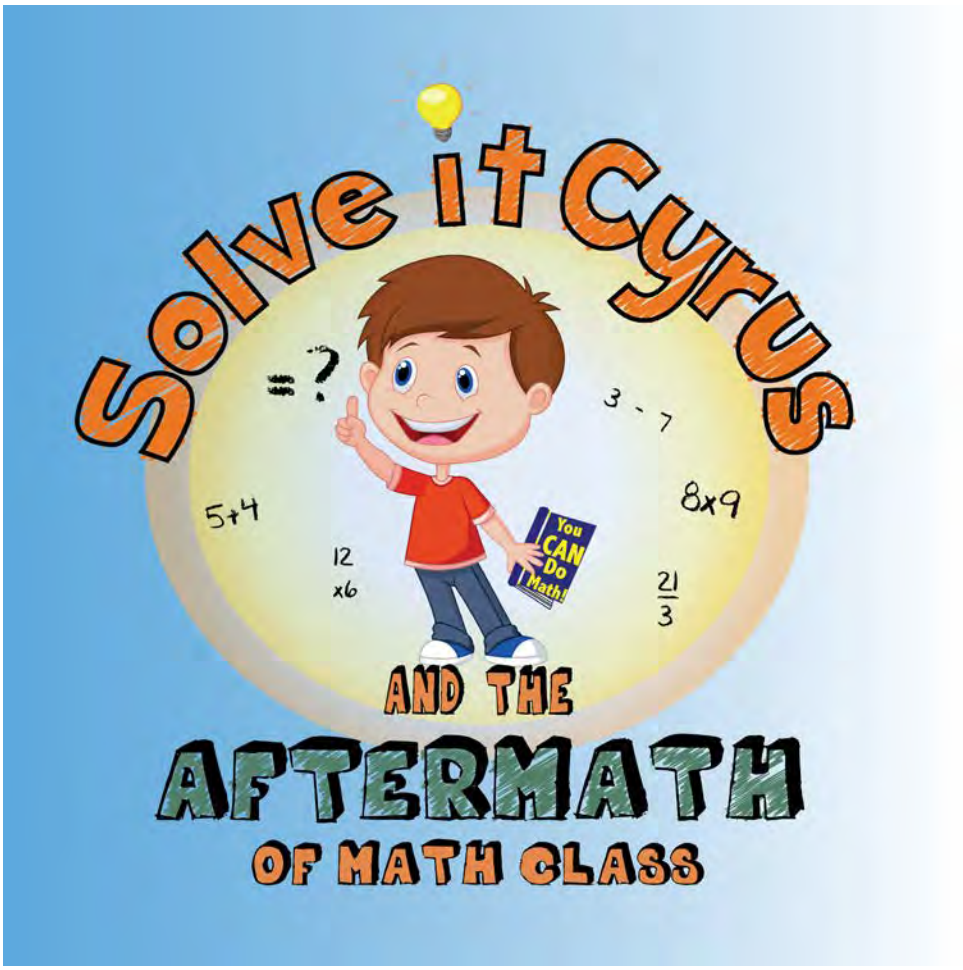


starswithinReach

LESSONS TO TEACH

A fun collection of classroom activities to connect you to Stars Within Reach Production's all-new, math musical "Solve It Cyrus And the Aftermath of Math Class!"

What's Inside!

STARS WITHIN REACH PRODUCTIONS, INC.
48-20 44th Street
Suite 1A
Woodside, NY 11377

718-606-2554

The name's "Cyrus", "Solve it, Cyrus".
Welcome to my awesome study guide!
Have you ever had a problem too big to resolve, a puzzle too tough to crack? Well, Cy's your guy and I'm here to help! I'm going to let you in on something top secret: my problem-solving plan! Want to know the best part about it? It is for more than just numbers on a chalkboard...because math is all around us! Let's talk it through!

Solve It Cy's Top Secret Problem Solving Plan

1. Understand the Problem.
2. Sort out Relevant from Irrelevant Information.
3. Make a Plan.
4. ACTION!
5. Retrace your steps.
6. Explanation with Justification.

PROBLEM SOLVED

1. What's *really* going on? This is where I gather up all the information I can get my hands on! You never know where the facts may lead.

2. What information is important to the case…what will we need to use?

3. When making a plan, it is important to have a wide variety of tools at your disposal. Practice makes perfect!

4. This one is my favorite! It's time to carry out your plan, to set it in action! And don't forget…SHOW YOUR WORK!

5. Look back and see if your answer is reasonable and answers the original question. You've found the answer! But it is it the right answer? Ask yourself: did I answer the original question?

