



Science Technology Engineering and Mathematics (STEM) Research Project

FOCUS

In the VEX IQ STEM Research Project Challenge, teams will learn more about the fields of Science, Technology, Engineering, and Mathematics (STEM). Each season, one STEM subject will be the featured Project Challenge theme. In this season, the Project Challenge theme is Mathematics (Math). Teams will use this Project Challenge to explore how math can apply to robotics.

MATH

Teams can also use the Robot Game Challenge to discover how math can be applied to robotics. In this season's *Add It Up* Robot Game, teams will use the math concept of the Fibonacci Sequence to add up the points scored in the game.

The Fibonacci Sequence is a series of numbers, in which the next number in the sequence is found by adding up the two numbers before it. For example, when using the sequence of 1, 2, 3, 5, 8..., the first two numbers, 1 and 2, are added to equal the next number of 3. The number 2 is then added to 3 to equal the next number of 5, and so on. Teams can use this STEM Research Project to explore how this math concept, and many others, applies to robotics.

STEPS

Following are suggested steps for teams to follow in this Research Project:

- Identify a topic of interest. Choose one area where math applies to robotics.
- Research the topic. Use reliable sources. Don't forget that talking to experts is a great resource!
- Develop a thesis statement, a 1-sentence summary of the topic findings.
- Organize all of the research information and decide what to share.
- Choose a format to share the team's research findings.
- Share the team's project in the following ways:
 - A creative 3-minute presentation to tournament judges. After the presentation, the judges will have 7 minutes to ask questions and learn more about the team's project.
 - A display at the team's table in the pits (tournament practice area)
 - Presentations to the team's community and beyond!

Example: Teams can explore how bats and marine mammals use high-frequency sounds, equivalent to sonar or radar, to communicate and navigate. What sensors and/or steps are required for a robot to complete similar tasks, and what kind of math is involved? Don't worry; teams don't have to complete all of the math calculations. Teams should explore project ideas, decide on their area of interest, and complete solid research to learn more about their topic. Once teams have developed a summary statement and organized their findings, they will prepare to share their discoveries in a 3-minute presentation format of their choice.

PRESENT

To develop an effective research project and presentation, teams are strongly encouraged to include more than one team member in the process. The team may think of many great ideas, but must choose only **one** topic and **one** presentation format to share with tournament judges. Following are only a few suggestions for presentation formats. Be creative and choose **one** format for the team to share their project discoveries!



Written Formats – Set up and presented by the team in no more than 3 minutes

- Share a copy of 1 to 2 pages of notes written in the VEX IQ Engineering Notebook, which documents how math is applied to robotics in the team’s topic of interest.
- Share a 1 to 2-page letter written to a teacher, which thanks the teacher for showing students how math is important and can be applied to robotics in the topic of interest.
- Share a short newspaper story about how math is used in the community and can be applied to robotics to make a positive difference in the topic of interest.
- Share a short poem about how math applies to robotics in the topic of interest.
- Share a one-page advertisement that encourages other students to take math classes that apply to robotics in the topic of interest.



Media Formats – Set up and presented by the team in no more than 3 minutes

- Create and present a short news broadcast that highlights how math and robotics are used in the team’s topic of interest.
- Create and present a short music video that shows the relationship between robotics and math in the topic of interest.
- Create and present a short teaching segment where students show how math applies to robotics in the topic of interest.
- Create and present a website that demonstrates the significance of math and robotics in the topic of interest.
- Create and present a short video or PowerPoint presentation on how math can be applied to robotics in the topic of interest.

TIP: It is best to choose a simple, less technical format, as the presentation time cannot be rescheduled or extended if technical difficulties occur. If equipment is required to deliver the presentation, it must be provided and set up by the students, within the time allotted.



An excellent project, which receives “Expert” ratings in the Research Project Rubric, requires the team to:

- Identify a topic of interest, in which math applies to robotics.
- Complete research on this topic, which uses reliable sources and is well organized
- Share their research findings in a creative and effective presentation.
- Demonstrate a good understanding of the topic and their research findings.

Review the STEM Research Project Rubric for more details.

STEM Research Project Rubric

- Identify a topic of interest, in which math applies to robotics.
- Complete research on this topic, which uses reliable sources and is well organized.
- Share their research findings in a creative and effective presentation.
- Demonstrate a good understanding of the topic and their research findings.

Team Name: _____ Team Number: _____

Topic:	Expert	Proficient	Emerging	Novice
Identifies the topic of interest	<i>Topic clearly identified with a strong math connection</i>	<i>Topic clearly identified with a math connection</i>	<i>Topic identified with some math connection</i>	<i>Topic not clearly identified, and/or limited math connection</i>
Describe how math applies to robotics in the topic of interest	<i>Clear description of how math applies to robotics in topic of interest, with enhanced depth</i>	<i>Clear description of how math applies to robotics in topic of interest</i>	<i>Some description of how math applies to robotics in topic of interest</i>	<i>Limited description of how math applies to robotics in topic of interest</i>
Research from reliable sources	<i>Research from reliable sources with enhanced depth and quality</i>	<i>Majority of research is from reliable sources, with some depth</i>	<i>Research contains some reliable sources</i>	<i>Limited research presented, and/or contains limited reliable sources</i>
Research demonstrates well organized thought process	<i>Research demonstrates highly organized processes and thorough documentation</i>	<i>Research demonstrates well-organized thought process with clear documentation</i>	<i>Research demonstrates some organization and/or some documentation</i>	<i>Research demonstrates limited organization and/or documentation</i>
Effective, creative presentation of findings	<i>Presentation maximizes clarity, creativity, and effectiveness in sharing findings and includes all objectives</i>	<i>Presentation effectively shares findings in a creative format that includes most of listed objectives</i>	<i>Presentation contained some effective elements and attempts to include some listed objectives</i>	<i>Findings not presented, or limited effectiveness with no listed objectives included</i>
Student understanding is present	<i>Students able to answer all questions with enhanced depth of understanding</i>	<i>Students able to answer majority of questions with some depth of understanding</i>	<i>Students able to answer most questions with some understanding</i>	<i>Students able to answer a few questions with limited understanding</i>

Comments to support team growth in knowledge and skills:
