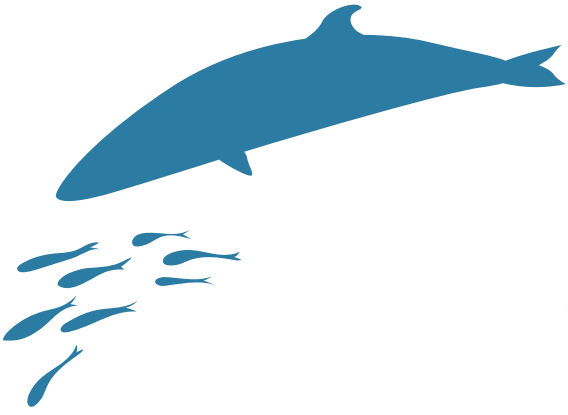
FIRST LEGO LEAGUE CHALLENGE

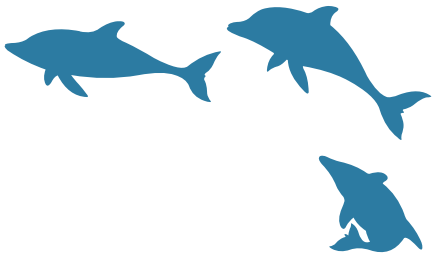
TEAM MEETING GUIDE

SUBMERGED℠

FIRST

LEGO education





FIRST LEGO LEAGUE CHALLENGE

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Introduction to *FIRST*® LEGO® League Challenge

Friendly competition is at the heart of FIRST® LEGO® League Challenge, as teams of up to 10 children engage in research, problem-solving, coding, and engineering as they build and code a LEGO® robot that navigates the missions of the robot game. Teams also participate in an innovation project to identify and solve a relevant real-world problem.

FIRST LEGO League Challenge is one of three divisions by age group of the FIRST LEGO League program. This program inspires young people to experiment and J U R Z W K H L U F R Q ¿ G H Q F H F U L W L F D O thinking, and design skills through hands-on learning. FIRST LEGO League was created through an alliance between FIRST® and LEGO® Education.

FIRST LEGO LEAGUE

FIRST LEGO LEAGUE DISCOVER

FIRST LEGO LEAGUE EXPLORE

FIRST LEGO LEAGUE CHALLENGE

FIRST® DIVE℠ presented by Qualcomm and SUBMERGED℠

Welcome to the FIRST® DIVE℠ presented by Qualcomm season. This year's FIRST LEGO League challenge is called SUBMERGED℠.

This season, children will learn about how and why people explore the oceans. Our discoveries beneath the ocean surface teach us how this complex ecosystem supports a healthy future for the plants and animals that live there.

During each session, teams will experience the engineering design process. There is no set order for this process, and they may go through each step several times in a single session. This means that during a session, children will be exploring the theme and ideas, creating solutions, testing them, iterating and changing them, and then sharing what they've learned with others.

More than 80% of the ocean remains unexplored, offering curious minds deep opportunities to dive into expeditions.

Program Outcomes

The team will:

- Use and apply the FIRST Core Values and engineering design process to develop robot and innovation project solutions.
- Identify and research a problem related to the season theme and then design and create a possible solution.
- Identify a mission strategy and design, create, and code a robot to complete missions.
- Test, iterate, and improve their robot design and innovation project.
- Communicate their robot design and innovation project and demonstrate their robot in the robot game.

Overview

How to Use This Guide

The sessions provide a guided experience for the FIRST® LEGO® League Challenge. The sessions are designed to be flexible so that teams with different experiences can use the materials.

Your role is to facilitate and guide the team during the sessions as they complete each task. The tips within this guide are just suggestions. Review the Sessions at a Glance page to determine what your team should work on during each meeting. Remember to do whatever is best for you and your implementation.

FIRST® Core Values

The FIRST® Core Values are the cornerstones of the program. Gracious Professionalism® is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community. The team's Core Values and Gracious Professionalism are evaluated during robot game matches and during the judging session at the tournament. The team demonstrates Coopertition® by showing that learning is more important than winning and that they can help others even as they compete.

Teamwork — We are stronger when we work together.

Inclusion — We respect each other and embrace our differences.

Impact — We apply what we learn to improve our world.

Fun — We enjoy and celebrate what we do!

Discovery — We explore new skills and ideas.

Innovation — We use creativity and persistence to solve problems.

What Does the Team Need?

LEGO® Education SPIKE ™ Prime Set

Core set

Expansion set

Note: Other LEGO® Education sets such as MINDSTORMS® and Robot Inventor are also allowed.

Electronic Devices

Each team will need two compatible devices such as a laptop, tablet, or computer. Prior to starting Session 1, you need to download the appropriate software (LEGO® Education SPIKE™ or other compatible software) on to the device.

Season Resources

SUBMERGED℠ Challenge Set

This challenge set comes in a box that contains the mission models, challenge mat, and some miscellaneous pieces. The team should build the models very carefully using the building instructions. The miscellaneous items include 3M™ Dual Lock™ Reclosable Fasteners, coach pins, and season tiles for the team members.

Challenge Mat and Table

Set up a table with the challenge mat in your classroom or meeting space. Even if you cannot build the whole table, building just the four walls will be useful. It is also SRVVLEOH WR XVH WKH PDW RQ WKH ARRU

Management Tips

- The team will be doing the work. You will facilitate their journey and remove any major obstacles.
- Determine your timeline. How often will you meet and for how long? How many meetings will you have before your tournament?
- Some sessions might take 2 hours or more to complete. You might need to work on a session in multiple team meetings depending on how long you PHHW %H ÀH[LEOH
- Set team guidelines, procedures, and expected behaviors for your meetings.
- Guide your team as they work independently through the tasks provided in each session.
- Use the guiding questions in the sessions to provide focus and direction to the team.
- Jobs in the Project Sparks connect to the Career Connections pages in the back of the Engineering Notebook.
- Teammates should be encouraged to work with each other, listen to each other, take turns, and share ideas.

- Place any extra or found LEGO® pieces in a cup. Have children who are missing pieces come to the cup to look for them.
- Wait to dismiss your team until you look over their LEGO set.
- The lid of the LEGO set can be used as a tray to keep pieces from rolling away.
- 8VH SODVWLF EDJV RU FRQWDLQHUV W builds or assembled models.
- Designate a storage space for the built mission models and your challenge mat/table.
- The teammate in the material manager role can help with the process of clearing away and storing materials.

