VOLUME 1

STEM sports®

science • technology
engineering • math • sports

STEM.ORG ACCREDITED™ EDUCATIONAL EXPERIENCE

INSIDE:

Turn the page to learn more about our NEW Digital Assets!

STEM SOFTBALL

SUPPLEMENTAL CURRICULUM

GRADES 3 - 5 AND GRADES 6 - 8

Go Digital

In addition to the classroom, STEM Sports® K-8 Supplemental Curriculum is flexible and scalable to teach and implement at home and virtually on platforms such as Zoom, Google Classroom, Skype, and other digital learning tools. For each and every module, we provide solutions for successful remote learning with PowerPoint presentation decks and digital worksheets with keys.
To access these useful tools, visit www.STEMSports.com/softballdigitaltools/

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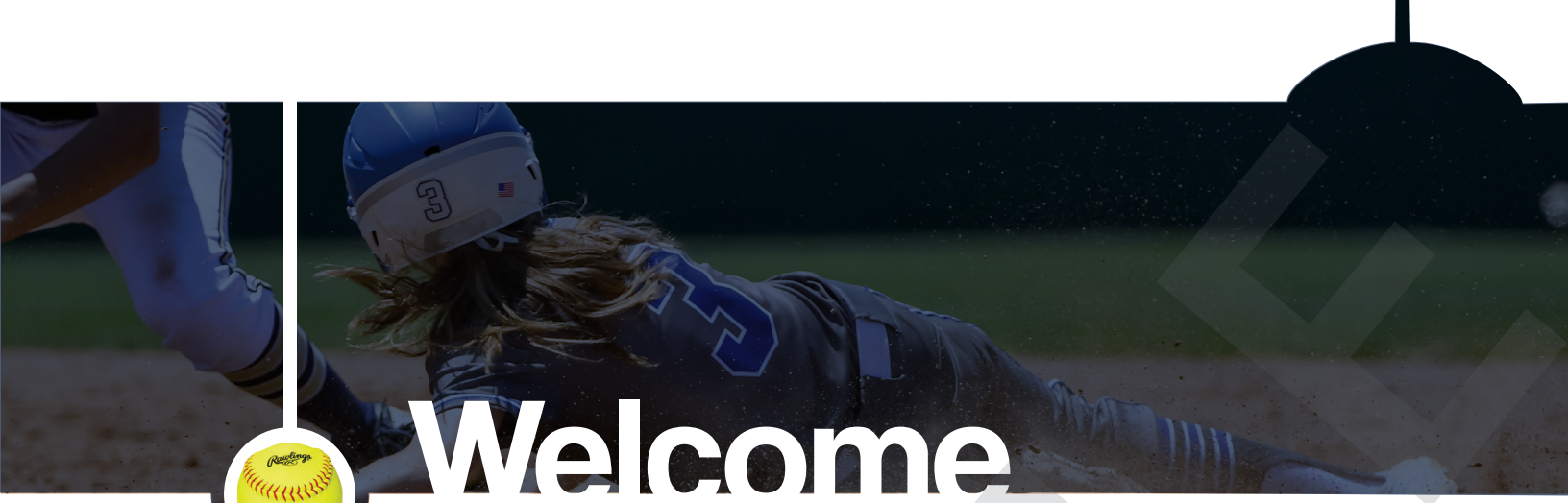

Welcome

STEM Sports® provides turnkey K-8 supplemental curricula that use sports as the real-life application to drive STEM-based, hands-on learning in classrooms, after-school programs, and camps.

We are pleased to present Volume 1 of STEM Softball, highlighted by the following:

- Content for a minimum of 16 hours of instruction that includes some healthy, physical activity.
- Turnkey kits equipped with all of the relevant sports equipment along with the necessary science supplies.
- Eight lessons aligned with Next Generation Science Standards (NGSS) and/or Common Core State Standards (CCSS) and/or National Standards for K-12 Physical Education.
- STEM.org Accredited™ Educational Experience approved
- 5E lesson plans so that students will develop 21st-century skills such as critical thinking, collaboration, creative problem-solving, and leadership.
- Differentiation: lessons for Kindergarten to 2nd graders, 3rd to 5th graders, and lessons for 6th to 8th graders.
- "Capstone" Project (Grades 6th to 8th) to commensurate student's knowledge of each curriculum.
- Assessments in each lesson to evaluate students effectively.
- Ready-to-use worksheets that align with each lesson and standards.
- A list of STEM-based, sports-related jobs pertinent to the lesson concept in each module.
- Engineering Design Process (EDP) woven into each curriculum.
- STEM Sports® glossary to support instructors and students as they come across key vocabulary in each module.
- Mindfulness Matters: important messaging to assist with the uniqueness of blending STEM with sports.
- Well designed and scalable for teachers, administrators, or volunteers.
- Professional development or training are not required.

