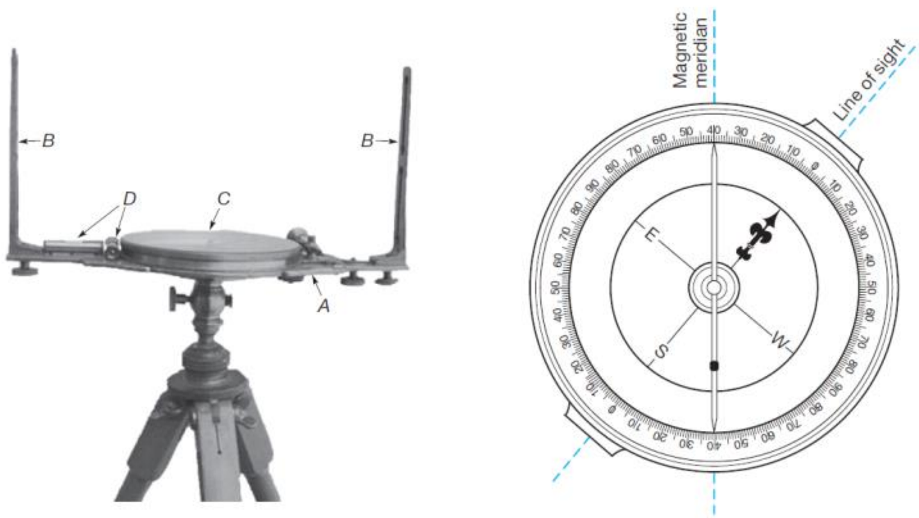

Figure 7.9 (a) Surveyor's compass. (Courtesy W. & L.E. Gurley) (b) Compass box.

Azimuths

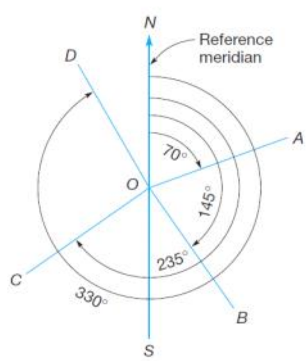

Figure 7.4 Azimuths.

TABLE 7.1	**COMPARISON OF AZIMUTHS AND BEARINGS**
Azimuths	**Bearings**
Vary from 0 to 360°	Vary from 0 to 90°
Require only a numerical value	Require two letters and a numerical value
May be geodetic, astronomic, magnetic, grid, assumed, forward or back	Same as azimuths
Are measured clockwise only	Are measured clockwise and counterclockwise
Are measured either from north only, or from south only on a particular survey	Are measured from north and south

Bearings

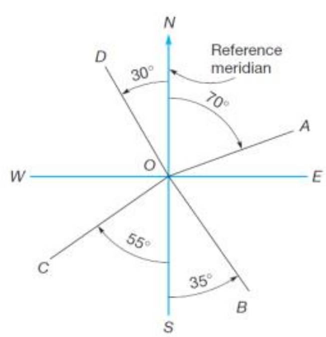

Figure 7.5 Bearing angles.