- Read the Engineering Notebook carefully. The team will share the notebooks and work on them collaboratively.
- The notebook contains relevant information and guides the team through the sessions.
- The tips in this Team Meeting Guide will direct you how to support each session.
- As facilitator, guide the team members in the performance of their roles during each session.
- Team roles are outlined in the Engineering Notebook. 8VLQJ UROHV KHOSV \RXU WHDP IXQFWLRQ PRUH HI¿FLHQWO\ and ensures that everyone on the team is involved.

Sessions at a Glance

Each session starts with an Introduction and ends with a Share activity. Details for these activities are provided in the session pages that follow. Tips and notes are provided in this guide to assist you in facilitating each team meeting.
It may take 2 hours to complete the tasks in a session. If needed, split sessions into two separate meetings.

Session 1 – Get Started

- SUBMERGED℠ Theme and Innovation Project Exploration
- Build the Mission Models

Session 2 – Training Camp 1

- Tutorial Activities (optional)
- Training Camp 1: Driving Around
- Explore Careers

Session 3 – Training Camp 2

- Training Camp 2: Playing with Objects
- Explore Project Sparks

Session 4 – Training Camp 3

- Training Camp 3: Reacting to Lines
- Brainstorm Project Problem

Session 5 – Investigate Ideas

- Guided Mission
- Identify Project Problem

Session 6 – Identify Solutions

- Pseudocode and Mission Strategy
- Identify Project Solutions

Session 7 – Create Solutions

- Develop Robot Design
- Develop Project Solution

Session 8 – Continue Creating

- Practice Solving Robot Game Missions
- Share and Test Project Solution

Session 9 – Solution Planning

- Iterate and Improve Robot Solution
- Iterate and Improve Project Solution

Session 10 – Iterate Solutions

- Iterate and Improve Robot Solution
- Plan Project Presentation

Session 11 – Presentation Planning

- Plan Robot Design Explanation
- Practice Project Presentation

Session 12 – Communicate Solutions

- Practice Robot Game Matches
- Practice Full Presentations

Pre-Session Checkpoint

Playful Learning Resources

Please read the student Engineering Notebook, Robot Game Rulebook, and this Team Meeting Guide before starting the sessions.

The guides are full of very useful information to guide you through this experience. Use this checkpoint to help you get started and guide you toward success.

- [ ] Watch the season videos on the FIRST ® LEGO® League YouTube channel.
- [ ] Explore the FIRST ® Core Values. These are the essential foundation for your team.
- [ ] Ensure you have at least two devices with Internet access and the appropriate LEGO® Education app installed per team.
- [ ] Unpack the robot set and sort the LEGO® elements into the trays.
- [ ] Make sure the controller is charged and all updates are completed.
- [ ] Scan the QR code for additional support resources and links.
- [ ] Look over the judging rubrics to see the evaluation criteria for their robot and innovation project solutions.

Sessions 1-4 Tips

Have the team set goals for what they want to accomplish together, and have individual team members set their personal goals.

If the team is new to using their LEGO Education robot set, take some time to get them acquainted with it. Have the team complete the Tutorial Activities.

Explore the Project Sparks and narrow the team's focus on which problem they want to work on. They can select a Project Spark problem or choose one of their own.

Place the mat and models in a safe location after each session if they have to be stored.

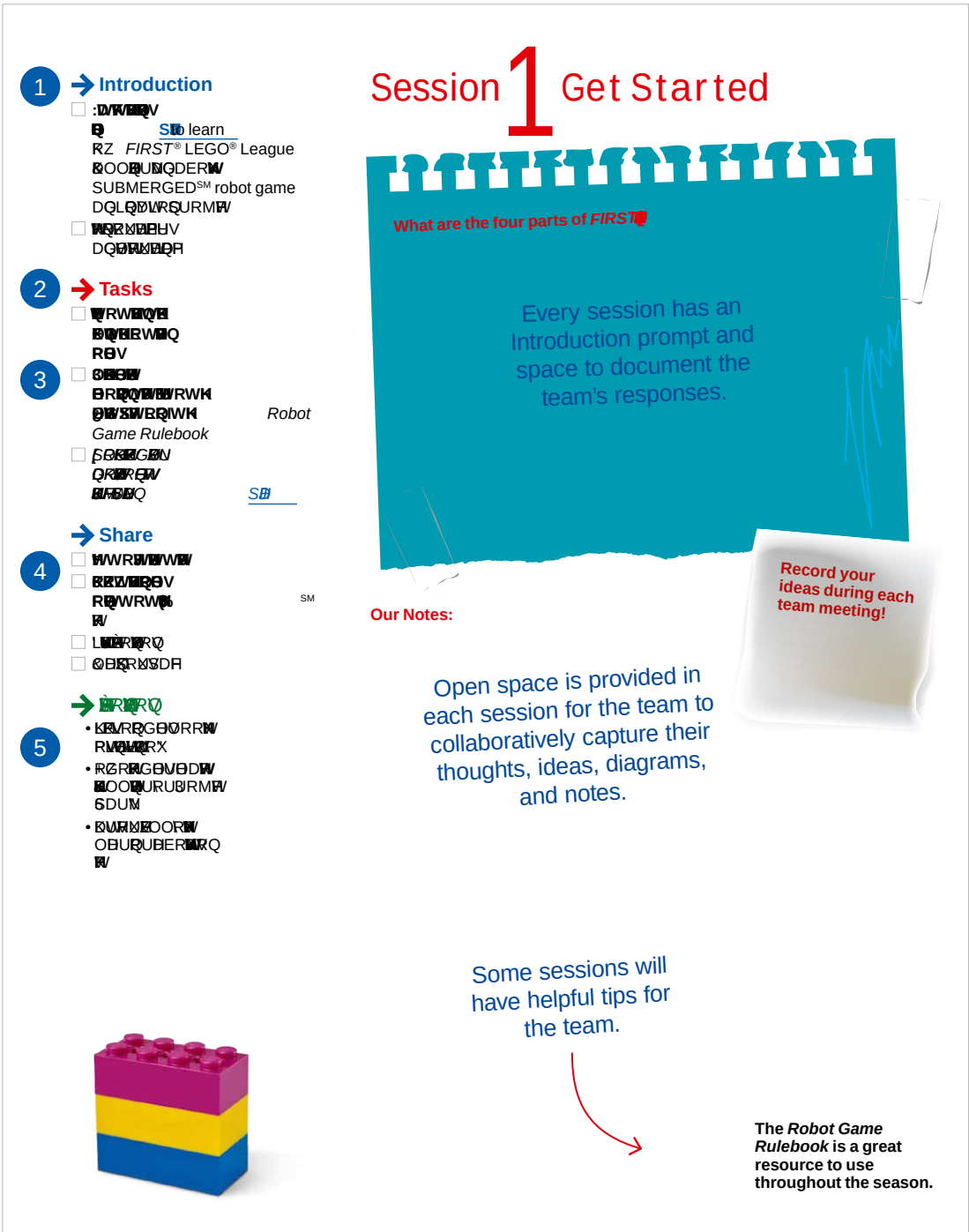
Session 1 Get Started

The team will:

- Explore the SUBMERGED℠ season theme and get to know each other.
- Make connections from the mission models to the Challenge story and Project Sparks.

