VOLUME 1

STEM sports

STEM.ORG ACCREDITED EDUCATIONAL EXPERIENCE

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

STEM HOCKEY

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/digitaltools.

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 Hockey, 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 lessons for teachers, administrators, or volunteers.
- Professional development or training are not required.

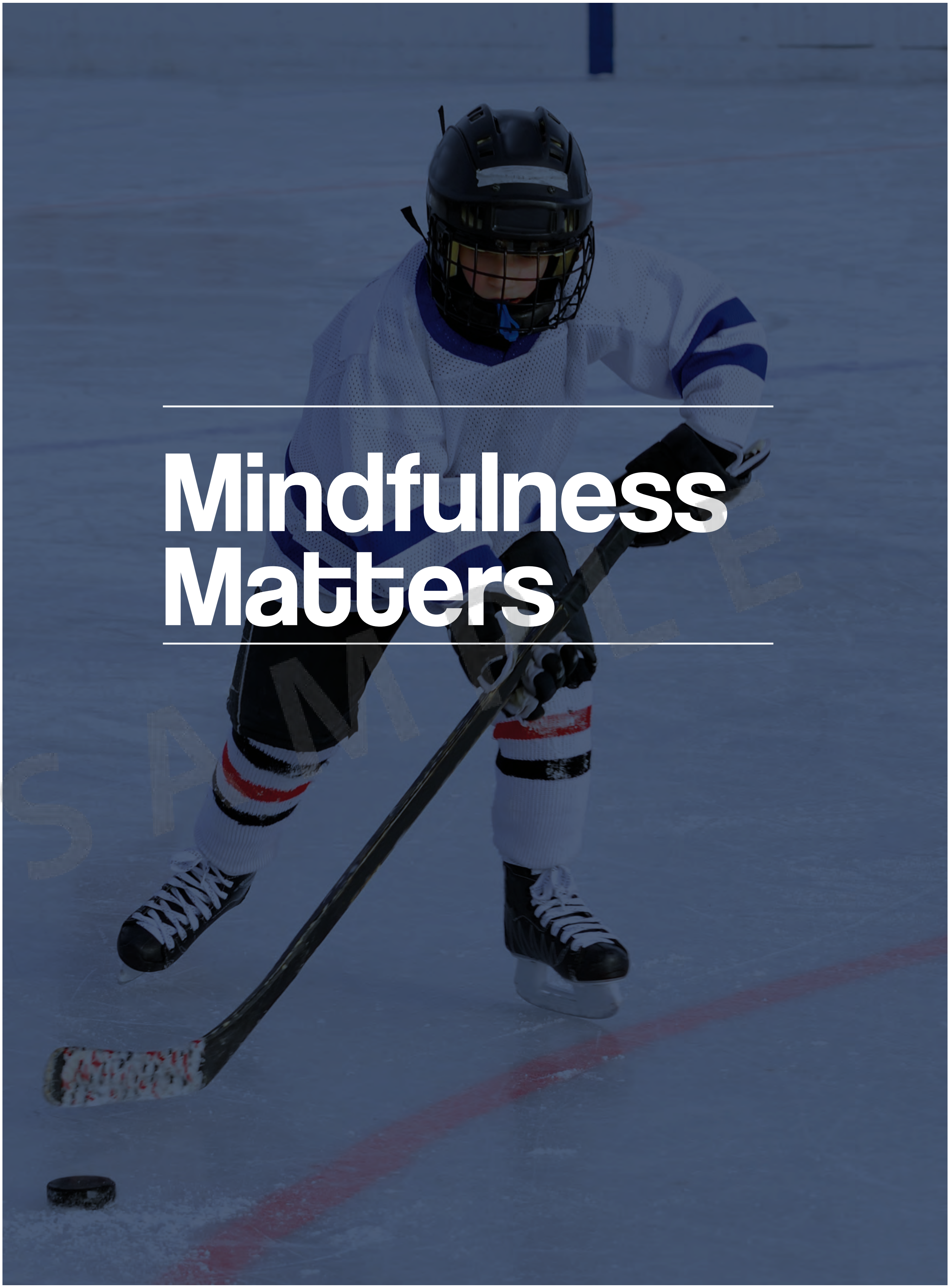
Please visit **www.STEMSports.com** for additional information and to learn about all of the curricula that we offer.

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.

Mindfulness Matters



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 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 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 understanding of STEM concepts in sports and life applications.

 Dr. Vigil is an education consultant and mindfulness educator. For more information on mindfulness training for your school/organization, visit **www.RayeEducationalServices.com** or call 602-510-0298.

Contents

Grades 3-5

Contents

Grades 3-5

Contents

Grades 6-8

Module 5.0

PAGE **72**

Puck Precision

Objective
Students will calculate the probability of scoring a goal. Students will use collected data to make a claim about how the angle, distance, and shot type affect the probability of scoring.

