Advanced Trigonometry

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1 Course Description

Course: 2030:260 Advanced Trigonometry
Credits: 2
Prerequisites: 2030:153 or equivalent with a grade of C− or better, or placement test.
Bulletin Description: Prerequisites: 2030:153 or equivalent with a grade of C− or better, or placement test. Horizontal circular curves, vertical curves, and spherical triangles, topics in astronomy.

2 Course Outcomes

After completing this course the student should have the following competencies:

1. the ability to identify a tangent line, secant line, diameter, radius, and chord of a circle;
2. the ability to find the length of an arc and a chord of a circle;
3. the ability to find the area of a sector, a segment, and between tangent lines and the circle;
4. the ability to determine the slope and external distance of a vertical curve;
5. the ability to identify the interior and dihedral angles in a spherical triangle;
6. an understanding of spherical coordinates;
7. the ability to use sine and cosine formulas for spherical triangles to solve theoretical and real-world applications;
8. an understanding of the PZS triangle and its applications.

3 Course Outline

1. Circles and circular curves
   (a) Arcs and central angles
   (b) Chords and segments
   (c) Secant and tangent lines
   (d) Perpendicular bisectors
   (e) Lengths of tangent lines, chords, curves, external distances and middle ordinates
   (f) Circular curve computation
2. Parabolic curves
   (a) Slope of a line (grade or gradient)
   (b) Distance of a line
   (c) Points of vertical curvature, intersection, and tangency
   (d) Tangent elevations
   (e) Basic form of a parabola
   (f) Finding the external distance of a vertical curve
3. Spherical trigonometry
   (a) Spherical triangles
   (b) Interior angles
   (c) Dihedral angles
   (d) Sine formulas for spherical triangles
   (e) Cosine formulas for sides of spherical triangles
   (f) Cosine formulas for angles of spherical triangles
4. Astronomy
   (a) Astronomical definitions
   (b) The PZS triangle
   (c) Applications of the PZS triangle
   (d) Sources of error in astronomical observations

4 Textbook

For circles, circular and parabolic curves use the following sections of the *Land Surveyor Reference Manual, Third Edition* by Harbin (2006).

Chapter 2: 2-31, 2-32, 2-33, 2-34, 2-35, 2-36, 2-37, 2-38, 2-39, 2-40, 2-41, 2-42, 2-43, 2-44, 2-45
Chapter 17: 17-1, 17-2, 17-3, 17-4, 17-5, 17-6, 17-7, 17-8, 17-9, 17-10, 17-14, 17-16
Chapter 22: 22-1, 22-2, 22-3, 22-4, 22-5, 22-6

For spherical trigonometry use the provided supplemental material or *Sphere, Spheroid and Projections for Surveyors* by Jackson (1987).

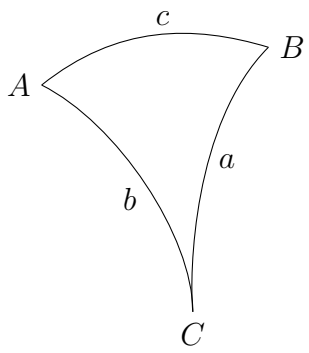
Chapter 2: 2.1, 2.2, 2.3, 2.4
Chapter 3: 3.1, 3.2

5 Calculator Policy

All students are **required** to have a **graphing** calculator with minimum functionality equivalent to that of the **Texas Instruments TI–83** calculator. Every student is **required** to have possession of their calculator by the end of the first week of classes. No exceptions to this policy will be made by the instructor.

6 Formula Policy

The formulas that students are required to know by heart at the end of this course are listed below.



$$\frac{\sin(a)}{\sin(A)} = \frac{\sin(b)}{\sin(B)} = \frac{\sin(c)}{\sin(C)}$$

$$\cos(a) = \cos(b)\cos(c) + \sin(b)\sin(c)\cos(A)$$

$$A = 4\pi r^2$$

$$V = \frac{4}{3}\pi r^3$$