Please visit www.STEMSports.com for additional information and to learn about all of the curricula that we offer.

We sincerely hope you and your students enjoy this STEM Sports® supplemental curriculum.

Please complete our Teacher Survey at www.stemsports.com/teacher-survey.

We appreciate your feedback.

DISCLOSURE: This curriculum, including any/all portions of this kit/equipment are intended for educational purposes only. The sport of basketball involves risk of injury, loss and damage. By choosing to partake in this program, all teachers, students, and participants assume full responsibility for such risks. This curriculum makes no representation or warranty, expressed or implied, including but not limited to any warranty of merchantability or fitness for a particular purpose. There are risks associated with participation in any athletic activity, and the student/teacher/participant is responsible for any potential risks associated with these activities. STEM Sports® shall not incur any liability for any damages, including but not limited to, direct, indirect, special or consequential damages arising out of, resulting from, or in any way connected to the use of this curriculum, whether or not based upon warranty, contract, or otherwise, whether or not injury was sustained by persons or property, and whether or not loss was sustained from, or rose out of, the implementation of this curriculum. The curriculum contained within this document is the property of STEM Sports®, and may not be reproduced or otherwise distributed for use without the written consent of STEM Sports®.

Mindfulness Matters

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Mindfulness may not be the first thing one thinks about STEM Sports®. However, mindfulness is essential to fully understanding the design and benefits of the STEM Sports® curricula by way of the following:

- Approximately 85% of STEM jobs anticipated for the year 2030 have yet to be invented.
- Moreover, within the next 10 years or so, 80% of all jobs will be STEM related.

The STEM Sports® curricula distinctly blends STEM content areas through hands-on/active play and sports. Active play provides a mechanism to teach STEM concepts; therefore, learning is integrated, engaging and meaningful as participants are exposed to STEM applications through real world experiences.

Teachers of the curricula should be mindful of the fact STEM Sports® curricula are:

- Collaborative in nature, ensuring peer-to-peer learning opportunities
- Inquiry-based, allowing learners to discover information for themselves
- Designed for problem-solving: an essential lifelong skill
- Hands-on, engaging all types of learners
- Student-led, encouraging ownership of learning
- Active, promoting physical activity and wellbeing

Participants of the curricula should be mindful of the fact STEM Sports® curricula are:

- Introduction to STEM concepts, facilitating comfort with STEM content areas
- Blending play and sport in an environment that is engaging, fun, and applicable to life outside the classroom
- Designed for all ensuring success for all participants – students do not have to be athletic or excel at science to accomplish curricula tasks
- Applicable to the real world where learning is meaningful for all participants

In sum, stakeholders should be mindful of all the STEM Sports® curricula have to offer. The unique design of the STEM Sports® curricula is essential to maximize learning and the understanding of STEM concepts in sports and life applications.

Contents
Grades 3-5

Contents
Grades 6-8

Supplies Checklist

- ☐ **Six (6)** Softballs
- ☐ **One (1)** Cut (halved) Softball
- ☐ **Six (6)** 25″ Tape Measures
- ☐ **One (1)** Radar Gun
- ☐ **One (1)** Baseball
- ☐ **One (1)** Weight Scale
- ☐ **Six (6)** Digital Stopwatches
- ☐ **One (1)** STEM Softball Curriculum Manual
- ☐ **One (1)** Cut (halved) Baseball

Materials Needed

- ☐ Pencils
- ☐ Internet Access
- ☐ Softball or Baseball Gloves
- ☐ Plate & Tee Set (*Extend* only)
- ☐ Calculators
- ☐ Outdoor Space
- ☐ Softball Bat

Softball

STEM Sports® Glossary

Acceleration: Change in speed over time.

Angle: A figure formed by two rays that have the same endpoint

Bunt: A ball hit lightly without swinging the bat that rolls on the infield between home plate and the pitcher's mound.

Constraints: A restriction that keeps something from being the best it can be.

Coordinate Plane System: A two-dimensional plane formed by the intersection of a vertical line called y-axis and a horizontal line called x-axis.

Characteristics: A feature or quality generally belonging to a person, place, or thing and serving to identify it.

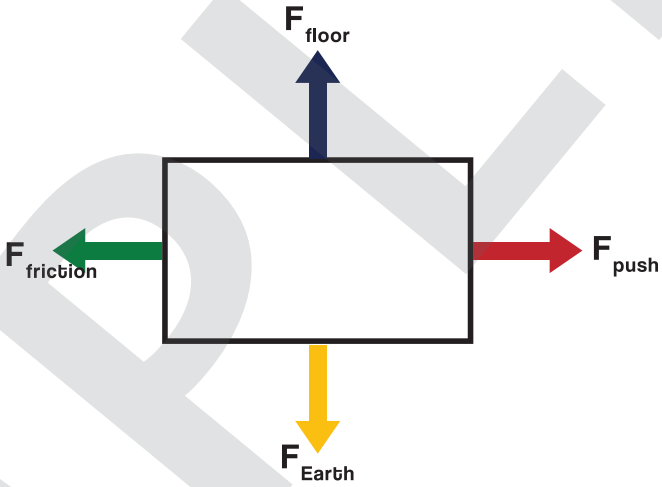
Criteria: A set of rules or directions that must be followed.

