Tumyaraa Bridge Program
Geometry Preparation/Review

Resources:
❖ *Understanding Geometry* by Terri Husted

❖ *Everything You Need to Ace Geometry in One Big Fat Notebook* by Christy Needham

**Why is Math Important:**
"Math is not just a subject; it's a system of thinking that underlies EVERYTHING in life! Every problem in the world benefits from thinking."
   Ben Orlin from Math with Bad Drawings

Understanding the game of Tic-Tac-Toe and Ultimate Tic-Tac-Toe helps students see that by "changing the rules," you can take something simple to a whole new level. At a young age, students learn that Tic-Tac-Toe ultimately ends in a tie game, but by creating an Ultimate Tic-Tac-Toe board and playing by the added rules, they learn to think strategically. This strategic thinking is a key aspect of math, empowering students to see that math is not just a subject but a powerful tool for problem-solving.
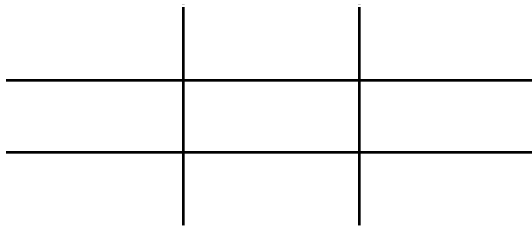
Tic-Tac-Toe
Game #1   Game #2
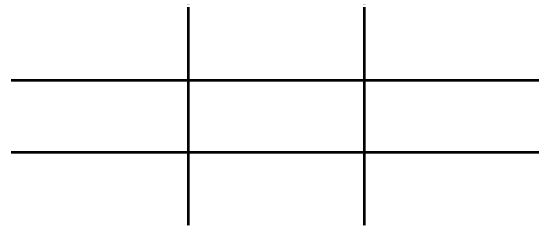
Ultimate Tic-Tac-Toe (students need to finish drawing a tic-tac-toe grid in each of the tic-tac-toe boxes to play the game)

Unit 1 - Fundamentals of Geometry Reasoning/Uncovering All the Angles/Basic of Geometry
UG: Chapters 1-2, GBFN: Chapters 1-3

1. Define Key Terms and Symbols:
   a. Point
   b. Line
      i. Line Segment
      ii. Ray
      iii. Parrel
      iv. Transversal
   c. Vertex
   d. Equal vs. Congruent
   e. Planes
   f. Bisector
   g. Angle
      i. Adjacent
      ii. Vertical
      iii. Complementary angles
      iv. Supplementary angles
      v. Right, Acute, Obtuse

Activity: Knowing your Community

Supplies needed: 1 large map of Anchorage per 2 students
                     One large map of Alaska Pacific University per 2 students
                     Colored pencils, rulers, compasses.

A. Using a large map of Anchorage and Alaska Pacific University:
   a. Identify critical spots on campus and/or in Anchorage:
      i. Example: Dorms, Pool, Classroom, Grocery Store, Mall, Target, Airport, Relatives Homes
   b. Label each point and draw lines to create visual definitions of the key terms listed above. Don't forget to label them.
      i. For example, a line between the dorms and the cafeteria might be labeled as a **Line Segment,** and you might use a **Ray** to indicate the direction you would travel from the Dorms to the Airport (assuming the airport is not on your campus map).

Unit 2 - Triangle
UG: Chapters 3, GBFN: Chapters 10-15

1. Types of Triangles (GBFN Chapter 10)

2. Interior and Exterior Angles (UG: p. 21 & 22; GBFN: Chapter 11)

3. Properties of Triangles (UG Chapter 3)

4. Triangle Congruency (GBFN Chapter 13 - summary on p.159)

Activity:

Triangulation with a Compass:

Unit 3 - Slope/Linear Equations/Midpoint and Distance
(should be reviewed from Algebra)
UG: Chapter 12, GBFN: Chapters 30, 32