Magnetic Declination

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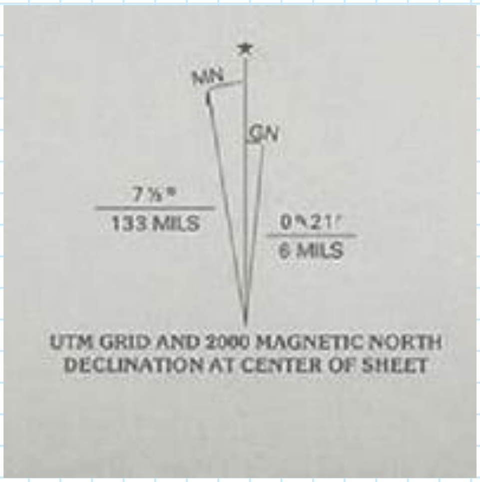
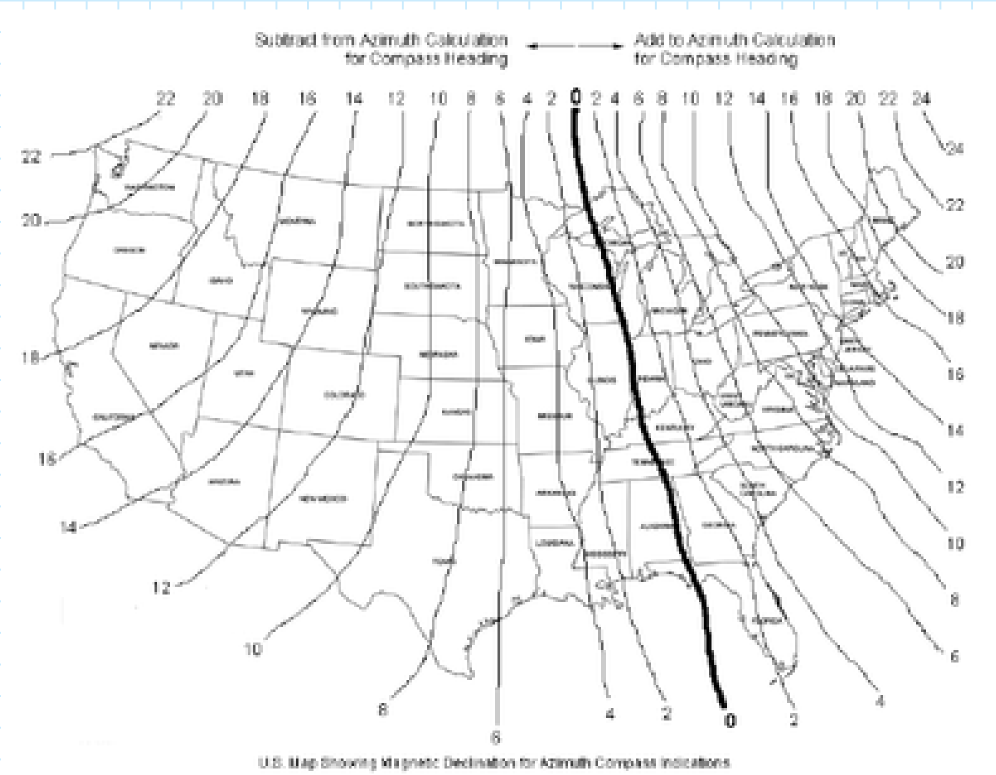
A **magnetic meridian** is defined by a freely suspended magnetic needle that is only influenced by the Earth's magnetic field. The difference between a geodetic meridian defining **true north** and a magnetic meridian defining **magnetic north** is called the **magnetic declination.**



Magnetic Declination (as shown on a topography map)

$$geodetic\ azimuth = magnetic\ azimuth + magnetic\ declination$$



Variation of magnetic declination across the United States

Magnetic Declination (cont.)

