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 international foot), 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 The easting coordinate for a point is 632,506.084 m. What is the coordinate using the

(a) Survey foot definition?

(b) International foot definition?

(c) Why was the survey foot definition maintained in the United States?

(a) **2,075,147.04 sft**; $632{,}506.084\left(\frac{39.37}{12}\right) = 2{,}075{,}147.044$ sft

(b) **2,075,151.19 ft**; $632{,}506.084/0.3048 = 2{,}075{,}151.194$ ft

(c) From Section 2.2: "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 called the *U.S. survey foot*, is still used."

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

(a)* 4129.57 m **13,548.44 sft**

(b) 686.504 m **2252.30 sft**

(c) 5684.237 m **18,649.03 sft**

1 US survey ft = 1200/3937 = 0.304801 m
a. 7038.506 sft
b. 2365.946 sft
c. 33641.86 sft

1 US survey ft = 1200/3937 = 0.304801 m
a. 182.88
b. 30545.663
c. 762.002

2.5 Convert the following distances given in survey feet to meters:

(a)* 537.52 sft **163.836 m**

(b) 504,864.39 sft **153,882.97 m or 153,882.974 m**

(c) 3874.26 sft **1180.88 m or 1180.877 m**

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

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

(b) 16 ch 2 lk **1057 sft**

(c) 3 ch 54 lk **233.6 sft**

2.7 Express 48,983 sft^2 in:

(a)* acres **1.1245 ac**

(b) hectares **0.44151 ha**

0.45507

(c) square Gunter's chains **11.245 sq. ch.**

25.654 acres

2.8 Convert 3.76934 ha to:

(a) square survey feet **405,727 sft^2**

(b) acres **9.31420 ac**

(b) square Gunter's chains **93.1420 sq. ch**

1,117,500 sft^2
10.382 hectars
256.54 ch^2

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

(a) 22 ft 8-1/4 in. **22.69 ft**

(b) 40 ft 6-1/2 in. **40.54 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) 30 ch 6 lk and 24 ch 98 lk **75.09 ac**

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

(a) 335.36 ft and 804.02 ft **3.0945 ac**

(b) 93.064 m and 30.346 m **0.70460 ac**

0.772 acres
0.31902 acres

2.12 A distance is expressed as 21,908.23 U.S. survey feet. What is the length in

***(a)** international feet? **21,908.27 ft**

(b) meters? **6677.642 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′; 2.1363 rad**

(b) 63.0984 grads **56°47′19″; 0.991147 rad**

(c) 235.8760 grads **212°17′18″; 3.705132 rad**

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 14.15, 7.992, 15.6, and 203.67 **241.4**

(c) product of 104.56 and 66.8 **6980**

(d) quotient of 5235.67 divided by 23.04 **227.2**

a. has 3 signif. figures
b. has 4 signif. figures
c. has 3 signif. figures
d. has 4 signif. figures

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

(a) 363.25 **3.6325×10^2**

(b) 1200 **1.2×10^3**

(c) square of 363.25 **1.3195×10^5**

(d) sum of (25.675 + 0.48 + 204.69) divided by 10.6 **2.18×10^1**

3.6325 x 10^2
1.2 x 10^3
1.3195 x 10^5
2.18 x 10^1

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

(a)* 39°41′54″, 91°30′16″, and 48°47′50″ **0.692867, 1.59705,** and **0.851672**

0.6928666 + 1.597054 + 0.8516721 = 3.14059 che

82°17′43″, 29°05′54″, and 68°36′23″ **1.43632, 0.507862**, and **1.19741**

1.436324 + 0. 5078617 + 1.197407 = 3.14159 check

0.6928666 + 1.597054 + 0.8516721 = 3.14159 check

82.29528 +29.09833 +68.60639 = 180.0000 check

2.17 Why should a number 2 pencil not be used in field notekeeping?

From Section 2.7: "Books so prepared (with 3h or higher pencil) 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 the field notes show the precision of the measurements?

Field notes should show the precision of the measurements made to indicate the accuracy of the measurements.

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 20 in Section 2.11 when recording field notes.

This is to maintain, legibility, clarity, and the legality of the notes..

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 How can survey controller data be stored?

From Section 2.15: "No matter, survey controllers should not be used for long-term storage. Rather the data should be downloaded and immediately saved to some permanent storage device such as a *universal serial bus* (USB) drive, CD, or DVD once the field collection for a project is complete."

2.30 What are the dangers involved in using a survey controller?

From Section 2.15: "Although survey controllers have many advantages, they also present some dangers and problems. There is the slight chance, for example, the files could be accidentally erased through carelessness or lost because of malfunction or damage to the unit."

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

From Section 2.15, "The 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.