1. Have the team watch the season videos on the FIRST® LEGO® League YouTube channel and read pages 3-11 in their Engineering Notebooks.
2. Provide the digital model building instructions to the team.
3. The team can work together or as individuals to build the models. Be sure to inspect and test the models to ensure they function correctly.
4. Encourage the team to investigate the mat and the mission models to inspire them. The team should record ideas for possible innovation projects that they could choose.
5. Encourage and support discussion about the Challenge story and Project Sparks and how they relate to the mission models.

Season Videos



Session 2 Training Camp 1

The team will:

- Build a driving base and code it to move forward, move backward, and turn.
- Explore careers related to the theme and the Project Sparks.

Session 2 Training Camp 1

Discovery: We explore new skills and ideas.

Our Notes:

The team should use these resources during the Share time. Sharing at the end is an important way for the team to summarize their learning and reach.

1 → Introduction

- [ ] [illegible] discovery[illegible]
- [ ] [illegible]

2 → Tasks (optional)

- [ ] [illegible]
  Tutorial Activities: 1-6

education

- [ ] [illegible] *Robot Game Rulebook*[illegible]

→ Tasks

- [ ] [illegible]
  Competition Ready Unit: Training Camp 1: Driving Around

3

education

- [ ] [illegible]
- [ ] [illegible]

4 → Share

- [ ] [illegible]
- [ ] [illegible]
- [ ] [illegible]
- [ ] [illegible]

→ [illegible]

- [illegible]
- [illegible]
- [illegible]

5

Use these goal prompts for inspiration!

- [illegible]
- [illegible]
- [illegible]
- [illegible]

1. Teams will explore the six Core Values throughout their season.
2. The Tutorial Activities are optional but recommended if your team has minimal coding experience.
3. After a program is downloaded onto the controller, it cannot be transferred back to be opened and edited.
4. Have the team practice their new skills by trying to drive the robot to a model and then returning to home.
5. Check out the Career Connections page in the Engineering Notebook. The team should be working toward selecting a problem for their project over the next few sessions.

Session 3 Training Camp 2

The team will:

- Explore and research ideas for their innovation project.
- Code their robot to avoid obstacles using a sensor and to power an attachment.

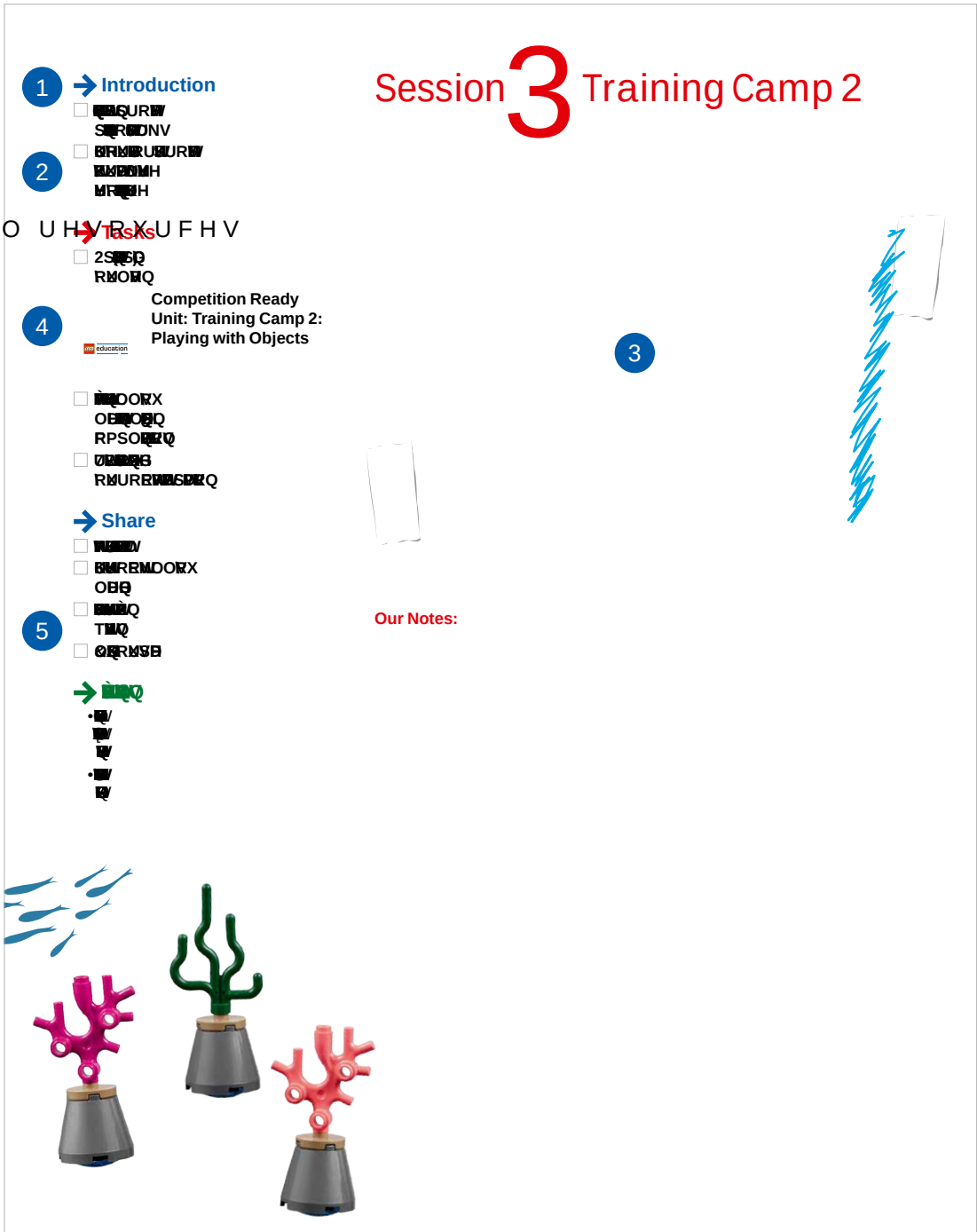
1. If your team has already agreed on the focus of their project, encourage them to begin researching the topic. You F D Q ¿ Q G K H O S I X O U H V R X U F H V on the season resource page.