Concept
Math: Probability

Time
(2) 50-minute blocks

Module 6.0

PAGE **77**

Shooting Forces in Hockey

Objective
Students will calculate the force used in two different shooting motions using Newton's Second Law. Students will explain how a change in force affects the acceleration of the puck (when mass remains constant) by using experimental data to support a claim.

Concepts
Science: Force, Acceleration, and Mass (Newton's Second Law)
Use of Technology

Time
(2) 50-minute blocks

Module 7.0

PAGE **81**

Area of Shooting Space

Objective
Students will determine the area of their shooting space by measuring the base and height of a triangle.

Concept
Math: Geometry and Area

Time
(2) 50-minute blocks

Module 8.0

PAGE **87**

Advancements in Hockey

Objective
Students will evaluate the criteria and constraints of instant replay to determine the needs of the stakeholders and hockey culture.

Concepts
Engineering: Criteria and Constraints
Use of Technology

Time
(2-3) 50-minute blocks

Capstone

PAGE **93**

Exploring the different classifications of disabilities in the Paralympics

Objective
Students will explore the different disabilities in the Paralympics. Students will participate in activities that simulate these disabilities. Students will research a Paralympic sport and discuss the STEM concepts that make each sport accessible.

Supplies Checklist

- [ ] **Six (6)** Floor Hockey Pucks
- [ ] **Five (5)** Right Hand Floor Hockey Sticks
- [ ] **One (1)** Left Hand Floor Hockey Stick
- [ ] **One (1)** Floor Hockey Goalie Stick
- [ ] **One (1)** Hockey Puck
- [ ] **One (1)** Cut Hockey Puck
- [ ] **One-Thousand (1,000)** Craft Sticks
- [ ] **One (1)** Rubber Bands Package (475)
- [ ] **Twenty-Four (24)** Disc Cones
- [ ] **Six (6)** 25-Foot Tape Measures
- [ ] **Six (6)** Digital Stopwatches
- [ ] **Six (6)** Ribbon Spools
- [ ] **One (1)** Masking Tape Roll
- [ ] **One (1)** Ball of String
- [ ] **One (1)** Fishing Line Spools
- [ ] **One (1)** Radar Gun
- [ ] **One (1)** STEM Hockey Curriculum Manual

Materials Needed

- [ ] Pencils
- [ ] Colored Pencils
- [ ] Prototyping Materials *(Extend only)*
- [ ] Various Sport Balls: Tennis, Baseball, Softball, Golf, and Ping Pong
- [ ] Paper/Notebook
- [ ] Rulers
- [ ] Smartphone/Tablet
- [ ] Various Sport Sticks/Clubs: Baseball, Softball, Golf, and Tennis
- [ ] Outdoor Space
- [ ] Calculators
- [ ] Ice Skates (Optional yet recommended)
- [ ] Ice Rink/Platform (Optional yet recommended)

Hockey STEM Sports® Glossary

Acceleration: Change in speed over time.

Acute Angle: An angle that measures less than 90°.

Area: The amount of space a flat shape (2D) consumes.

Balanced Force: Two forces acting in opposite directions on an object, equal in size.

Constraint: 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.

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

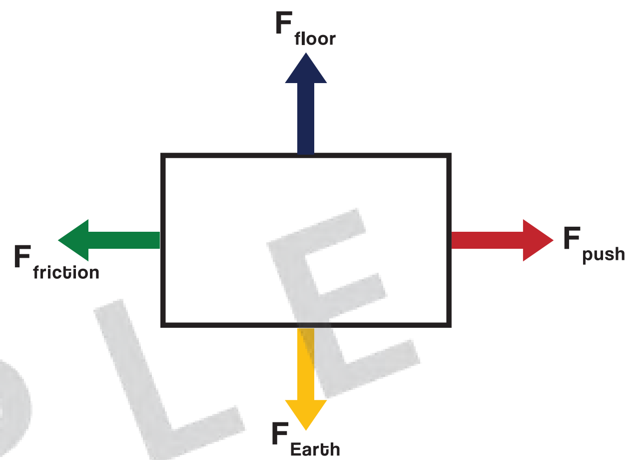
Critical Point: In the case of thermodynamics, it is the end point of the pressure-temperature curve that indicates a condition where liquid and vapor can coexist.

