

2 UNITS, SIGNIFICANT FIGURES, AND FIELD NOTES

2.1 List the five types of measurements that form the basis of traditional plane surveying. From Section 2.1, they are (1) horizontal angles, (2) horizontal distances, (3) vertical (altitude or zenith) angles, (4) vertical distances, and (5) slope (or slant) distances.

2.2 Give the basic units that are used in surveying for length, area, volume, and angles in (a) The English system of units.

From Section 2.2:

length (U.S. survey ft or in some states m), area (sq. ft. or acres), volume (cu. ft. or cu. yd.), angle (sexagesimal)

(b) The SI system of units.

From Section 2.3:

length (m), area (sq. m. or hectare), volume (cu. m.), angle (sexagesimal, grad, or radian)

2.3 Why was the survey foot definition maintained in the United States?

From Section 2.2:

The survey foot definition was maintained in the United States because of the vast number of surveys performed prior to 1959. It would have been extremely difficult and confusing to change all related documents and maps that already existed. Thus the old standard, now call the U.S. survey foot, is still used today.

2.4 Convert the following distances given in meters to U.S. survey feet:

*(a) 4129.574 m **13,548.44 ft**

(b) 738.296 m **2422.23 ft**

(c) 6048.083 m **19,842.75 ft**

2.5 Convert the following distances given in feet to meters:

*(a) 537.52 ft **163.836 m**

(b) 9364.87 ft **2854.418 m**

(c) 4806.98 ft **1465.170 m**

2.6 Compute the lengths in feet corresponding to the following distances measured with a Gunter's chain:

*(a) 10 ch 13 lk **668.6 ft**

(b) 6 ch 12 lk **404 ft**

(c) 24 ch 8 lk **1589 ft**

2.7 Express 95,748 ft² in:

- *(a) acres 2.1981 ac
- (b) hectares 0.88953 ha
- (c) square Gunter's chains 21.981 sq. ch.

2.8 Convert 5.6874 ha to:

- (a) acres 14.054 ac
- (b) square Gunter's chains 140.54 sq. ch

2.9 What are the lengths in feet and decimals for the following distances shown on a building blueprint:

- (a) 30 ft 9-3/4 in. 30.81 ft
- (b) 12 ft 6-1/32 in. 12.50 ft

2.10 What is the area in acres of a rectangular parcel of land measured with a Gunter's chain if the recorded sides are as follows:

- *(a) 9.17 ch and 10.64 ch 9.76 ac
- (b) 12 ch 36 lk and 24 ch 28 lk 30.01 ac

2.11 Compute the area in acres of triangular lots shown on a plat having the following recorded right-angle sides:

- (a) 208.94 ft and 232.65 ft 0.55796 ac
- (b) 9 ch 25 lk and 6 ch 16 lk 2.85 ac

2.12 A distance is expressed as 125,845.64 U.S. survey feet. What is the length in

- *(a) international feet? 125,845.89 ft
- (b) meters? 38,357.828 m

2.13 What are the radian and degree-minute-second equivalents for the following angles given in grads:

- *(a) 136.00 grads 122°24'
- (b) 89.5478 grads 80°35'35"
- (c) 68.1649 grads 61°20'54"

2.14 Give answers to the following problems in the correct number of significant figures:

- *(a) sum of 23.15, 0.984, 124, and 12.5 160.
- (b) sum of 36.15, 0.806, 22.4, and 196.458 255.8
- (c) product of 276.75 and 33.7 9330
- (d) quotient of 4930.27 divided by 1.29 3820

2.15 Express the value or answer in powers of 10 to the correct number of significant figures:

- | | |
|---|--|
| (a) 11,432 | <u>1.1432×10^4</u> |
| (b) 4520 | <u>4.52×10^3</u> |
| (c) square of 11,293 | <u>1.2753×10^8</u> |
| (d) sum of (11.275 + 0.5 + 146.12) divided by 7.2 | <u>2.2×10^1</u> |