Energy: The motion of molecules or objects.

Engineering: A system of thinking that uses science and technology to solve problems.

Engineering Design Process (EDP): An organized series of steps that engineers use to develop functional products or processes.

Force: Something that causes a change in the motion of an object.
Force = mass of object x acceleration



Force Diagram: A diagram showing all the forces acting on an object, the force's direction and its magnitude.

Function: The relationship or expression involving one or more variables.

Gravity: A force of attraction inclined to bring particles or bodies together.

Engineering Design Process

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Ground Ball: A ball hit that bounces or rolls along the ground.

Inertia: An inclination to do nothing or to remain unchanged.

Joule: A standard unit of energy or work in the International System of Units (SI).

Kinetic Energy: The energy an object possesses due to its motion.

Line: The part of a line with two endpoints.

Line Drive: A ball hit not far above the ground on a straight line.

Mass: A fundamental property of matter that is a numerical measure of the inertia (inactive) of an object or the amount of matter an object contains.

Newton's First Law: The process in which a body remains either in place or in motion at a constant speed unless altered by an external force.

Newton's Second Law: The net force of an object is related to the acceleration and mass: F = MA.

Newton's Third Law: The process in which an action and reaction are equal and opposite.

Parallel: Lines, planes, surfaces, or objects that are side by side, having the same distance continuously between them.

Perpendicular: A 90 degree angle to a given line, plane, or surface.

Point: An element in geometry that has position but does not extent.

Properties: Any traits that can be measured, such as mass, color, density, length, odor, and temperature.

Pythagorean Theorem: A statement about the sides of a right triangle. One of the angles of a right triangle is always equal to 90 degrees. This angle is the right angle. The theorem written as an equation is $a^2+b^2=c^2$.

Ray: The part of a line with one endpoint that goes on forever in the opposite direction.

Speed: The distance an object travels in a given time.

$$\text{speed} = \frac{d\ (\text{distance})}{t\ (\text{time})}$$

Technology: An object, idea or method used to solve problems or invent new objects, ideas, or methods.

Velocity: The rate of change of position with respect to time.

$$\text{velocity} = \frac{s\ (\text{displacement})}{t\ (\text{time})}$$

Modules

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Module 5.0

GRADES 3-5

The Field of Play

Concept
Math: Angles and Lines

Objective
Students will draw a softball field using points, lines and angles. Students will diagram and label the angles and distances on the field.

Time
(2) 60-minute sessions

Standards

Common Core State Standards Connections

CCSS.MATH.CONTENT.4.G.A.1
Draw points, lines, line segments, rays, angles (right, acute, obtuse), perpendicular and parallel lines. Identify these in two-dimensional figures.

National Standards for K - 12 Physical Education Connections

Standard 1: The physically literate individual demonstrates competency in a variety of motor skills and movement patterns.

Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies and tactics related to movement and performance.

Standard 4: The physically literate individual exhibits responsible personal and social behavior that respects self and others.

Supplies Provided
Worksheets

Please email Info@STEMSports.com to access Worksheet Keys.

Materials Needed
Pencils and Rulers (recommended)
Tape Measures and Outdoor Space *(Extend only)*

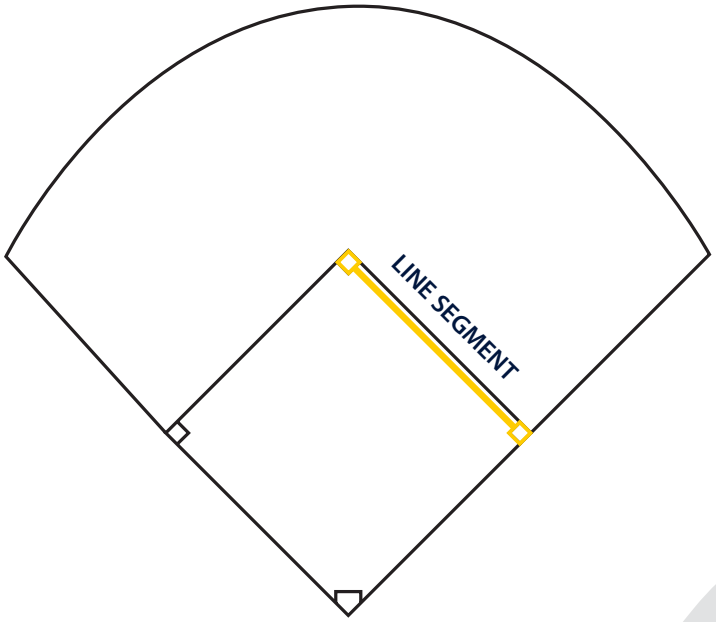
Sequence of Lesson

Have your students take this lesson's assessment prior to engaging by visiting:
www.stemsports.com/assessments
If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.