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

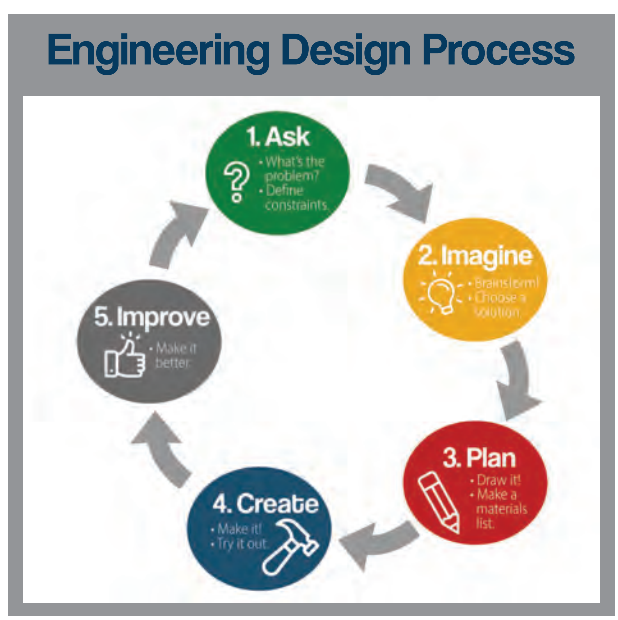
Engineering Design Process (EDP): An organized series of steps that engineers use to develop functional products or processes.

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.



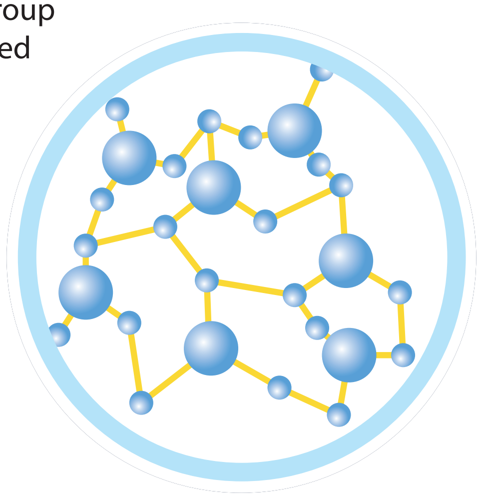
Forehand Pass & Shot: A pass or shot in which a player uses the inside curve of the stick or concave part of the stick to effectively control the puck when passing to a teammate or taking a shot on goal.



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

Line of Symmetry: A line that passes through the center of an object or shape**.**

Molecule: A group of atoms bonded together, representing the smallest fundamental unit of a chemical compound that can take part in a chemical reaction.



Molecular Structure: The manner of electrons and nuclei interacting to form a molecule.

Obtuse Angle: An angle that measures between 90° and 180°.

One-timer (Slap shot): When a player connects with a teammate's pass with an immediate slap shot.

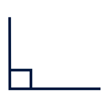
Parallel Lines: Lines, planes, surfaces, or objects that are side by side, having the same distance continuously between them.

Perimeter: A continuous line forming the boundary of a closed geometric figure.

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

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

Right Angle: An angle of exactly 90° that corresponds to a quarter turn.



Slap Shot: The hardest shot in hockey that requires full and one fluid body motion to execute. Slap shot typically requires a player to raise the stick's blade above their shoulders or higher, whereas a "One-timer" is often lower or at shoulder height due to timing by way of receiving a teammate's pass.

States of Matter:
A *Solid* is a set of atoms or molecules held together (within a constant state) so they maintain a distinct shape and size.
A *Liquid* is a state of matter defined by its condensed make-up and ability to flow.
Gas is a state of matter defined by its movable or non-condensed state and/or ability to flow.

Stick-Handling: A player's ability to effectively control the puck with their stick.

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

Triple Point: In the case of thermodynamics, it is the substance of temperature and pressure in which these three states of matter can coexist: gas (vapor), liquid (water), and solid (ice).

Unbalanced Forces: A force that changes the position, speed, or direction of the object to which it is applied.

Vertex: The point at which two lines meet.

Wrister: A wrist shot in which a player uses their arms (less body) to generate force on the shot.

Module
4.0

GRADES
3-5

Ice Time

Concept
Math: Identifying Lines and Shapes

Objective
Students will identify fundamental areas on the playing surface/ice. Students will learn how lines and areas on the playing surface/ice uniquely correspond to the rules of the game. Students will use this information to graph and recognize coordinates on a coordinate plane system.

Time
(2) 50-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), and perpendicular and parallel lines. Identify these in two-dimensional figures.

CCSS.MATH.CONTENT.4.G.A.3: Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry

CCSS.MATH.CONTENT.5.G.A.1: Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis, and x-coordinate, y-axis and y-coordinate).