6. It's time to explain why, and how you got your answer! This step is very important when dealing with clients (or teachers!). They haven't experienced steps 1 through 5 with you. So, step 6 brings them up to speed!

Apply The Problem Solving Plan!

Cyrus and Jessie gathered clues and organized them equally on pages in their notebook. Cyrus had a blue notebook and Jessie's was Orange. Cyrus had 8 clues on 4 pages and Jessie had 6 clues on 2 pages. How many clues did they collect together?

Show your work

Make a model

Explain your answer

Write your own problem to solve with the following equation!

7 x 7 = 49

My Problem

Make a model

Explain your answer

Time to Be a Detective!

Solve the following problems to unlock a secret code so you can answer the riddle!
Your answers will tell you what letters to fill in at the end!

A 14 -11 =	**B** 5 +9 =	**C** 4 ÷4 =	**D** 8 x 12 =	**E** 22 -10 =	**F** 7 +3 =
G 36 ÷4 =	**H** 7 x 9 =	**I** 11 -6 =	**J** 17 +9 =	**K** 60 ÷10 =	**L** 4 x 7 =
M 14 -7 =	**N** 12 +10 =	**O** 30 ÷5 =	**P** 8 x 4 =	**Q** 18 -7 =	**R** 22 +56 =
S 24 ÷6 =	**T** 10 x 2 =	**U** 19 -6 =	**V** 13 + 31 =	**W** 72 ÷9 =	**X** 5 x 5 =
Y 56 -37 =	**Z** 15 +70 =				

Why did the duck become a spy?

63	12		8	3	4		9	6	6	96		3	20

11	13	3	1	6	5	22	9		1	6	96	12	4

INCORPORATING STEM

In "Solve It Cyrus and the Aftermath of Math Class," Cyrus is the guy to call whenever there's a problem that needs solving, but he finally appears to meet his match: math class.

When he viewed math as numbers and equations, Cyrus became overwhelmed, confused, and intimidated. With a little help from his friend and tutor, Margaret, Cyrus begins to see math problems as real life scenarios; a new case to be solved!

Cyrus, like so many of us, didn't realize that math is far more than just numbers on a chalkboard. Math is all around us. We use it everyday!

With the help of his teachers and friends, Cyrus realizes that his issues in math class weren't due to the principles of math, as he had been using those every time he used his top-secret "Problem Solving Plan" to help crack a case.

Mr. Adams helps teach Cyrus that what he learns in math class can be applied in all of his other studies, because they're all connected! Whether it be Science, Technology, Engineering, or Math!

MARSHMALLOW CATAPULT

Make those catapults fly, soldiers!

That's our science teacher. He always picks a theme for our lessons. This week we're learning about potential and kinetic energy, so you can call him Sergeant Science! Well, sir yes sir! We will do our best! Let's go! Time to make some marshmallows fly!

IN THIS ACTIVITY:

Students will work in groups to create a catapult from popsicle sticks. They will modify their catapult in order to produce the best launch possible. Kids will have a great time launching mini marshmallows across the room while learning about potential and kinetic energy.

MATERIALS LIST: MARSHMALLOW CATAPULT

Materials listed below are per group (3-4 students)

10 Popsicle sticks (jumbo size is best)
3 or 4 rubber bands
1 pop bottle top
mini-marshmallows
hot glue gun with glue (1 per class ... only the teacher applies this when the students request it)
Masking tape (for team names / distance marker)
Student Instructions Sheet

Optional:
1 Ping Pong Ball
Markers (for coloring the catapult)

TEACHER INSTRUCTIONS: MARSHMALLOW CATAPULT

Set out the materials (per station):

10 Popsicle sticks (jumbo size is best)
3 or 4 rubber bands
1 pop bottle top
mini-marshmallow
hot glue gun with glue (1 per class ... only the teacher applies this when the students request it)
Masking tape (for team names / distance marker)
Student Instructions Sheet

Optional:
1 Ping Pong Ball
Markers (for coloring the catapult)

You will need to split your students into groups or stations.

Introduction:
You can begin discussion by asking students what a catapult is and how maybe they've been used in the past. (You may go into a mini history lesson here if you want:)

Say that today we will be having a competition. We will be building catapults and trying to see which group can get their marshmallow to go the furthest. (You may also want to point out that special recognition will be made for the most artistic catapult too).

Tell the students that this challenge will test their group's ability to work together in building a catapult that will launch the marshmallow as far as possible before touching the ground. Tell the students to put their names on a piece of masking tape to mark their best distance on the ground.