Engage: Ask students how to diagram a softball field in their notebooks without looking at a diagram.

Explore: Ask them to label any angles, shapes and lines on the field. Have them share out with their classmates.

Explain: Define important vocabulary: Ray, Angle, Line, Point, Parallel and Perpendicular,



Line (Segment)

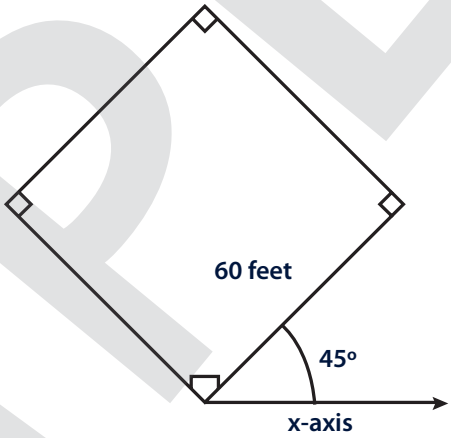
- A **line segment** is a part of a line consisting of two end points and all points in between them.
- A line segment on a softball field would be from First Base to Second Base.

which can be found in STEM Sports® Glossary in the front of this manual and at STEMSports.com under Resources. Tells students about common angles in triangles and squares. Have students demonstrate examples:

- Have three students stand in a right triangle, with one student throwing to the other students at a 90 degree angle.
- Have four students stand in a square. Have students throw to the player parallel to them.
    - For additional support, provide students with everyday objects, where players run or throw parallel or perpendicular. Review the diagram on the worksheet. Have students think about and discuss important lines (first and third base), shapes (batters boxes), and key points/ markers (fair/foul poles) on the field.

Elaborate: Based on information from *Explore* and *Explain*, have students draw a diagram of a softball field labeling angles, points (first, second and third base) and any parallel or perpendicular lines.

Evaluate: Have students explain to a partner or video record (if technology is available) their descriptions of the lines, shapes and angles that make up a softball field.



Have your students retake this lesson's assessment to effectively evaluate their comprehension by visiting:
www.stemsports.com/assessments
If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.

Extend: Students could use a tape measure and create a softball field to scale. They can calculate the scale or measure it using the information provided.

STEM Jobs in Sports

- Stadium/Arena: Engineer Technician
- Systems Engineer
- Stadium/Arena Architect
- Softball: Product Development Scientist
- Stadium/Arena: Quality Control Coordinator