1. Slope and Linear Equations (UG - p.201-211, GBFN Chapter 30)

   a. Slope, (m) = $\dfrac{\text{rise}}{\text{run}}$ = $\dfrac{\text{change in y}}{\text{change in x}}$ = $(y_2 - y_1)/(x_2 - x_1)$

   b. 4 Types of Slope (GBFN p.342)

   c. 5 Things You Need to Know about Slope: (GBFN p. 343)

   d. Graphing Linear Lines;

      i. Standard Form: $Ax + By = C$

      ii. Y-intercept (slope-intercept): $y = mx + b$

      iii. Point - slope: $y - y_1 = m(x - x_1)$

2. Midpoint and Distance Formulas (UG - p212-222) (GBFN Chapter 32)

   a. Midpoint of a line = $\dfrac{(a + b)}{c}$

   b. Midpoint Cord. Plane = $\dfrac{x_1 + x_2}{2}$, $\dfrac{y_1 + y_2}{2}$

Unit 4 - Pythagorean Theorem
UG: Chapter 4, GBFN Chapter 31

1. Pythagorean Theorem: $a^2 + b^2 = c^2$ (UG Chapter 4, GBFN Chapter 31)
    a. Various hands-on activities will be conducted using the survey's rope and tiles to explore the Pythagorean Theorem.

Activities (Depending on time, the instructor could select one or more of the below activities to allow students to explore Units 2, 3 & 4 in their everyday lives)

❖ Building Bridges: A variety of Lessons are available on the internet:
➢ Many of our rural communities are in remote locations and require communities to build bridges that cross creeks and streams. This exercise will help students understand the strength of a truss vs straight planks. Have students use balsa wood to build bridges, testing for strength and ability to span a distance. This activity can be expanded into a multiple-day activity.

❖ Building a Smokehouse: Geometry of Prisms:
➢ Math in a Cultural Context.
https://www.uaf.edu/mcc/mcc_resources/modules.php
❖ Village Math Tarpaper Roof

Unit 5 - Polygons
UG: Units 5 GBFN: Chapters 19

1. Polygons (UG Unit 4 and GBFN Chapter 19)
    a. Activity - The Handshake Problem (UG p. 52/53)

Unit 6 - Quadrilaterals/Parrallograms
UG: Unit 6, GBFN: Chapter 16,17,18

1. Quadrilaterals (UG - p54-57, GBFN - p.186-187)

2. Parrallelograms (UG - p.58-68, GBFN - p.188-196)

3. Trapezoids & Kites (UG p.69-75, GBFN Chapter 18)

4. Rhombuses, Rectangles and Squares (GBFN - Chapter 17)

Activities: While completing the following activities, challenge students to think about ways they travel:

- ❖ Around the village (some live with boardwalks as their pathways, and you can not travel in the village without staying on the boardwalk)
- ❖ What about when you are traveling on the tundra for hunting or trapping
- ❖ They will want to take the shortest route in Anchorage and have multiple stops while out and about town.

   - ➢ Draw these figures without lifting your pencil. These challenges can be found in a variety of resources: https://www.transum.org/Maths/Activity/without/
   - ➢ Challenging Problem/Extra Lesson: **Dijkstra's Algorithm**
      - ■ https://kids.frontiersin.org/articles/10.3389/frym.2021.631045

Unit 7 - Perimeter, Area & Circles
UG: Chapter 7, GBFN: Unit 8 & 9

1. Circles (GBFN Unit 8 and UG p83-87)
   a. Definitions: (GBFN Chapter 37)
      i. Circle
      ii. Center
      iii. Circumference (C)
      iv. Chord
      v. Diameter (d)
      vi. Radius ®
      vii. Pi (π)
   b. Understanding Pi (UG p83-87)
   c. Central Angles and Arces (GBFN - Chapter 38)
   d. Radians (GBFN - Chapter 39)
   e. Arcs and Cords (GBFN - Chapter 40)
   f. Inscribed Angles Tangents (GBFN - Chapter 41)
   g. Secants ((GBFN - Chapter 42)
   h. Equations of Circles   (GBFN - Chapter 43)
2. Area of Parallelograms, Triangles, Trapezoids & Circles (UG - p93-86 GBFN Chapters 45, 46 & 47)

Activities: The following Activities from Village Math help students understand how Perimeter and Area are part of their everyday lives. Students can work in Pairs to complete each Activity and then present it to the class.