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

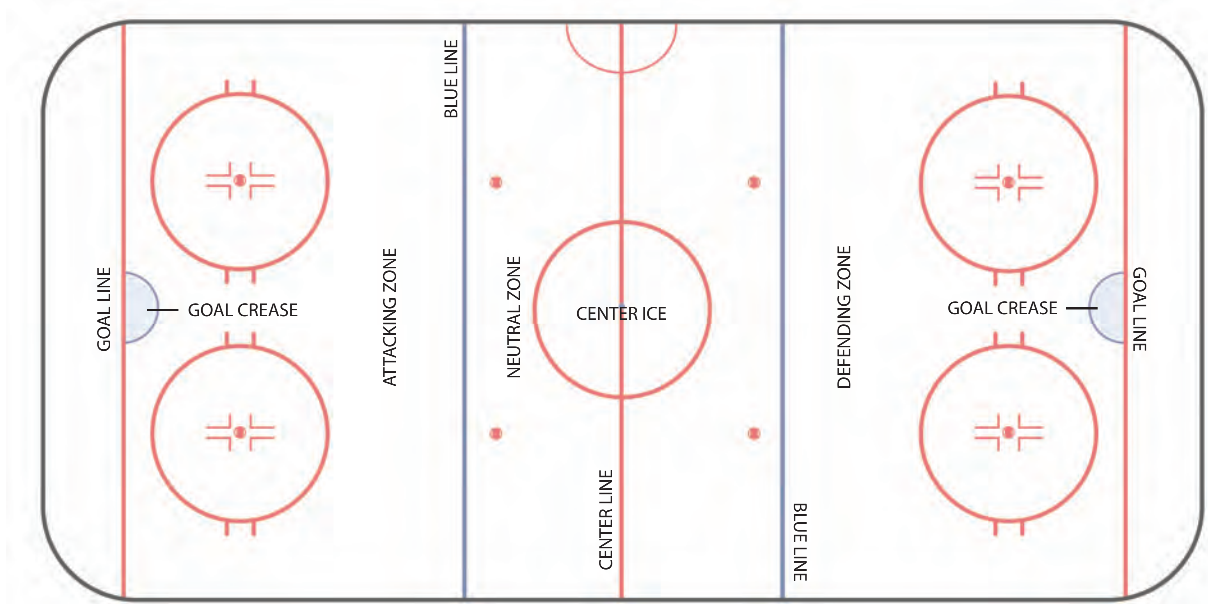
Please email Info@STEMSports.com to access Worksheet Keys.

Materials Needed
Pencils

Extend Only: *Ice Rink/Platform*

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 the different lines and shapes marked on the ice. Have students brainstorm the hockey names of the lines and shapes seen.

Explore: Review with students the ice markings from the picture above. Discuss with students that each line and shape marking is unique to its corresponding rule. Ask students to draw a line connecting the ice marking to its corresponding rule on the worksheet provided.

Explain: Define key terms: Acute Angle, Obtuse Angle, Right Angle, Perpendicular Lines, Parallel Lines, Line of Symmetry, and Coordinate Plane System, which can be found in the STEM Sports® Glossary in the front of this manual and at STEMSports.com under Resources. Ask students to label the five ice markings from the *Explore* section on the picture of the rink on the worksheet provided. Then explain to students that these ice markings are placed strategically to enforce the rules of hockey. Their placement also results in six different math relationships. Model for students how to find these relationships using the worksheet as a guide.

Elaborate: Have students label the x-axis and y-axis of the Coordinate Plane System. Remind students the first number given is the x-coordinate and tells you how far you should travel to the right of zero. Remind students the second number given is the y-coordinate and tells you how far you should go up from zero. Model for students where the coordinate (2, 3) would be placed.

Evaluate: Ask students to plot the points provided on the worksheet. Students will also need to write down the hockey ice marking that plotted point is a part of.

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 space is available, students could skate to the different ice markings mentioned in *Explore*, continuing to use the vocabulary of the ice marking to associate it with the corresponding rule and math relationship.

STEM Jobs in Sports

- Ice Painter
- Arena - Light Technician
- Stadium - Director of Building Operations
- Arena Architect
- NHL Team: Director of Strategy and Analytics

Fun Facts

Ice hockey was invented in the late 19th century in Montreal, Quebec, Canada, when a group of students decided to play field hockey on an ice rink using a piece of wood instead of a ball.

Name: ____

Ice Time

GRADES 3-5

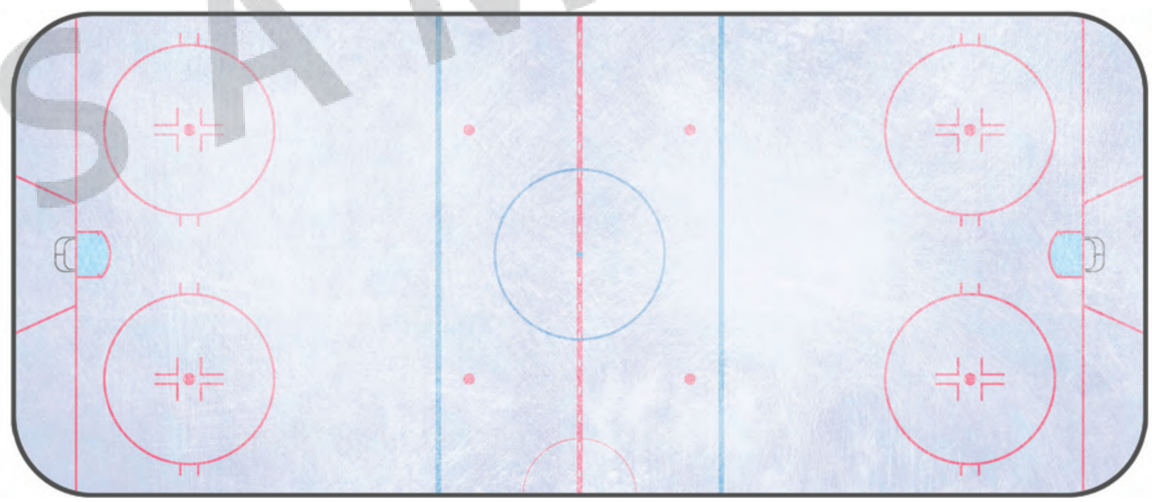
Explore

Draw a line connecting the ice marking to its corresponding rule.

Ice Marking		Rule
Center Line		Used to separate the ice into three zones: offensive, defensive, and neutral
Dots		Used for face-offs: marks where the players can position themselves
Blue Lines		Used to judge icing
Circles		Used to judge goals
Goal Line		Used for face-offs

Explain

Label the five ice markings mentioned above on the rink below.



Using the color __________, outline the hockey markings that result in parallel lines.
Using the color __________, outline the hockey markings that result in perpendicular lines.
Using the color __________, outline the hockey markings that result in right angles.
Using the color __________, outline the hockey markings that result in acute angles.
Using the color __________, outline the hockey markings that result in obtuse angles.
Using the color __________, draw the two lines of symmetry in the hockey rink.

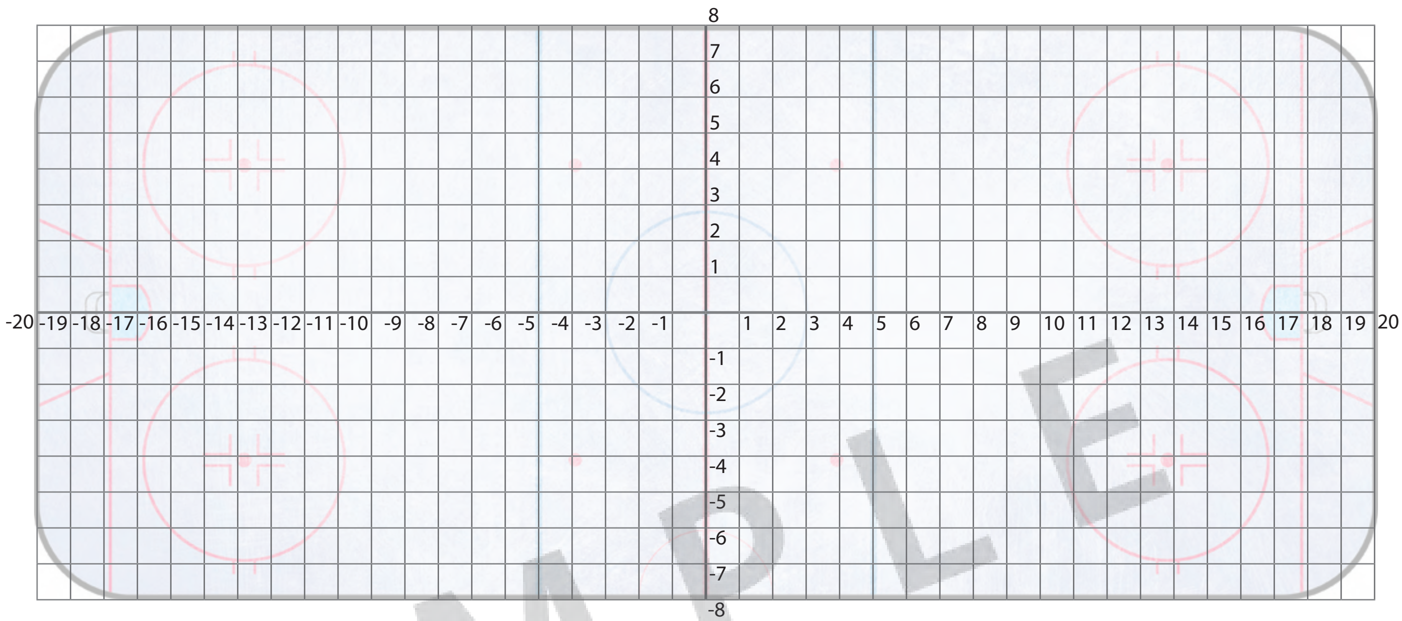
Module 4.0

Name: ____________________

Ice Time

GRADES 3-5

Elaborate



Evaluate

1. Graph the point (5, 2). What is the name of this hockey marking?

____

2. Graph the point (18, 6). What is the name of this hockey marking?

____

3. Graph the point (0, 5). What is the name of this hockey marking?

____

4. Graph the point (11, 3). What is the name of this hockey marking?

____

5. Name two coordinate points where you can find a face-off dot.

____

STEM sports

Module
4.0

GRADES
6-8

Ice Time

Concept
Math: Units and Area and/or Pythagorean Theorem

Objective
Students will identify fundamental areas on the playing surface/ice. Students will learn how lines and areas on the playing surface/ice uniquely correspond to the rules of the game. Students will use this information to develop a coordinate plane system to determine the distance of the game's markings.