Fun Facts

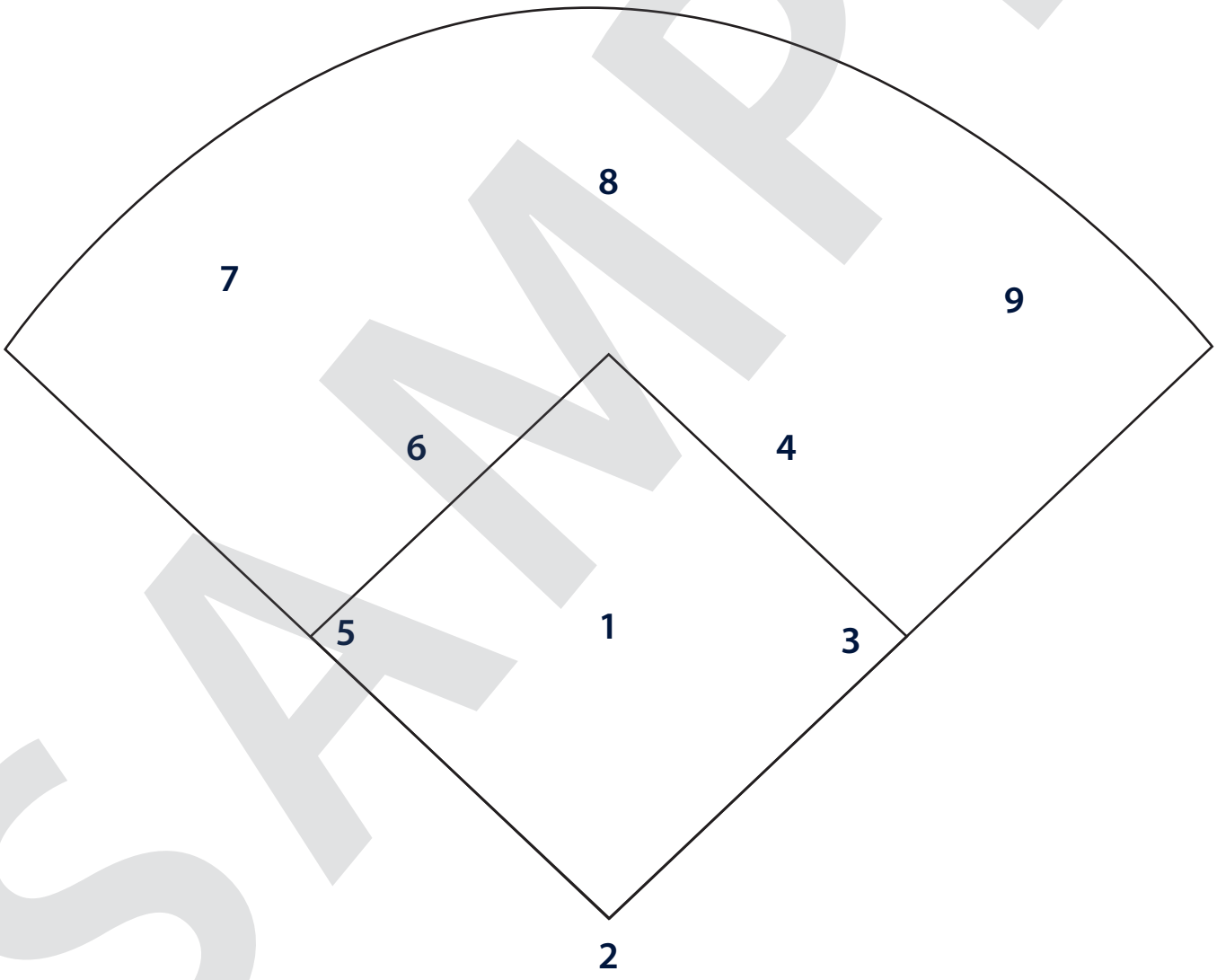
The game of softball is played in over 140 countries.

Name: _____

The Field of Play

GRADES 3-5

Explore: Observe and discuss important lines (first and third base), shapes (batters boxes), and key points/markers (fair/foul poles) on the field.



Name: _____

The Field of Play

GRADES 3-5

Elaborate: Draw a diagram of a softball field labeling the angles, points (first base, second base), and any parallel or perpendicular lines.

Write an explanation that describes the lines, shapes and angles that make up a softball field.

Module 5.0

GRADES 6-8

The Field of Play

Concept
Math: Units and Area and/or Pythagorean Theorem

Objective
Students will compare and contrast which position on the field requires the strongest arm and fastest player by using distances on a coordinate plane system. Students will calculate the unknown distance of a right triangle using the Pythagorean Theorem.

Time
(2) 50-minute blocks

Standards

Common Core State Standards Connections

CCSS.MATH.CONTENT.6.NS.C.8
Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

CCSS.MATH.CONTENT.8.G.B.8
Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

National Standards for K - 12 Physical Education Connections

Standard 1: The physically literate individual demonstrates competency in a variety of motor skills and movement patterns.

Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies and tactics related to movement and performance.

Supplies Provided
Worksheets and Softballs *(Extend only)*

Please email Info@STEMSports.com to access Worksheet Keys.

Materials Needed
Pencil and Space to Throw *(Extend only)*

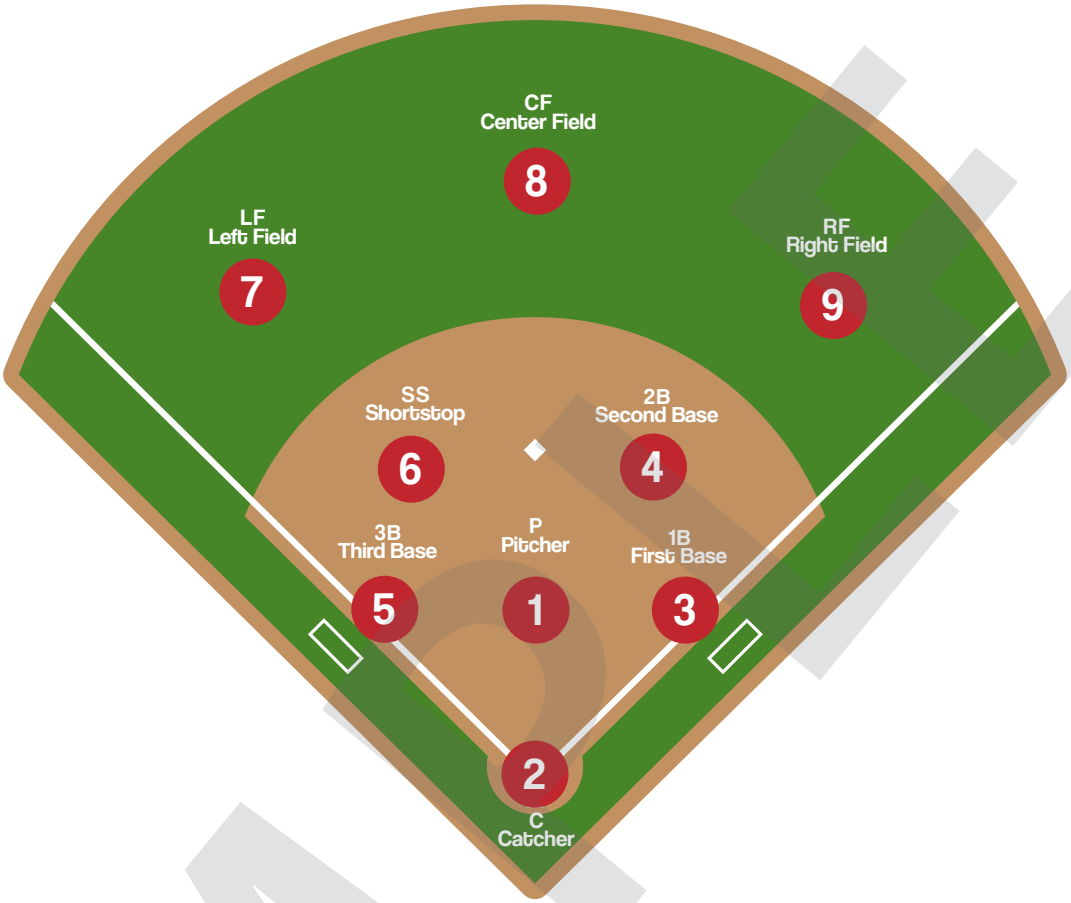
Sequence of Lesson

Have your students take this lesson's assessment prior to engaging by visiting:
www.stemsports.com/assessments
If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.

Engage: Ask students to identify their favorite position: Pitcher, Centerfield, Shortstop, Catcher, etc. Once students have moved, have them brainstorm on chart paper how and why their position is unique. What skills are required? How far do they need to throw the ball?

Explore: Review with students the field of play with the player's numbers on it.

Have students outline what makes a stronger player at each position. What player/position needs to throw the farthest and fastest? Who needs to run the furthest? Using the worksheet, have students plot the position of the players on a coordinate plane system.



Explain: Define key terms: Coordinate Plane System and Pythagorean Theorem (if using), which can be found in STEM Sports® Glossary in the front of this manual and at STEMSports.com under Resources. Model for students how to find the distance between each player using the coordinate plane system.

OR

Model for students how to use the labeled distances to determine the unknown distance using the Pythagorean Theorem.

Elaborate: Have students use the coordinate plane system to fill in the distance that a player would need to throw.

**6th grade standard: Determine the distance between players by subtracting the coordinates for absolute value.*

**8th grade standard: Determine the distance between players by using the Pythagorean Theorem.*

Evaluate: Have students review the problems where the player's location changed to catch the ball. Determine how far the player would need to throw the ball to make an out. (Questions 5 and 6 on the worksheet).

Have your students retake this lesson's assessment to effectively evaluate their comprehension by visiting:
www.stemsports.com/assessments
If you have limited digital capability, please email Info@STEMSports.com to access the Assessment & Key.

Extend: If there is space available, allow students to throw the ball a distance between each player to determine what position on the field would best suit their skill set.

STEM Jobs in Sports

- Softball Developer (IT) - Softball Data and Development
- Softball: Assistant Coach
- Groundskeeper - Softball and Baseball Fields
- Athletic Director & Varsity Softball Coach
- Parks & Recreation: Equipment Operator

Fun Facts

A softball diamond is smaller than a baseball diamond: the distance between the bases in softball is 60 feet; the distance between the bases in baseball is 90 feet.

