

A Common Core and STEM Curriculum Guide to

***Astrotwins—Project Rescue***

By Mark Kelly

With Martha Freeman

**About the Book**

Mark and Scott Kelly, who are mostly known for getting in trouble, are finally back from their first space adventure. The twins have wanted to explore space ever since they were little and watched Neil Armstrong walk on the moon. And when they hear that a Russian cosmonaut is trapped inside the Salyut space station now orbiting 220 miles above the surface of the Earth, they wish they could find a way to help.

While staying in the countryside at their grandfather’s house with their friend Jenny (aka Egg), the twins repurpose a NASA Titan 2 rocket ship being stored nearby. Complete with spacesuits and snacks, the twins take off to rescue the Russian spacecraft. Will they ever see their family or their grandfather’s backyard again? Written by astronaut Mark Kelly, *Astrotwins – Project Rescue* brings the world of an astronaut to life in an exciting adventure tale.

**Prereading Questions**

1. What is the value of helping someone in need? Is there anything in it for you? How far would you go to help someone—even if it meant your life could be in danger?
2. What kind of skills might you need to plan a launch into space for a rescue mission?

**Discussion Questions**

The following questions may be used with *Project Rescue* as writing prompts or used to introduce class discussion and reflection. The questions contained in this section particularly address the Common Core State Standards:

(RI. 3.1, 2, 3) (RI. 4–5.1, 2, 3, 8, 10) (RI.6–7.1, 2, 3, 5, 6, 8) (RL.3.1, 3, 5, 6, 9) (RL.4.1, 2, 3, 7) (RL.5.1, 2, 3, 6) (RL.6.1, 2, 3, 5, 6) (RL.7.1, 2, 3, 6)

1. What is the relationship between Mark and Scott? Give examples from the book as evidence of how they interact.
2. Mark didn’t get to go on the first launch. Why would he have an advantage for being one of the astronauts this time?
3. Whom among the group of friends do you think should be the new astronauts?
4. What triggered Mark and Scott’s interest in current events? Why did they want to continue to learn about events in the world?

5. Mark and Scott were angry they hadn't been told about the plans NASA had for Greenwood Lake. Why were they angry? How would you feel if you were left out of plans with a friend? Has that ever happened to you? How did you feel?
6. What advantages did the kids have when dividing up jobs for the new launch?
7. How does the time period in which the book takes place play a part in the story line? Support your answers with evidence from the book.
8. Is the setting an important part of the success of the mission? Explain why or why not.
9. Trace the changes evident in Mark and Scott as they plan and execute the rescue mission.
10. How did working together as a team benefit the launch? Would it have been possible if only two of them worked on it? What's the benefit of a team? In what instances is it better to work with others as a team than it is to work alone?
11. Discuss some of the information you learned in the novel about outer space and how to survive.
12. Explain why it was important to have the exact times and schedule figured for Mark and Scott's launch. What was the purpose of the multiple checklists the astronauts had to perform? Is there value in being organized? Explain your thoughts.
13. Talk about the strength and weaknesses of three of the main characters.
14. Why did the kids call their mission "Project Rescue"? Why was it important to rescue the Russian cosmonaut?
15. What consequences could happen in zero gravity? Why are those consequences important to consider? What are some of the problems for humans in zero gravity and how do the astronauts deal with it?
16. What part of the mission do you consider the most dangerous? Support your answer from evidence in the book.
17. Do you believe Mark and Scott will become astronauts when they grow up? If you don't think so, what job do you think they'd have instead?
18. Why were the twins worried about Barry being in the USSR? Discuss the political situation and the dangers he might face while in the Soviet Union.
19. What were some of the concerns of the twins as they approached the Salyut?

20. How did Scott feel about his brother's walk in space? What did he say and what did he promise? What was Mark's response?
21. Review the Author's Note in the back matter. Discuss the parts of the book that are real and the parts that are definitely fiction. How do you think Mark Kelly's life influenced this story? Explain your answers.
22. Compare the theme, setting, and plot of Kelly's story *Project Blastoff* with *Project Rescue*.
23. Describe how this story might be different if it had been told from another character's point of view? What other character could you visualize telling the story?
24. Review Chapter 13. How does it contribute to the plot's development?
25. What was Mark Kelly's point of view in writing the book, and how does his expertise help make the book real?