2. Team planning and project management is important to achieve goals and be ready for the tournament.

3. Encourage the team use their Engineering Notebooks and to take notes when researching their ideas.

4. Have the team check that the wires are plugged into the right ports and that the ports used match their program.

5. Robot Game Connection: Have the team think about how to use the attachment from the robot lesson to complete missions.



Session 4 Training Camp 3

The team will:

- Narrow down their ideas for their innovation project.
- Code their driving base to detect a line using a sensor.
- Start to think about their strategy for the robot game.

Session 4 Training Camp 3

Innovation Project Problem Ideas:

Our Notes:

Introduction

1

Tasks

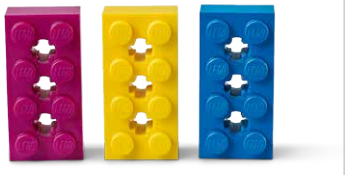
2

3 **Competition Ready Unit: Training Camp 3: Reacting to Lines**

4

5

Share



1 Each team member might not get their favorite problem chosen, but the team should choose something everyone supports.

2 Plug in the controller and open the app periodically to check for software and ¿ U P Z D U H X S G D W H V

3 Have the team choose lines on the mat that will help them navigate the robot to different missions.

4 Have the team follow the program on the screen to see how it matches the robot's actions. This will help them debug their programs.

5 Try to start the robot in the same or a very similar place each time in one of the launch areas.

Checkpoint 1

- [ ] The team has bonded and are working well together. If they need more support to achieve this, do some extra team-building activities.
- [ ] New teams may want to summarize the new robot skills they have learned.
- [ ] All models must be built and placed on the mat and secured with the Dual Lock squares as needed.
- [ ] Extra time can be spent on the robot lessons before moving on to the next sessions.
- [ ] The team has reviewed the missions and rules in the Robot Game Rulebook.
- [ ] The team has explored topics for their innovation project and has narrowed down their ideas.
- [ ] The team could complete the exploration activity listed in the Career Connections pages in the Engineering Notebook after Session 4.
- [ ] Check in with the team on their progress on their personal and team goals. They can adjust their goals based on information they have learned in the last few sessions.

Sessions 5-8 Tips

Remember that the Core Values are about HOW the team behaves and works together. They should be demonstrated by all team members all the time.

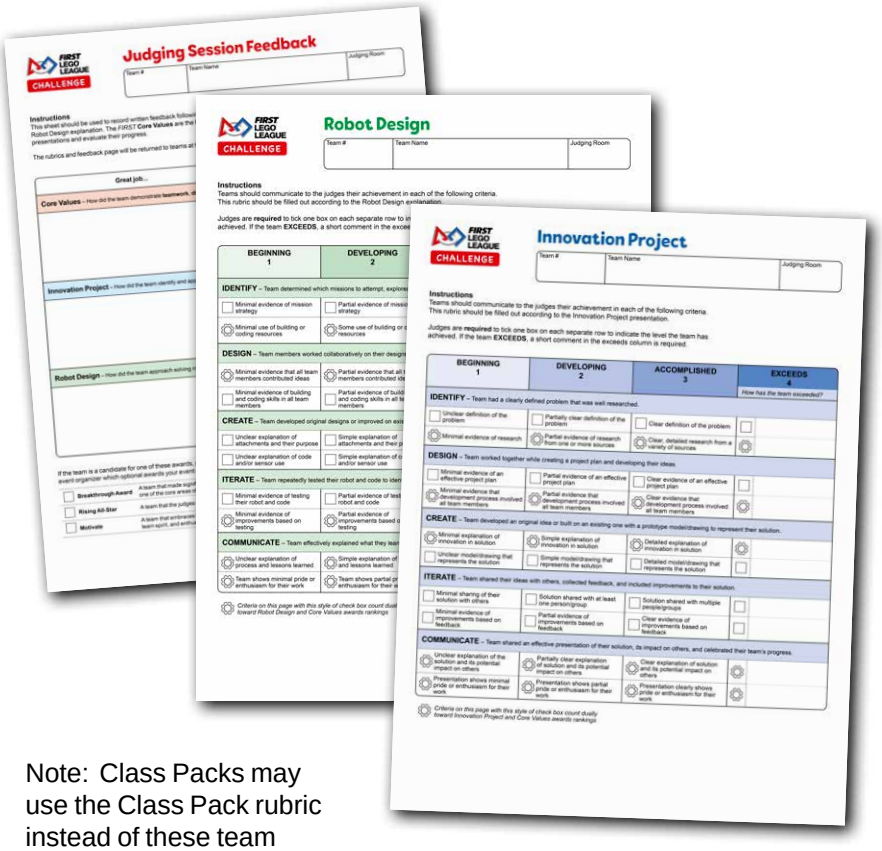
At the robot game matches, two robot game tables will be set up next to each other. However, during the sessions, you can work with a single robot game table.

The team will have to select a mission and solution to focus on and then share their idea with others for feedback. It will be helpful to think about this goal during each session.

Look for missions that:

- Use basic robot skills like push, pull, or lift.
- Have models close to a launch area.
- Involve navigation with line following.
- Have easy access to home.

Understanding the Rubrics



Note: Class Packs may use the Class Pack rubric instead of these team rubrics.

Innovation Project and Robot Design

The rubrics used to evaluate the teams in these areas are based on the engineering design process. The team works on their project and robot to solve problems using this process. Team members need to demonstrate and explain everything they have worked on during the judging session.

Core Values and Gracious Professionalism ®

Teams express the six Core Values through the way they behave with each other and with people outside the team on their learning journey. In FIRST® LEGO® League Challenge, this is called Gracious Professionalism®.

Teams will have their Core Values evaluated during the judging session while they share about their innovation project and robot design.

Teams will also be scored on their Gracious Professionalism at every robot game match. Remember, if they cannot attend a match, they should let the referee know.

Download Rubrics

Session 5 Investigate Ideas

The team will:

- Apply coding principles to the guided mission.
- Identify their innovation project problem to solve and research solutions. (Revisit page 6 of the Engineering Notebook.)

1. The team should be able to describe how everyone contributes to the team.
2. If the team is sharing one robot, they can code on individual devices and then take turns running their programs on the robot.
3. The provided program for the guided mission will not only solve the "Send over the Submersible" mission but also be helpful to use on other missions.
4. Remind the team to test program changes in small steps instead of changing the entire program at once.
5. If an attachment is needed for a mission, keep it in a plastic bag labeled with the mission number.