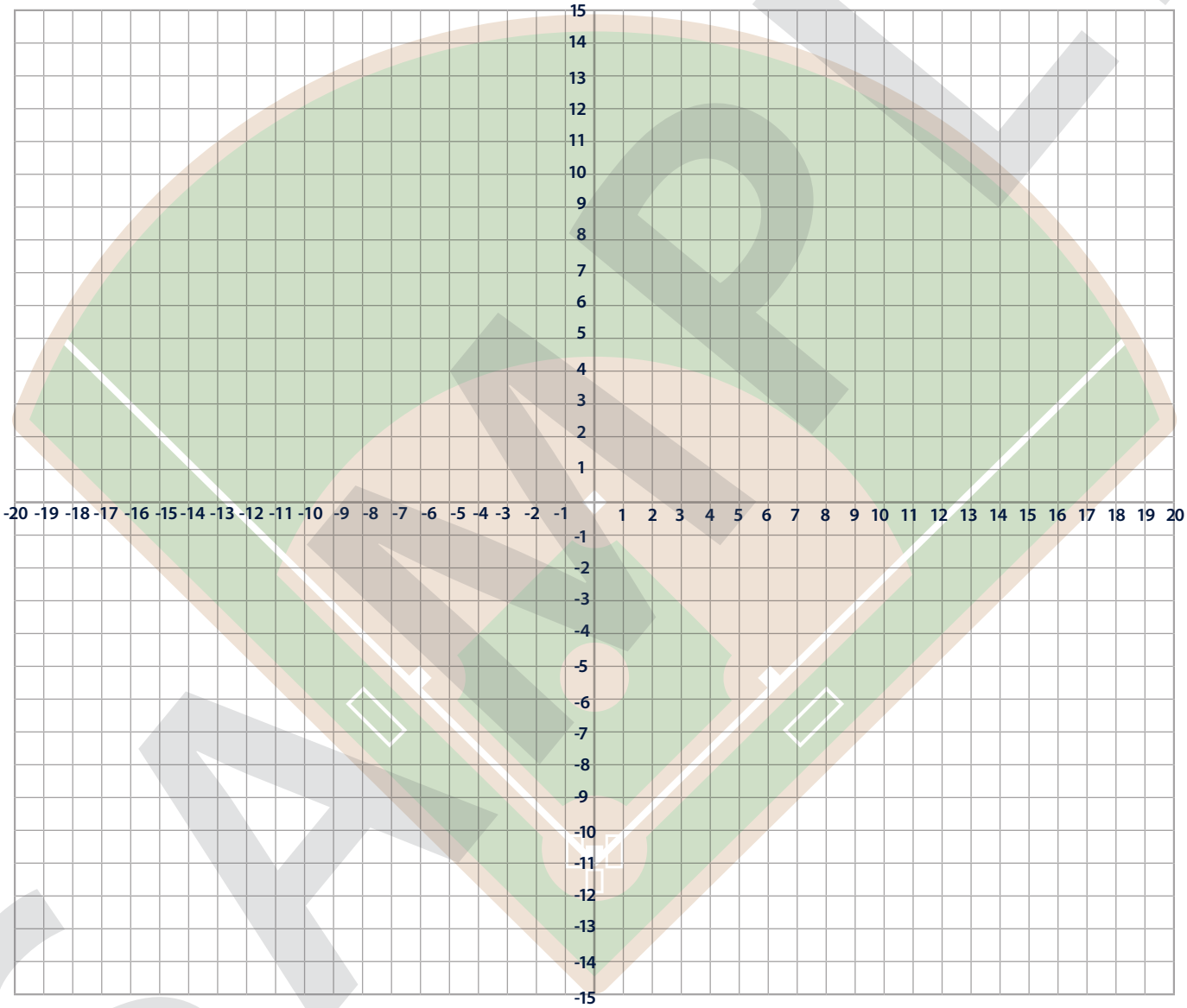
Name: _____ Class: _____

The Field of Play

GRADES 6-8

6th grade specific standards

Plot each player on the coordinate plane. Label their x,y coordinates.



Center Field: Pitcher: Shortstop:

Left Field: First Base: Third Base:

Right Field: Second Base: Catcher:

Name: _____ Class: _____

The Field of Play

GRADES 6-8

Use the coordinate plane to determine the absolute value between players.

1. How far would the Second Base player need to throw to the Shortstop?

2. How far would the Third Base player need to throw to the First Base player?

3. How far would the Pitcher need to throw to the Catcher?

4. How far does the Center Fielder need to throw to the Pitcher?

5. If the First Baseman ran to (0, 6) to catch the ball and then needed to throw to Home to make the play, how far would they throw?