### **Writing**

The writing prompts contained in this section particularly address the following Common Core State Standards: (RL.4–7.2) (W.3–7.1, 2, 3, 4, 7) (W.6.9)

1. Write a descriptive passage about Mark and how he felt as the twins entered orbit and zero gravity. Include a conclusion.
2. Write a summary of the story and discuss the main idea and theme of the book.
3. Write a personal essay in the voice of one of the characters describing how they felt about the cosmonaut being stranded with no hope of rescue.
4. Write a letter to your senator asking for the US and NASA to intervene and rescue the cosmonaut.
5. Write a passage as if you were an astronaut. Describe a liftoff and what space looks like from the view in a spacecraft.
6. Write to explain how you personally feel about the space program and the role of astronauts.

### **Setting**

The activities contained in this section particularly address the following Common Core State Standards: (RI.3–4.1, 9) (RI.5.1,3, 9) (RI.6.1, 6, 9) (RI.7.1, 3, 9) (RL.4.3) (RL.5.3) (RL.7.3)

1. Find examples from the book that show the events taking place during that time period.
2. Compare and contrast Grandpa Joe's home and location to that of the Kellys' home and explore how the setting helped the group of friends launch the twins into space.

3. Describe outer space based on the information the twins see on their flight.
4. Compare and contrast Mark and Scott's spacecraft with that of the Russian cosmonaut.
5. Read a nonfiction book about space and space travel, such as *Moonshot* by Brian Floca. Compare and contrast the two accounts of space.

### **Characters**

The questions contained in this section particularly address the following Common Core State Standards: (RI.3–4.1) (RI.5–7.1, 3) (RL.3–7.1, 3)

1. Describe the personalities of Scott and Mark. Use examples from the book to support your description.
2. What kind of person is Jenny (or Egg)? Find three scenes from the book that show her personality and explain what she's like.
3. How did Mark develop his dislike of communists and what influence did it have on him? Explain.
4. What role did Tommy play in the rescue of the cosmonaut? Why was he important to the mission?
5. Compare and contrast two of the characters from the book. What qualities did they have that made them able to work together on the rescue project?
6. Choose an event that changed or affected one of the characters. Explain how it made a difference.
7. Which character in the book would likely be your friend? Explain your choice.

### **Plot**

The questions contained in this section particularly address the following Common Core State Standards: (RL.3.1, 9) (RL.4.1, 2, 9) (RL.5.1, 2) (RL.6.1, 2, 3) (RL.7.1, 2, 3) (RI.3.1, 3) (RI.4–5.1, 2, 5) (RI.6–7.1, 2, 5, 6)

1. Identify five main points in the story's plot. Discuss why you chose those five and how they moved the story forward.
2. What is the main conflict in the story?
3. In what kind of order is the story presented? How does this order contribute to understanding the story?
4. Do you think it was unfair of NASA not to try to rescue the cosmonaut? How did this make the story move along? Have you had something unfair happen to you? How did you deal with it?

5. Read the NASA site about spacewalking: <http://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-a-spacewalk-k4.html>. Compare and contrast Mark's spacewalk with NASA's explanation.
6. Identify the theme of the book, and explain how different parts of the plot contributed to the overall theme.
7. In what way did the help of John Glenn add to the plot and success of the mission?
8. Did the ending of the book provide a satisfactory resolution? Why or why not?

### **Point of View and Structure**

The questions contained in this section particularly address the following Common Core State Standards: (RL.3–4.6) (RL.5–6.5, 6) (RL.7.3, 5)

1. How was the story structured? How did that particular structure work to develop the story?
2. What point of view was used in the story? Choose one scene and rewrite it in first person.
3. What evidence in the first chapter led you to think a major plot point would occur later in the story? Provide examples to support your answer.