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

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

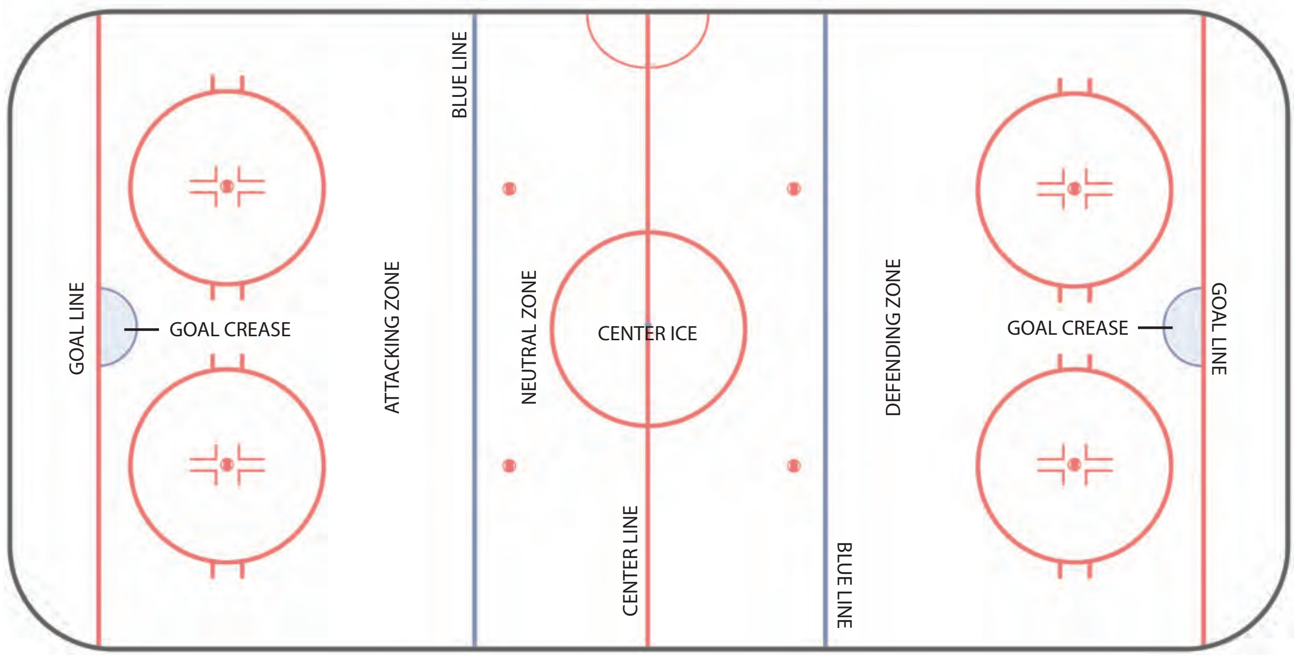
Materials Needed
Pencils

Extend only: *Ice rink/platform (recommended)*

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 the markings on the ice. Have them brainstorm how and why each marking is unique. How are the features unique to one another? Why do the features need to be unique?



Explore: Review with students the ice markings above. Discuss with students that each marking is unique to correspond to its unique rule. Ask students to draw a line connecting the ice marking to its corresponding rule on the worksheet provided.

Explain: Define key terms: Coordinate Plane System and Pythagorean Theorem (if using). Model for students how to locate a given coordinate point; how to find the distance between two coordinate points when either the x-coordinates or y-coordinates are the same; and how to find the diagonal distance between two coordinate points using the Pythagorean Theorem.

Elaborate: Have students use the coordinate plane system to identify unique ice markings for the given coordinates.

Evaluate: Have students use the coordinate plane system to find the distance between the given ice markings.

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: Please reference the following options:
Ice Option:
Have students skate to the different ice markings mentioned in *Explore*, continuing to use the vocabulary of the ice marking and associating it with the corresponding rule.

Non-Ice option:
Have students develop their own distance questions and solutions similar to those in *Evaluate*.

STEM Jobs in Sports
- Ice Painter
- Arena Light Technician
- Director of Building Operations
- Architect
- Director of Strategy and Analytics

Fun Facts
It takes over 10,000 gallons of frozen water to make an ice rink with the official dimensions.

Name: ______________________________ Class: __________

Ice Time

GRADES 6-8

Explore

Draw a line connecting the ice marking to its corresponding rule.