Session 5 Investigate Ideas

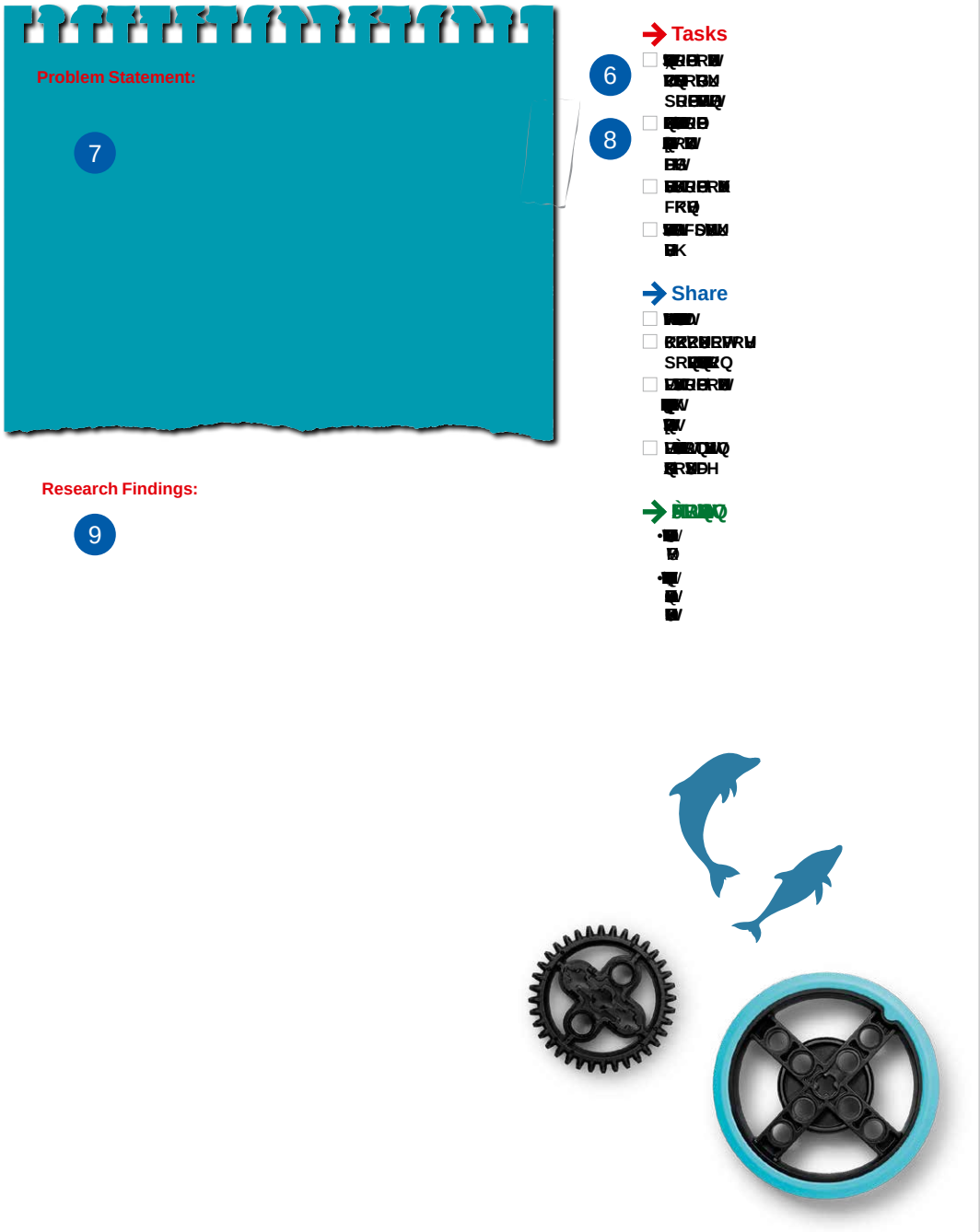
1. **Introduction**
   - [ ] [illegible] teamwork [illegible]
   - [ ] 5[illegible]
2. **Tasks**
   - [ ] 2S[illegible]
   - Competition Ready
   - Unit: Guided Mission
3. 5[illegible]
4. [illegible]
5. 5[illegible]
   - [illegible]
   - [illegible]

Coopertition®

Guided Mission: Mission 10: "Send over the Submersible"

1. To help you learn about navigating and interacting with a model, complete this guided mission.
2. In the app, download the program that solves this mission.
3. Start your robot in the correct position in the left launch area. Run your robot and watch it complete the mission and score the points.
4. Like all the mission models, Mission 10: "Send over the Submersible" might inspire you to think of a solution for your innovation project.
5. Think about how to incorporate the Submersible mission into your mission strategy.
6. Apply your new line-following skill to a different mission model.

Team-building activities are great for teams to develop their Core Values and learn how to work together.



6 Teams should be able to F O H D U O \ G H ¿ Q H W K H they have chosen. This is evaluated during the judging session at the event.

7 The team will write their problem statement here. Remember, teams can choose one of the problems from the Project Sparks if they are unable to come up with their own idea. If they have multiple ideas, they could use a voting process to narrow it down to one.

8 Project resource examples include websites, videos, books, magazines, personal stories, user experiences, and experts.

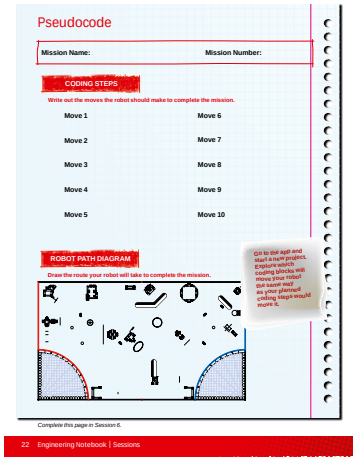
9 The team should record what they learn and note any questions that still need to be researched to develop their solution.

Session 6 Identify Solutions

The team will:

- Create a mission strategy plan and write pseudocode for a mission.
- &RQGXFW UHVHDUFK RQ WKHLU LGHQWL¿HG SUREOHP
  Planning page.

1. The team should pause WR UHÀHFW RQ WKH RYHUDOO VXFFHVV sessions. What does the team feel proud of? What are they excited about?
2. Provide sticky notes and planning cards for the team to place on the mat to map out their mission strategy.
3. Encourage the team to ¿QG WKH PLVVLRQV ZKHUH points can be scored most easily and do them ¿UVW
4. The Pseudocode page can be photocopied. It can be used for each mission the team attempts.