### **Vocabulary**

The questions contained in this section particularly address the following Common Core State Standards: (RL.3–7.4) (RI.3–7.4)

1. Find a vocabulary word you are not familiar with. Using context clues, write a definition. Then look up the word in the glossary of the book or a science dictionary. Explain how close you came to defining the word correctly.
2. Use the glossary in the back of the book to select three to five words. Look up the words and learn more about the object or principle and the science behind them. Write to explain the selected words and give an example of how it applies or is used in the book.
3. Find two examples of figurative language and explain their meaning.
4. Locate two to three words in the book that you don't know. Rewrite the sentences containing the chosen words with their appropriate page numbers. Look up the chosen words in the dictionary and explain their meaning. Did it help you understand the meaning? Write your own original sentences using your chosen words.

### **Science, Technology, Engineering, and Mathematics (STEM)**

(Next Generation Science Standards:

(**Grade 3** ESS1.B: Earth and the Solar System, ESS3.C: Human Impacts on Earth Systems, PS2.A: Forces and Motion, PS2.B: Types of Interactions)

(**Grade 4** PS3.A: Definitions of Energy, PS3.B: Conservation of Energy and Energy Transfer, PS3.C: Relationship Between Energy and Forces, ETS1.A: Defining Engineering Problems, PS4.C: Information Technologies and Instrumentation, ESS3.A: Natural Resources, )

(**Grade 5** PS1.B: Chemical Reactions, PS2.B: Types of Interactions, ESS1.B: Earth and the Solar System, ESS3.C: Human Impacts on Earth Systems, ) ETS1.A: Defining and Delimiting Engineering Problems, ETS1.B: Developing Possible Solutions)

(**Middle School** PS1.B: Chemical Reactions, PS3.A: Definitions of Energy, ETS1.B: Developing Possible Solutions, PS2.A: Forces and Motion, PS2.B: Types of Interactions, PS3.A: Definitions of Energy, PS3.B: Conservation of Energy and Energy Transfer, PS3.C: Relationship Between Energy and Forces, ETS1.A: Defining and Delimiting an Engineering Problem, PS4.C: Information Technologies and Instrumentation, ESS1.A: The Universe and Its Stars, ESS1.B: Earth and the Solar System, ETS1.B: Developing Possible Solutions)

### **Common Core State Standards**

CCSS.MATH.CONTENT.4.MD.C.5.A, CCSS.MATH.CONTENT.4.MD.C.5.B,  
CCSS.MATH.CONTENT.4.G.A.1, CCSS.MATH.CONTENT.5.G.B.3,  
CCSS.MATH.CONTENT.7.G.A.2)  
(RST.6-8.1) (RST.6-8.8)

### **Science**

1. Read a description of an actual astronaut's spacewalk. Compare and contrast the real spacewalk with Mark's spacewalk. Use the following link from NASA's website as reference: [https://www.nasa.gov/multimedia/imagegallery/image\\_feature\\_1098.html](https://www.nasa.gov/multimedia/imagegallery/image_feature_1098.html)
2. Describe Newton's Three Laws of Motion. How did they apply in the story, and which ones were used?
3. What equipment helped keep the astronauts safe during the flight and spacewalk? Describe them and tell how each piece contributes to the overall safety of the astronauts.
4. Discuss the effects of zero gravity on the body as described in the story.
5. Why is it necessary to use stages of a rocket that drop away, and how does that work?
6. Explain the problem Russian cosmonaut Ilya Ilyushin faced and the consequences if he wasn't rescued.

### **Technology**

1. What technology tools were used to prepare and carry out the launch and mission?

2. How did Barry communicate with Mission Control and the spacecraft? Explain the procedure and what it was called.
3. Discuss the design and parts of the suit Mark wore on the space walk and how it addressed his needs.
4. In the novel, Mark states that the Russians are going to patch Howard through to their Mission Control Center. Look up the definition here: <http://www.macmillandictionary.com/us/dictionary/american/patch-through>. Explain why Howard had to be patched through.
5. Identify and summarize the different technologies the kids used to send the twins into space.

### **Engineering**

1. Engineering is based on repeating and testing the process until the best design possible emerges. What flaw did the group have in their engineering of the spacecraft? Is it possible to succeed in an engineering mission on the first attempt? How is this different from the usual engineering process?
2. What did the group have to do to launch the rocket, and why?
3. What parts and activities contributed to the mission's success? Give examples.
4. How did the kids address specific issues relating to the mission? How was engineering important to their problems and solutions?