- [Cord Of Wood](#)
- [Fiberglassing a Boat](#)
- [Parcel Post Limits](#)
- [Log Cabin Log Count](#)
- [Fur Sewing](#)

Unit 8 - Geometric Constructions
UG: Chapter 8
Each student will need paper, a pencil, a ruler, and a compass

First, using Chapter 8 in Understanding Geometry, students will learn to construct geometric shapes. Then, they will apply that knowledge to real-world problems and solve the following problems: If time is a constraint, students can work in pairs and present to the whole class.

Activities - The following Activities will reinforce geometric construction and topics already

covered.

- ❖ Village Math Activities:
    - ➢ 1906 Native Allotments
    - ➢ Sled Runners
    - ➢ Beaver Boards
- ❖ Math in Cultural Context:
    - ➢ Building a Smoke House

Unit 9 - 3D Shapes
UG: Chapter 9, GBFN: Unit 10
Recommend either ordering or printing geometric nets. Amazon - Geometric Folding Shapes

1. Types of 3-D shapes (UG - p. 124, GBFN p.532-533)

    a. Triangular Prisim   d. Trapezoidal Prism

    b. Cube Prisim   e. Pentagonal Prism

    c. Rectangular Prism   f. Hexigonal Prism

2. Surface Area (GBFN - p.534-544, UG - p.135-137)
3. Surface Area of Pyramids and Cones (GBFN - Chapter 50)
4. Volume of Prisms and Cylinders (UG - p.125 - 132, GBFN Chapter 51)
5. Spheres - Surface Are and Vlume (UG - 133-134, GBFN - Chapter 53)
6. **If time allows**, the volume of Pyramids and Cones (GBFN - Chapter 52).

Activity:

❖ Eulers Formula (UG p. 138)

❖ Village Math - Berries

❖ Have students select a building or room and calculate how much paint they need to paint the space. Then, have them add in the cost and possibly shipping.

❖ Have students calculate how much linoleum they need to cover their homes, add the cost, and don't forget shipping. What about the necessary glue to adhere it to the floor?

❖ Hunting: it's a little windy; can you hit that caribou, or do you need to get closer? The answer is a cone, where the circumference of the base is the size of the caribou's vital area, the height of the cone (or length, since it's sideways) is the maximum point-blank range, and the point of aim is the center of the cone.

Unit 10 - Symmetry and Transformations
UG: Chapter 10, GBFN: Unit 5

1. Types of Symmetry (UG p. 141-143)
    a. Vertical Symmetry
    b. Horizontal Symmetry
    c. Point Symmetry
2. Types of Transformations (UG p.144)
    a. Reflection (UG p.144-149, GBFN - Chapter 20)
    b. Translation (UG p. 150-153, GBFN - Chapter 21)
    c. Rotation (UG p. 154-159, GBFN - Chapter 22)
    d. Dilation (UG p.160-163, GBFN - Chapter 26)
3. Compositions (UG p.164-170, GBFN - Chapter 26)
4. Tesselations (UG p.171-173)

Activities:
- Village Math - [Nets](#)
- Math in Cultural Context - [Patterns in Parkas](#)
- Have students design a tile pattern for a bathroom and then calculate the cost; what about adhesive and grout?

Unit 11 - Congruence/Similarity
UG: Chapter 11, GBFN - Chapter 24, and Unit 6

1. Congruent (GBFN - Chapter 24)
2. Similar Triangles (UG p176 - 181, GBFN Chapter 28)
3. Geometric Proof (UG p. 182 - 197)
4. Ratio & Proportion (GBFN - Chapter 25)
5. Portions in Triangles (GBFN - Chapter 29)

Activities:

- Village Math:
    - [Mixing Gas and Oil](#)
    - [High School Education](#)
    - [Non-Standard Math](#)
- Math in Cultural Context
    - [Kayak Building](#)

Unit 12 - Coordinate Proofs
UG Chapter 12 (p. 223-232) GBFN - Chapter 33, 34

1. Coordinate Triangle Proofs (GBFN Chapter 33)
2. Coordinate Quadrilateral Proofs (GBFN Chapter 34, UG p. 232-232)

Unit 13 - Trigometric Ratios (Sine, Cosine, Tangant)
GBFN Chapter 35
This section will expose students to Trigonometry as they prepare for higher-level math.

1. Trigonometry - the study of the relations between side length and angles in triangles
2. Definitions:
    a. Hypotenuse
    b. Opposite
    c. Adjacent
    d. Theta