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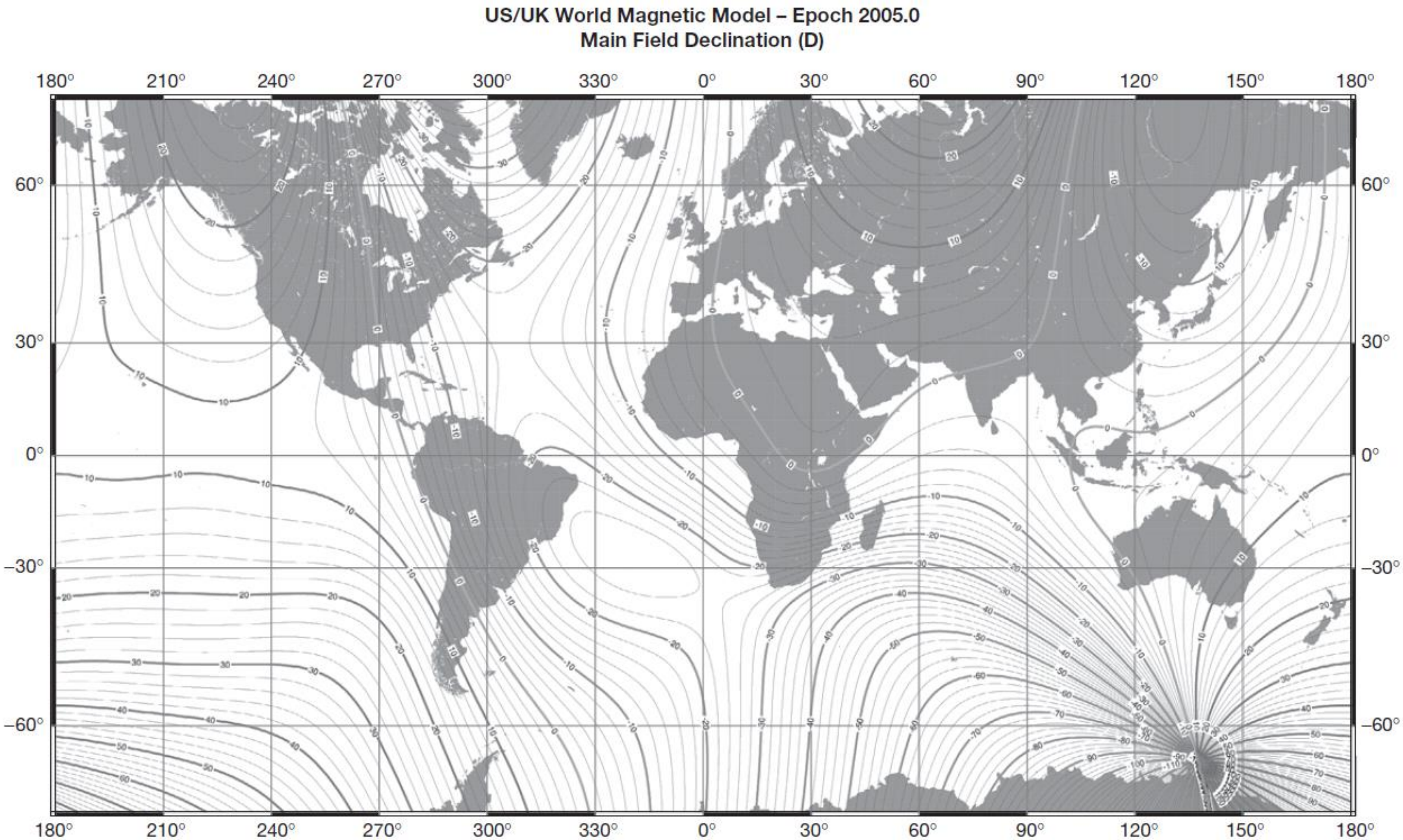

Figure 7.10 Isogonic lines from World Magnetic Model for 2005. This image is from the NOAA National Geophysical Data Center, NGDC on the Internet at http://www.ngdc.noaa.gov/seg/geomag/declination.shtml