### **Mathematics**

1. Give a definition of *trigonometry*. Explain how this branch of mathematics helped during the space mission rescue.
2. Explain *sine*, *cosine*, and *tangent* as they relate to trigonometry.
3. In the novel, Barry explains the Pythagorean theorem to Scott and Mark. Use your own words to explain the theorem and the different mathematical words in it.
4. Find the definition of square roots here or on a similar site. <http://www.math.com/school/subject1/lessons/S1U1L9DP.html>. Compare the definition to Barry's explanation in the novel. List some examples of square roots.
5. How is space navigation determined using stars as explained in the book? In your own words, explain the relationship between navigation and trigonometry.

6. Describe and define an angle. Look up right angles, obtuse angles, and acute angles and draw an example of each.

### **Extension Activities**

The activities contained in this section particularly address the following Common Core State Standards: (RL.3–7.1) (RL.4–6.7) (RL.6–7.9) (RI.3–7.3) (RI.4.7, 9) (RI.5.5, 9) (RI.6–7.7) (W.3–7.1, 2, 3) (MATH.CONTENT.4.MD.C.5, 4.G.A.2)

1. Draw a model of Mission Control and label the different parts using the description from the book.
2. Create a timeline of the days and events leading up to the launch and the mission to rescue the cosmonaut.
3. Research Pythagoras and the time in which he lived. Describe your findings and his contribution by making a presentation.
4. Give your opinion about space and space flight in an essay. Support your arguments.
5. Identify three examples about history from the book's setting. What events can you find that show historical information? Discuss by writing about those events in relation to the twins' world.
6. Write a poem that reflects the feelings and emotions expressed by either Scott or Mark as they travel through space.
7. Write a three-act play based on three important scenes from the book. Break into groups and present the play to your classmates.
8. In your library, look at all the books classified in the Engineering section. Choose three-to-five books and browse them. Read one of them and locate anything in the book that relates to *Project Rescue*. Describe those actions or events that are similar.
9. Look up John Glenn and his contributions to space. Make a list of questions you might ask if you were to interview him.
10. Read about microgravity at <http://www.nasa.gov/centers/glenn/shuttlestation/station/microgex.html>. Then explain microgravity in your own words, and discuss how it was portrayed in the novel.
11. Read about G-forces here: <https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/Acceleration.pdf>. What level of G-forces or G-loads did Mark and Scott experience and under what circumstances? Summarize your explanation and the times when the twins experienced the forces.



12. Read about John Glenn's Friendship 7 flight here: <http://www.nasa.gov/content/astronaut-john-h-glenn-jr-with-mercury-friendship-7-spacecraft>. Make a chart to show his velocity, apogee, and time in space. On the chart, compare his numbers to the statistics of the twins' flight during their rescue mission.

13. The spacecraft used solar panels for energy. Explore solar energy by reading about it here: <http://www.alliantenergykids.com/energyandtheenvironment/renewableenergy/022400>

Then build a simple solar oven like this one:

[http://www.alliantenergykids.com/wcm/groups/wcm\\_internet/@int/@aekids/documents/document/mdaw/mdi/~edisp/022819.pdf](http://www.alliantenergykids.com/wcm/groups/wcm_internet/@int/@aekids/documents/document/mdaw/mdi/~edisp/022819.pdf). Practice safety and do the activity with adult supervision.

14. Explore how a sextant works by reading about navigating with one: <http://www.pbs.org/wgbh/nova/shackleton/navigate/escapeworks.html>

15. Write interview questions for Mark and Scott. Then also write the answers that you think Mark and Scott might give.

16. Reenact the first meeting between Mark and Major Ilyushin. Then present this scene as a skit to the class.

17. Write an explanation about why the Russian spaceship exploded.

18. Draw and label three triangles. Make one have a right angle, one have an acute angle, and the third have an obtuse angle.

19. Read the author's note. Then watch a video of Mark and Scott Kelly's mission for the International Space Station: <https://www.youtube.com/watch?v=Bo2igadkAHU>. Discuss the value of a study like this relating to space flight.

*Guide written by Shirley Duke, a children's freelance writer.*

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