2.16 Convert the adjusted angles of a triangle to radians and show a computational check:

***(a)** $39^\circ 41' 54''$, $91^\circ 30' 16''$, and $48^\circ 47' 50''$ 0.6928667, 1.59705, and 0.851672

$$0.6928666 + 1.597054 + 0.8516721 = \underline{3.14059 \text{ check}}$$

(b) $82^\circ 17' 43''$, $29^\circ 05' 54''$, and $68^\circ 36' 23''$ 1.43632, 0.507862, and 1.19741

$$1.436324 + 0.5078617 + 1.197407 = \underline{3.14159 \text{ check}}$$

2.17 Why should a pen not be used in field notekeeping?

From Section 2.7: " Books so prepared will withstand damp weather in the field (or even a soaking) and still be legible, whereas graphite from a soft pencil, or ink from a pen or ballpoint, leaves an undecipherable smudge under such circumstances."

2.18 Explain why one number should not be superimposed over another or the lines of sketches.

From Section 2.7: This can be explained with the need for integrity since it would raise the issue of what are you hiding, legibility since the numbers are often hard to interpret when so written, or by clarity since the notes are being crowded.

***2.19** Explain why data should always be entered directly into the field book at the time measurements are made, rather than on scrap paper for neat transfer to the field book later.

From Section 2.7: Data should always be entered into the field book directly at the time of the measurements to avoid loss of data.

2.20 Why should a new day's work begin on a new page?

A new day's work should begin on a new page to provide a record of what work was accomplished each day and to document an changes in the field crew, weather, instrumentation, and so on.

2.21 Explain the reason for item 18 in Section 2.11 when recording field notes.

A zero should be placed before a decimal point for the sake of clarity.

2.22 Explain the reason for item 24 in Section 2.11 when recording field notes.

The need for a title, index, and cross-reference is to provide a clear path of where the work to find the notes for a specific project, even if some notes come from previous work.

2.23 Explain the reason for item 12 in Section 2.11 when recording field notes.

Explanatory notes are essential to provide office personnel with an explanation for something unusual and to provide a reminder in later reference to the project.

2.24 When should sketches be made instead of just recording data?

Sketches should be made instead of recording data anytime observations need to be clarified so that the personnel interpreting the notes can have a clear understanding of the field conditions. This also serves as a reminder of the work performed and any unusual conditions in later references to the project.

2.25 Justify the requirement to list in a field book the makes and serial numbers of all instruments used on a survey.

Listing the makes and serial numbers of the instruments used in the survey may help isolate instrumental errors later when reviewing the project.

2.26 Discuss the advantages of survey controllers that can communicate with several different types of instruments.

The ability of survey controllers to communicate with several different types of instruments allows the surveyor to match the specific conditions of the project with the instrument that this is ideally suited for the job. Thus total station, digital levels, and GNSS receivers can all be used in a single project.

2.27 Discuss the advantages of survey controllers.

From Section 2.15: " The major advantages of automatic data collection systems are that (1) mistakes in reading and manually recording observations in the field are precluded, and (2) the time to process, display, and archive the field notes in the office is reduced significantly. Systems that incorporate computers can execute some programs in the field, which adds a significant advantage. As an example, the data for a survey can be corrected for systematic errors and misclosures computed, so verification that a survey meets closure requirements is made before the crew leaves a site."

2.28 Search the Internet and find at least two sites related to

- (a) Manufacturers of survey controllers.
- (b) Manufacturers of total stations.
- (c) Manufacturers of global navigation satellite system (GNSS) receivers.

Answers should vary with student.

2.29 What advantages are offered to field personnel if the survey controller provides a map of the survey?

This allows field personnel to view what has been accomplished and look for areas of the map that need more attention.

2.30 Prepare a brief summary of an article from a professional journal related to the subject matter of this chapter.

Answer should vary by student.

2.31 Describe what is meant by the phrase “field-to-finish.”

From Section 2.15, " These field codes can instruct the drafting software to draw a map of the data complete with lines, curves and mapping symbols. The process of collecting field data with field codes that can be interpreted later by software is known as a *field-to-finish* survey. This greatly reduces the time needed to complete a project."

2.32 Why are sketches in field books not usually drawn to scale?

This is true since this would require an overwhelming amount of time. The sketches are simply to provide readers of the notes an approximate visual reference to the measurements.

2.33 Create a computational program that solves Problem 2.16.

Answers to this problem should vary with students.