Introduction

Tasks

Robot Game Rulebook

Competition Ready Unit: Assembling an Advanced Driving Base

Robot Game Strategy Notes:

Pseudocode is a written description of the steps for your planned robot program.

3URYLGH H[WUD SDSHU RU D VKDUHG RQOLQH ¿OH IRU W
to create their robot and innovation project solutions. The team will be judged on
WKHLU ¿QDO URERW DQG SURMHFW VROXWLRQV DV ZHO

Record important information here:

Tasks

5 [illegible]

6 [illegible] SD[illegible]

7 [illegible]

[illegible]

Share

8 [illegible]

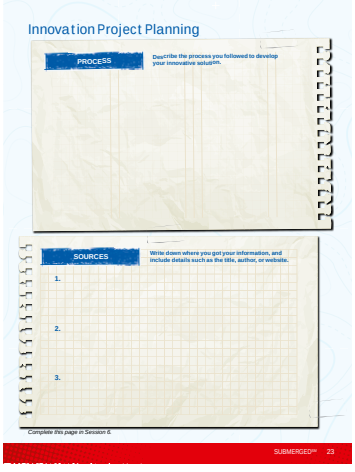
[illegible]

5 Be sure the team collects their sources in a shared location, either online or on paper.

6 Take some extra time with the team if needed to explore all the solution ideas and narrow it down to one.

7 The Innovation Project Planning page can be completed over multiple sessions and helps the team document their process.

8 The team will begin to develop their innovation project solution in the next session.



Session 7 Create Solutions

The team will:

- Begin to create their innovation project solution and complete the Innovation Project Planning page.
- Design and iterate on their robot to complete additional robot game missions.

1. Check the team knows the Core Values and understands what Gracious Professionalism® is.
2. Different members of the team can be responsible IRU VSHFL¿F PLVVLRQV and develop and own the robot run for those missions.
3. When the team has a base robot, they should do a straight drive test. If it doesn't go straight, look at the robot's center of gravity and balance.
4. Have the team determine which launch area will be the starting position and make sure there is enough room for the ZKROH URERW WR ¿W Q V L G H the launch area.
5. Encourage the students to explain their program as the robot moves and make notes about what they observe during testing.

Session 7 Create Solutions

Introduction

1. [ ] RQ W *Gracious Professionalism®*
   - [ ]
   - [ ]
   - [ ] Robot Game Rulebook Z *Gracious Professionalism*
   - [ ]
   - [ ]

Tasks

2. [ ] RQ DWWD RWRRH RQH WDH
3. [ ] RQ W RX W Q
4. [ ] RQ WR R P
5. [ ] WDQ RQ W Q W
   - [ ] U Q Q Q

WRQRQ

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Robot Design:

You could modify the existing robot you've used in past sessions.

By embracing the Core Values, the team learns that friendly competition and mutual gain are not separate goals and that helping one another is the foundation of teamwork.

Project Sketch

Project Description:

6 Arrange a visit to look at examples in your community that can be a focus of the project.

7 A sketch can include a detailed annotated drawing or a computer-aided design (CAD) drawing.

8 Provide a variety of materials for the team to use to make a prototype or model of their project solution.

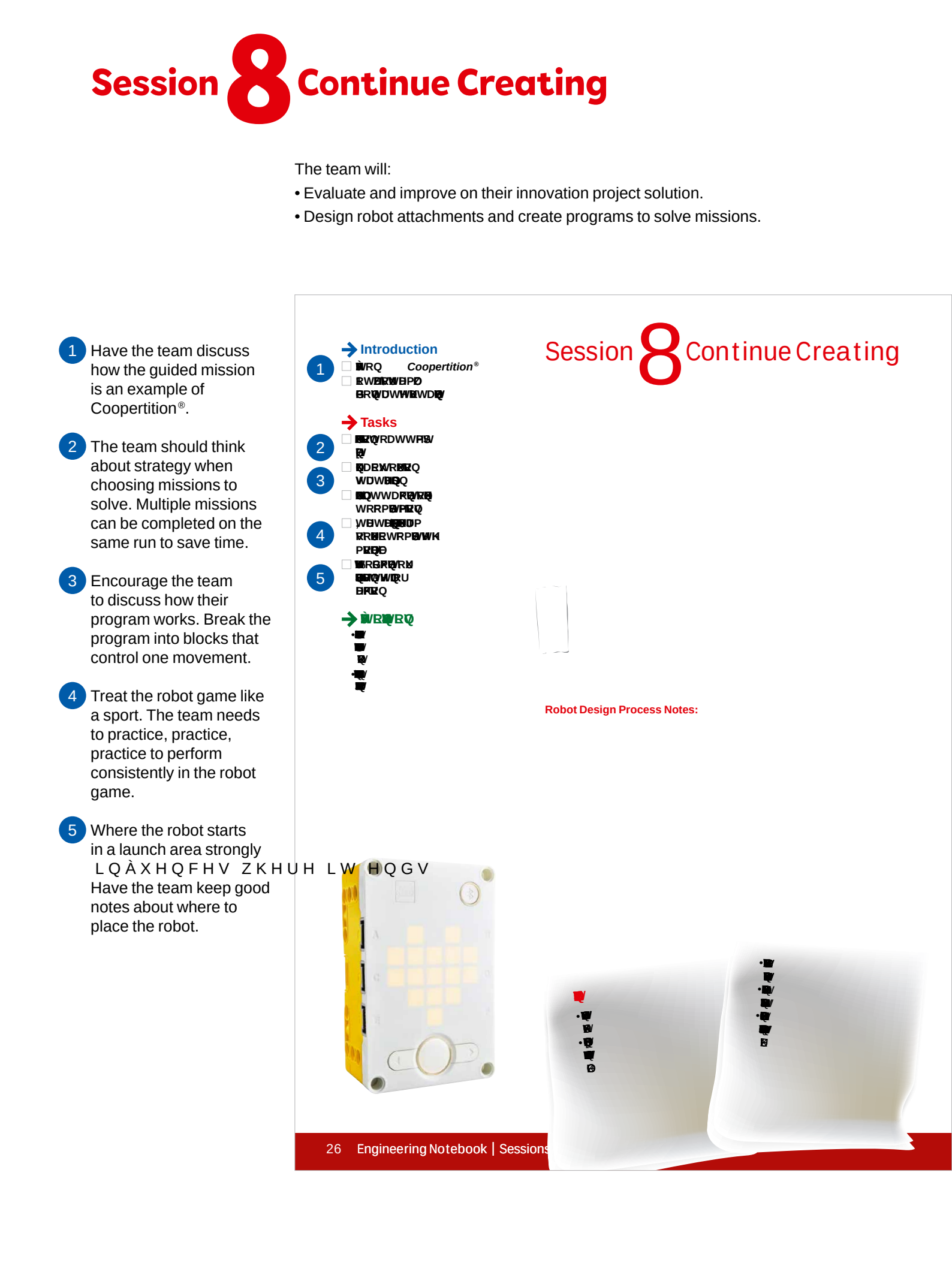
9 Have the team think of people (audience or experts) they would like to get feedback from on their solution.