Ice Marking		Rule
Center Line		Used to separate the ice into three zones: offensive, defensive, and neutral
Dots		Used for face-offs: marks where the players can position themselves
Blue Lines		Used to judge icing
Circles		Used to judge goals
Goal Line		Used for face-offs

Elaborate

1. What ice marking can be found at (10, 1)?

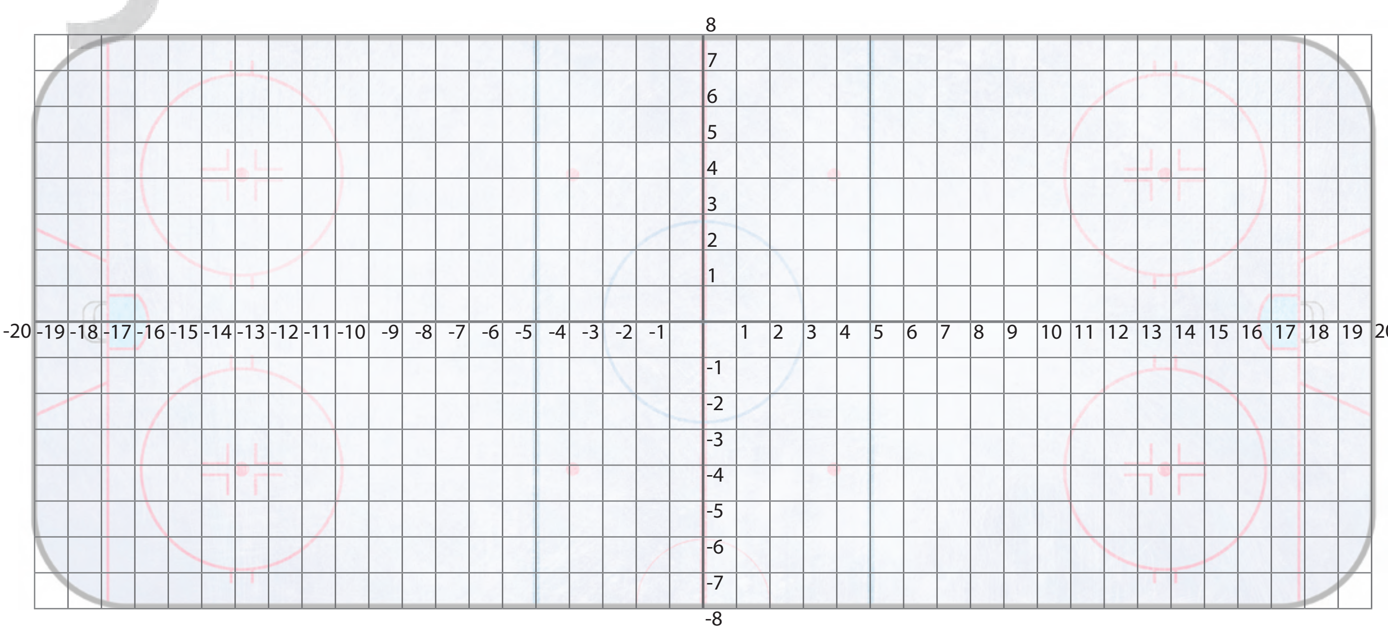
____

2. What ice marking can be found at (0, -5)?

____

3. What two ice markings can be found at the origin (0, 0)?

____



Module 4.0

Name: ______________________ Class: ____________

Ice Time

GRADES 6-8

Evaluate

Use the coordinate plane to find the distance between the ice markings by finding the absolute value.