Variation of magnetic declination across the globe

Magnetic Declination from Software

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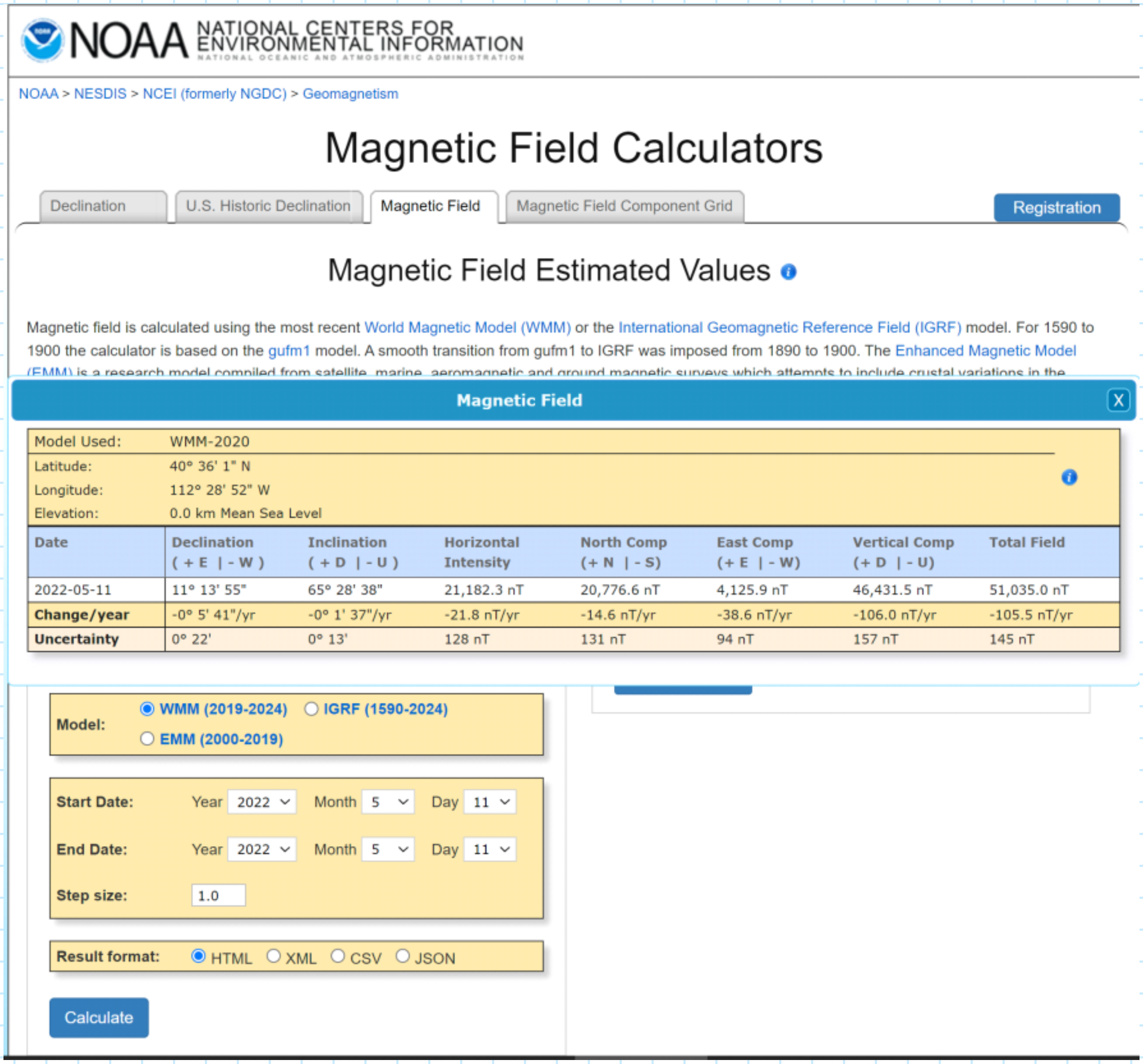
https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml?#igrfwmm



NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NOAA > NESDIS > NCEI (formerly NGDC) > Geomagnetism

Magnetic Field Calculators

Declination | U.S. Historic Declination | Magnetic Field | Magnetic Field Component Grid | Registration

Magnetic Field Estimated Values

Magnetic field is calculated using the most recent World Magnetic Model (WMM) or the International Geomagnetic Reference Field (IGRF) model. For 1590 to 1900 the calculator is based on the gufm1 model. A smooth transition from gufm1 to IGRF was imposed from 1890 to 1900. The Enhanced Magnetic Model (EMM) is a research model compiled from satellite, marine, aeromagnetic and ground magnetic surveys which attempts to include crustal variations in the

Magnetic Field

Model Used:	WMM-2020
Latitude:	40° 36' 1" N
Longitude:	112° 28' 52" W
Elevation:	0.0 km Mean Sea Level

Date	Declination (+ E | - W)	Inclination (+ D | - U)	Horizontal Intensity	North Comp (+ N | - S)	East Comp (+ E | - W)	Vertical Comp (+ D | - U)	Total Field
2022-05-11	11° 13' 55"	65° 28' 38"	21,182.3 nT	20,776.6 nT	4,125.9 nT	46,431.5 nT	51,035.0 nT
Change/year	-0° 5' 41"/yr	-0° 1' 37"/yr	-21.8 nT/yr	-14.6 nT/yr	-38.6 nT/yr	-106.0 nT/yr	-105.5 nT/yr
Uncertainty	0° 22'	0° 13'	128 nT	131 nT	94 nT	157 nT	145 nT

Model: WMM (2019-2024) IGRF (1590-2024) EMM (2000-2019)