Session 8 Continue Creating

The team will:

- Evaluate and improve on their innovation project solution.
- Design robot attachments and create programs to solve missions.

1. Have the team discuss how the guided mission is an example of Coopertition®.
2. The team should think about strategy when choosing missions to solve. Multiple missions can be completed on the same run to save time.
3. Encourage the team to discuss how their program works. Break the program into blocks that control one movement.
4. Treat the robot game like a sport. The team needs to practice, practice, practice to perform consistently in the robot game.
5. Where the robot starts in a launch area strongly LQÀXHQFHV ZKHUH LW HQGV Have the team keep good notes about where to place the robot.



Use the Core Values where appropriate to encourage the team. To celebrate the team learning these important values, share examples of when the team demonstrates these principles.

Plan to Share:

Tasks

6

7

Share

9

10

Project Notes:

8

6 The team can create a survey to evaluate their solution or ask for feedback from an expert or user of their chosen problem.

7 The team should iterate and improve their innovation project solution following feedback from others.

8 Consider inviting an expert or user to this session to share content D E R X W W K H L U L G H Q problem.

9 The team should reference the rubrics so they can be prepared for judging at the event.

10 The team should think about who their innovative project solution is for.

Checkpoint 2

- [ ] The team has completed all the robot lessons outlined in Sessions 1-8.
- [ ] The team has selected an innovation project problem, conducted research, and designed a solution.
- [ ] Visit the FIRST® LEGO® League Challenge Season Resource page to print copies of the judging rubrics and any other information that will help prepare for your event.
- [ ] 3 U R Y L G H W K H W H D P Z L W K W K H M X G rubrics.
- [ ] If you are implementing a Class Pack, you can make copies of the Class Pack rubric from the Class Pack Guide.
- [ ] The team could complete the Career Connections exploration activity after Session 9 and the U H À H F W L R Q D F W L Y L W \ D I W H U 6 H V V I are found on pages 34-35 in the Engineering Notebook.

Photocopy page 25 to help the team with their mission strategy.

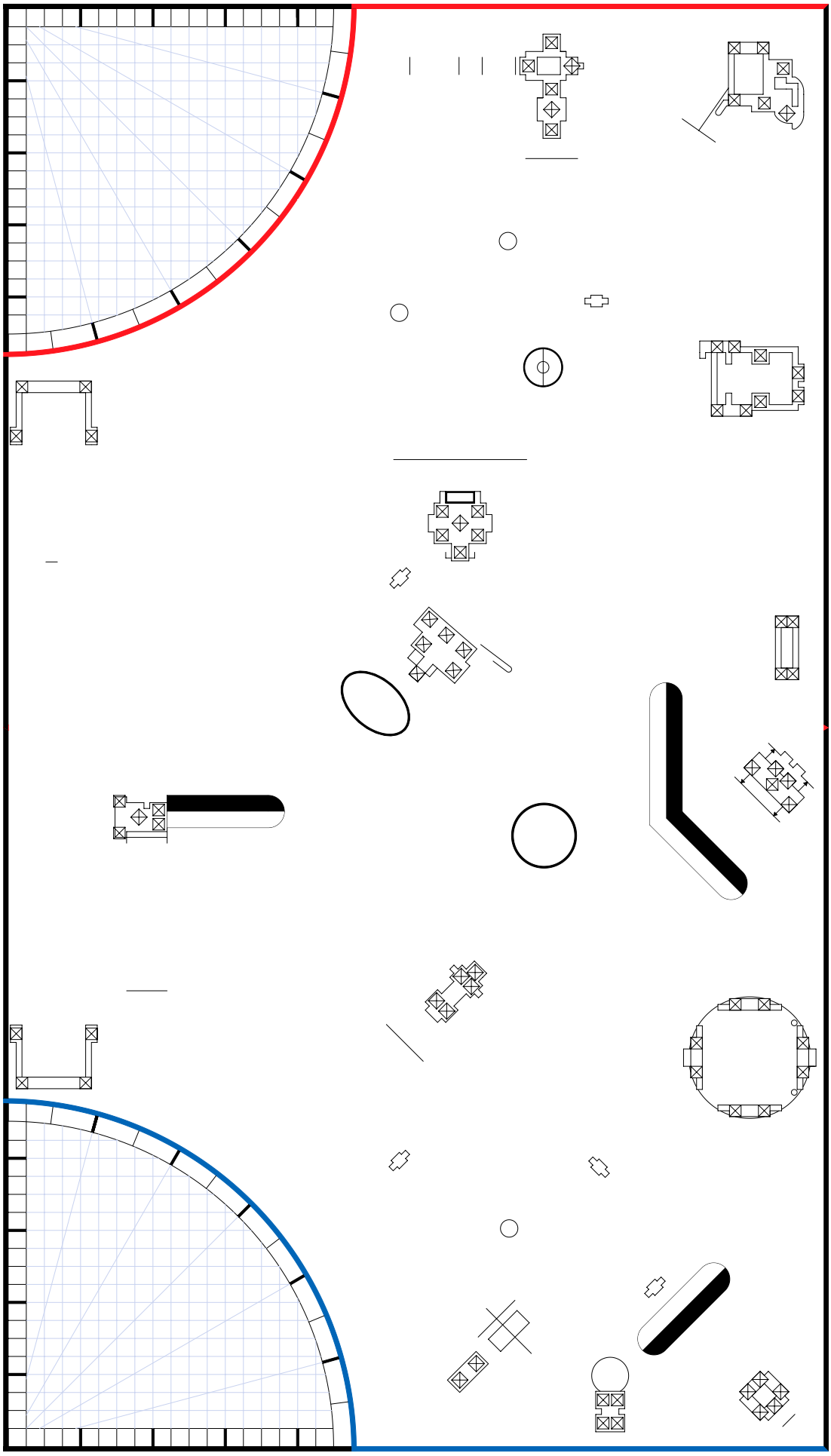
Sessions 9-12 Tips

Make sure the team can provide concrete examples of the Core Values they use. Don't forget Coopertition® and Gracious Professionalism®.