1. Find the distance between the blue lines at (-5, 2) and (5, -2).

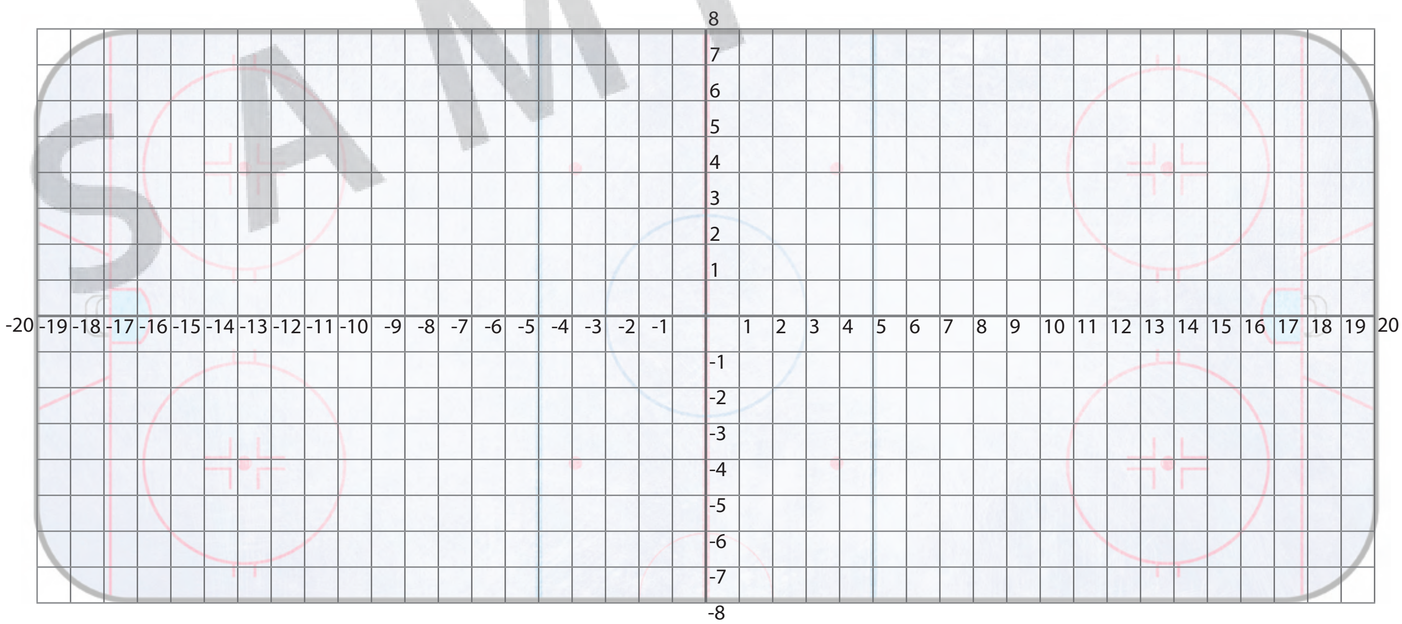
____

2. Find the length of the goal line using (-18, 7) and (-18, -7).

____

3. Find the distance a player would have to skate to go from one goal line (-18, 4) to the other (18, 4).

____



STEM sports

Name: ______________________________ Class: __________

Ice Time

GRADES 6-8

Evaluate

Use the coordinate plane to find the distance between the ice markings by using the Pythagorean Theorem.

1. Find the distance between the face-off dots at (-14, -4) and (14, -4).

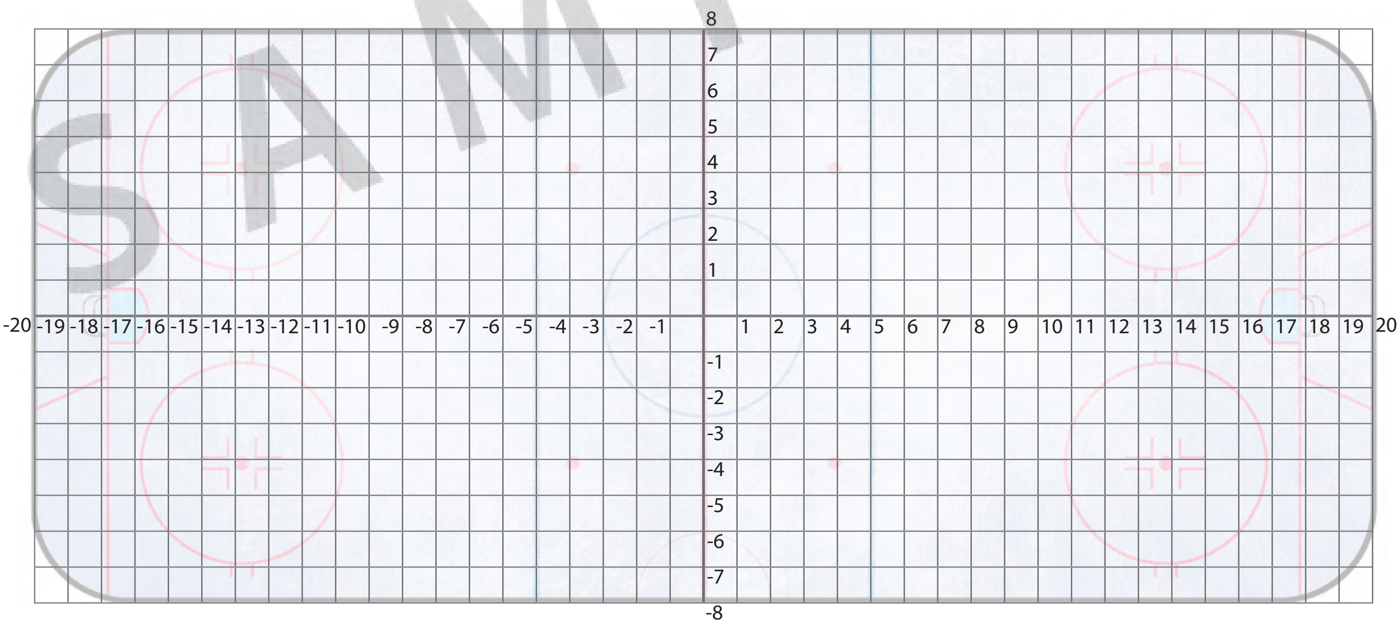
___

2. Find the distance a player would have to skate from the goal line at (-18, -3) to the center line at (0, 5) to avoid an icing penalty.

___

3. Find the distance a player would have to shoot the puck for it to go from the face-off dot at (14, 4) and the goal at (18, 0).

___



Notes

SAMPLE

Notes

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