Start Date: Year 2022 Month 5 Day 11

End Date: Year 2022 Month 5 Day 11

Step size: 1.0

Result format: HTML XML CSV JSON

Calculate

Declination calculation for 38 N Tiebreaker Circle, Grantsville UT 84029

Computing Azimuths

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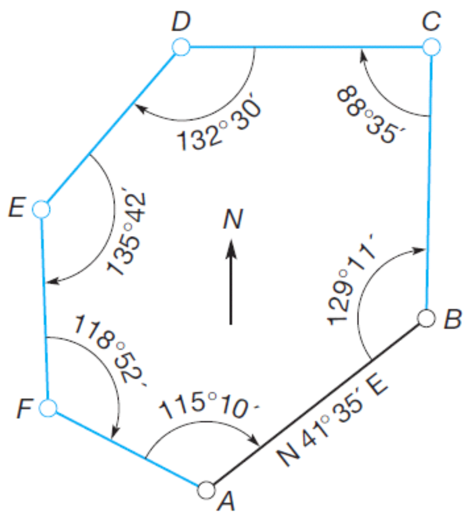
Computing Azimuths



(a)

TABLE 7.2 COMPUTATION OF AZIMUTHS (FROM NORTH) FOR LINES OF FIGURE 7.2(a)

Angles to the Right [Figure 7.2(a)]

41°35′ = AB	211°51′ = DE
+180°00′	−180°00′
221°35′ = BA	31°51′ = ED
+129°11′	+135°42′
350°46′ = BC	167°33′ = EF
−180°00′	+180°00′
170°46′ = CB	347°33′ = FE
+88°35′	+118°52′
259°21′ = CD	466°25′ − *360° = 106°25′ = FA
−180°00′	−180°00′
79°21′ = DC	286°25′ = AF
+132°30′	+115°10′
211°51′ = DE	401°35′ − *360° = 41°35′ = AB ✔

*When a computed azimuth exceeds 360°, the correct azimuth is obtained by merely subtracting 360°.

Computing Bearings

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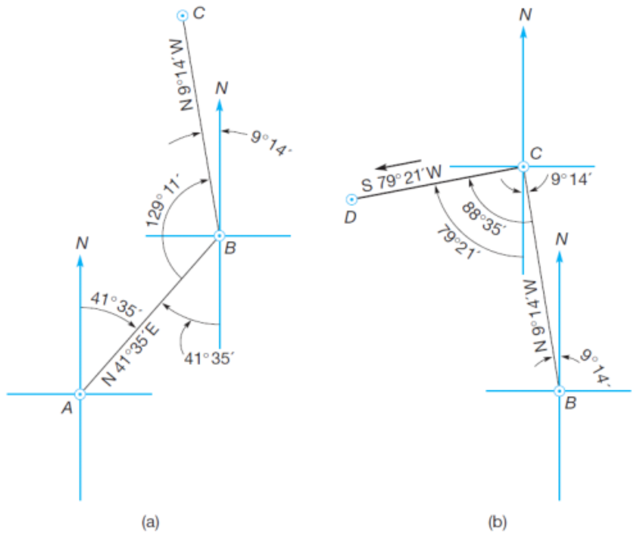
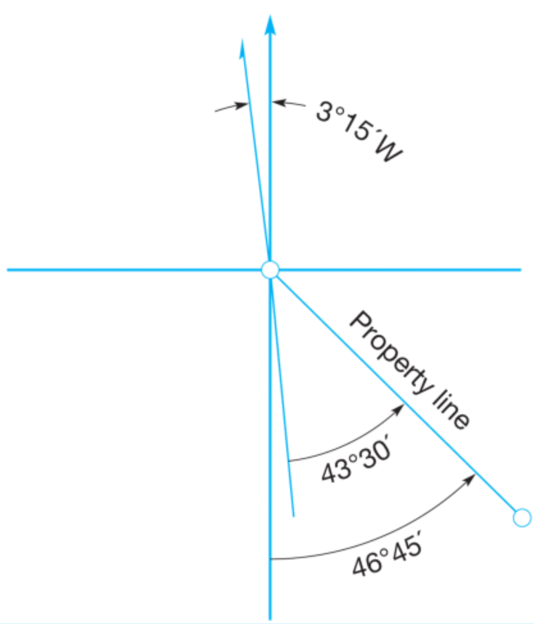


Figure 7.8
(a) Computation of bearing *BC* of Figure 7.2(a).
(b) Computation of bearing *CD* of Figure 7.2(a).

TABLE 7.3 BEARINGS OF LINES IN FIGURE 7.2(a)

Course	Bearing
AB	N41°35′E
BC	N9°14′W
CD	S79°21′W
DE	S31°51′W
EF	S12°27′E
FA	S73°35′E
AB	N41°35′E ✔

Figure 7.12 Computing geodetic bearings from magnetic bearings and declinations.



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