The team should bring their robot, all the LEGO® attachments, and their computer or program printouts to their judging session when they provide their explanation to the judges. Remind the team to explain their mission strategy.

The team will need plenty of time to iterate, improve, and create a model or drawing of their innovation project solution. From Session 9 on, they should focus on progress toward their innovation project solution and presentation.

The team needs a well-practiced and reliable robot run that they know will score them points. If they have time, they can do additional runs to score more points.

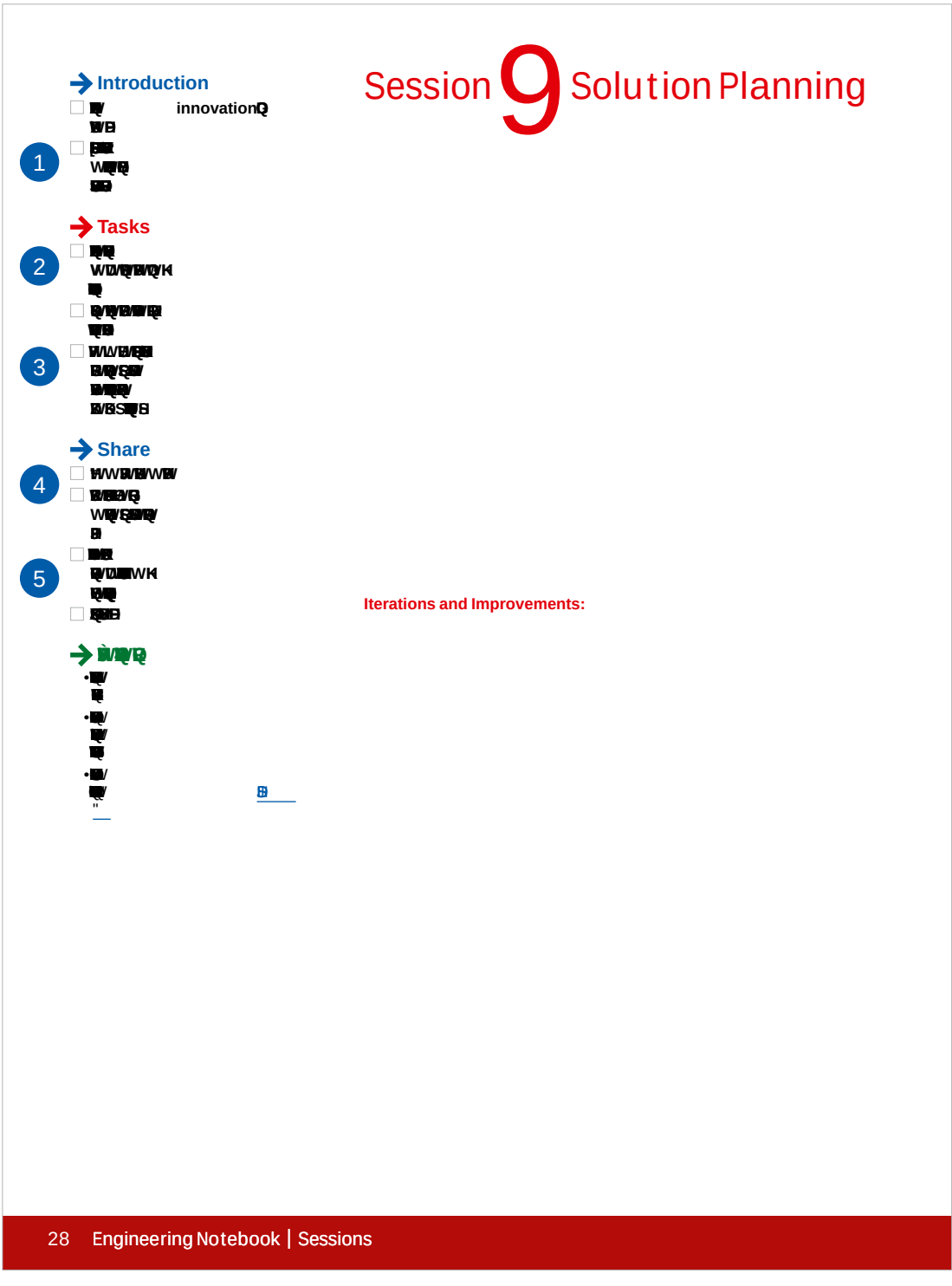


Session 9 Solution Planning

The team will:

- Code their robot and test their mission strategy.
- Iterate and improve their innovation project solution based on testing and feedback.

1. Examples recorded here could be used for the innovation project presentation or robot design explanation.
2. The team should have a clear strategy for which programs to run and in what order during the robot game.
3. The team can also have a backup of their programs on external drive like a USB stick or an online storage website.
4. The Share tasks are important to keep the whole team updated on how the project and the robot are developing.
5. Core Values are evaluated throughout the judging session while teams present on their innovation project and robot design. Review the judging rubrics with the team.



Session 10 Iterate Solutions

The team will:

- Plan and create their innovation project presentation, where they will summarize their work.
- Continue to solve missions for the robot game.

Session 10 Iterate Solutions

Impact: We apply what we learn to improve our world.

Presentation Outline:

Introduction

- [ ] [illegible] impact[illegible] [illegible]
- [ ] [illegible] [illegible]

Tasks

1. [ ] [illegible]
2. [ ] [illegible]
3. [ ] [illegible]
4. [ ] [illegible]

Share

5. [ ] [illegible]
   - [ ] [illegible]
   - [ ] [illegible]
   - [ ] [illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible] GP[illegible]

How will your innovation project solution have an impact [illegible]

1. The presentation can be a slideshow, poster, play, or even a skit. Props can be used, such as costumes, shirts, or hats. Make sure teams have a drawing or model that represents their solution to show to judges.
2. Scripts could be used for the judging session when the team presents their innovation project and robot solutions. Provide copies for each team member.
3. The team might need more space to store all their materials for the presentation.
4. Encourage the team to run their robot within 2.5-minute practice matches so that they get used to the time limit.
5. Provide the team with the innovation project rubric.

Session 11 Presentation Planning

The team will:

- Finalize their live innovation project presentation.
- Finalize their robot for the robot game and prepare their robot design explanation.

1. Have the team review the rubrics to see where judges might expect to hear teams talk about how they've used inclusion.
2. It's important for the team to practice how to communicate their innovation project and robot design solutions.
3. Provide the team with the robot design rubric.
4. Every team member should be involved in the presentation at the judging session.
5. The team should know who will run the robot during the matches.

1
2
3
4
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