6. If the Catcher (-11) was attempting to throw out a runner stealing Third Base, how far would they throw?

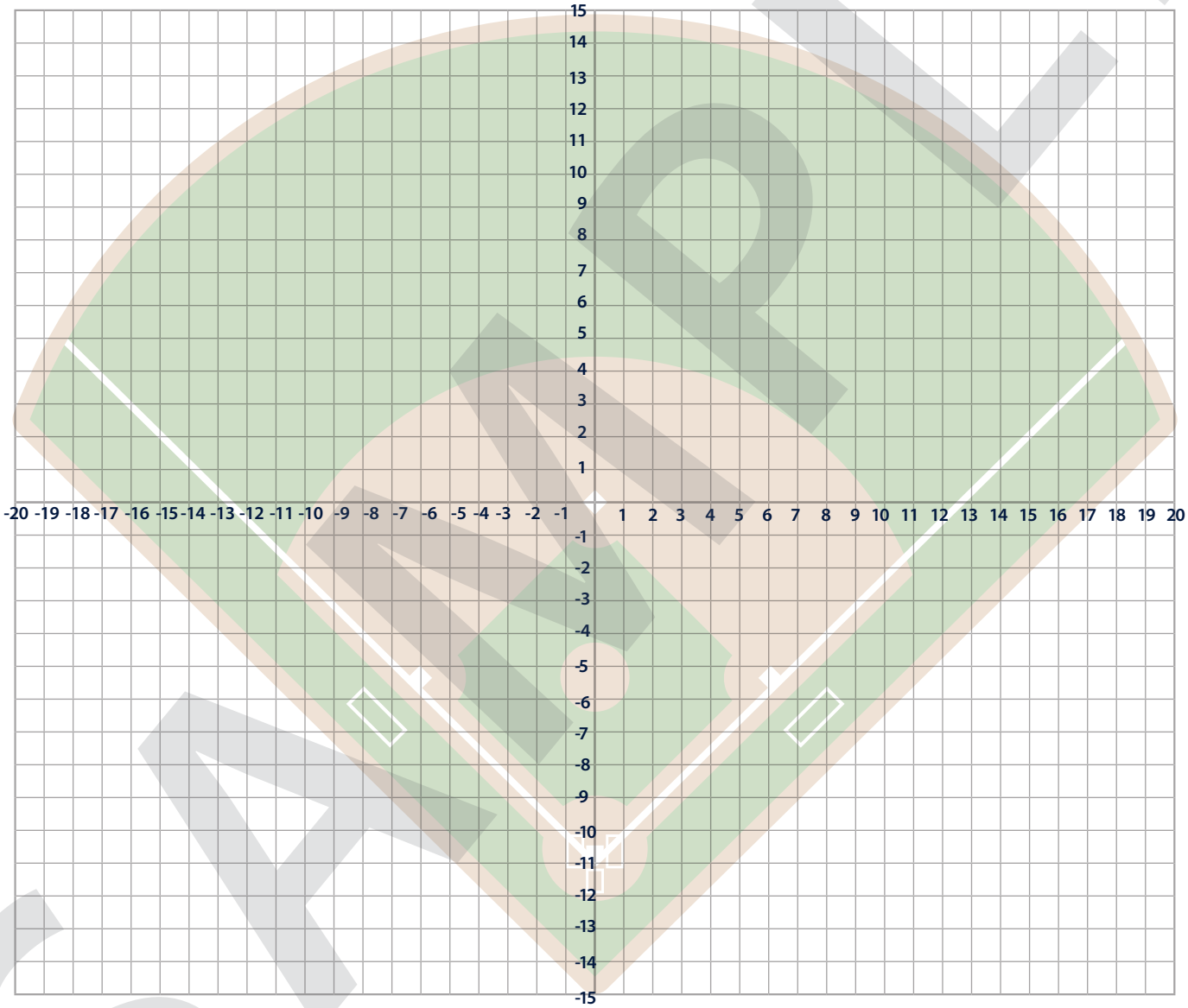
Name: _____ Class: _____

The Field of Play

GRADES 6-8

8th grade specific standards

Plot each player on the coordinate plane. Label their x,y coordinates.



Center Field: Pitcher: Shortstop:

Left Field: First Base: Third Base:

Right Field: Second Base: Catcher:

Name: _____ Class: _____

The Field of Play

GRADES 6-8

1. Use the distance between the Pitcher and First Base (A), and the Pitcher and Catcher (B). Use the Pythagorean Theorem to calculate the distance between First Base and the Catcher. $A^2 + B^2 = C^2$

2. Use the distance between the Pitcher and Third Base (A), and the Pitcher and Catcher (B). Use the Pythagorean Theorem to calculate the distance between Third Base and the Catcher. $A^2 + B^2 = C^2$

3. Use the distance between the Pitcher and Center Field (A), and the Pitcher and Third Base (B). Use the Pythagorean Theorem to calculate the distance between Third Base and Center Field. $A^2 + B^2 = C^2$

4. Use the distance between the Pitcher and Center Field (A), and the Pitcher and First Base (B). Use the Pythagorean Theorem to calculate the distance between First Base and Center Field. $A^2 + B^2 = C^2$

5. The Catcher moves to (6, -11). Use the distance between First Base and Catcher (A) and First Base and Pitcher (B). Use the Pythagorean Theorem to calculate the distance between the Pitcher and Catcher. A2+ B2 =C2

6. The Right Fielder moves to (4, 7) in line with the Second Base player. Use the distance between the Second Base player and the Right Fielder (A) and the Second Base player and the Shortstop (B). Use the Pythagorean Theorem to calculate the distance between the Right Fielder and Shortstop. $A^2 + B^2 = C^2$

Notes

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