Direct students to follow their student instructions sheet. As students are working, wander the classroom and ask questions about why they are doing what they are doing. If students ask questions to you the teacher, encourage them or their group to answer.

Research Activity (optional)
The research activity asks the students to research the furthest launch on a TV show called "punkin chunkin". If you ask them to do this, they will find it flew several thousand feet!!! They might even want to share what that catapult looks like and how it did so well!

STEM ACTIVITY: MARSHMALLOW CATAPULT

NAME(S):

Challenge:
Can you create a catapult that will launch a mini-marshmallow? Can you launch your marshmallow further than other groups? Your challenge is to create a catapult from popsicle sticks and rubber bands that will give your group the best launch possible.

Construction:
1. Take 2 popsicles sticks and lay them on top of each other.
2. On one end attach a rubber band (you may need to twist it over on itself several times).
3. Take 3 popsicle sticks and lay them on top of each other.
4. Twist a rubber band around each end (one rubber band around each end)
5. Slide these 3 sticks into the 2 stick set.
6. Choose where you would like your cap and hot glue it on (leave a little popsicle stick to pull down on).

Make predictions:
You now have a basic catapult. You will be making modifications to it to improve your launching ability. After making changes, you will test them and evaluate if they helped.

1. Do you think the catapult arm is a good length right now, or should you attach another stick and make it longer? Why?

2. Do you think the 3-popsicle-stick wedge is a good sized wedge, or do think it should have more, or less sticks? Why?

STEM ACTIVITY: MARSHMALLOW CATAPULT (PG. 2)

Practice time:
Start launching some mini-marshmallows and make some changes to your catapult. Remember, only change one variable at a time. When you find something that works, keep it. If you find something that hurts, get rid of it.

3. Based on your practice launches, what changes / modifications did you choose for your catapult?

Let the competition begin!

4. How did your catapult do? Approximately how far did your marshmallow go? If you could change something or perform more trials, what would you change about your catapult and why?

Further research:
There is a TV show called "Punkin Chunkin". The whole point of the show is to launch a pumpkin as far as possible. With your parent permission, search the internet to find the record for the farthest a pumpkin has been launched with a catapult. Note: There are different devices that will launch a pumpkin (like an air cannon) this research question is only about the catapult category!

GRADING RUBRIC

NAME:	GRADE:
PROJECT: MARSHMALLOW CATAPULT	

CATEGORY	4	3	2	1
Problem-solving	Actively looks for and suggests solutions to problems.	Refines solutions suggested by others.	Does not suggest or refine solutions, but is willing to try out solutions suggested by others.	Does not try to solve problems or help others solve problems. Lets others do the work.
Contributions	Routinely provides useful ideas when participating in the group and in classroom discussion. A definite leader who contributes a lot of effort.	Usually provides useful ideas when participating in the group and in classroom discussion. A strong group member	Sometimes provides useful ideas when participating in the group and in classroom discussion. A satisfactory group member who does what is required.	Rarely provides useful ideas when participating in the group and in classroom discussion. May refuse to participate.
Attitude	Never is publicly critical of the project or the work of others. Always has a positive attitude about the task(s).	Rarely is publicly critical of the project or the work of others. Often has a positive attitude about the task(s).	Occasionally is publicly critical of the project or the work of other members of the group. Usually has a positive attitude about the task(s).	Often is publicly critical of the project or the work of other members of the group. Often has a negative attitude about the task(s).
Focus on the task	Consistently stays focused on the task and what needs to be done. Very self-directed.	Focuses on the task and what needs to be done most of the time. Other group members can count on this person.	Focuses on the task and what needs to be done some of the time. Other group members must sometimes nag, prod, and remind to keep this person on-task.	Rarely focuses on the task and what needs to be done. Lets others do the work.
Working with Others	Almost always listens to, shares with, and supports the efforts of others. Tries to keep people working well together.	Usually listens to, shares, with, and supports the efforts of others. Does not cause "waves" in the group.	Often listens to, shares with, and supports the efforts of others, but sometimes is not a good team member.	Rarely listens to, shares with, and supports the efforts of others. Often is not a good team player.

PARACHUTE TIME!

Great job on those catapults, soldiers!
Now it's time for a new challenge!
Jack and the parachute. Let's see how you do.
Get creative! I believe in you!
Believe in yourself!

The parachute challenge is my favorite!
The goal is to find the most air resistance.
In other words, the longer your parachute stays in the air, the better! Go get 'em!

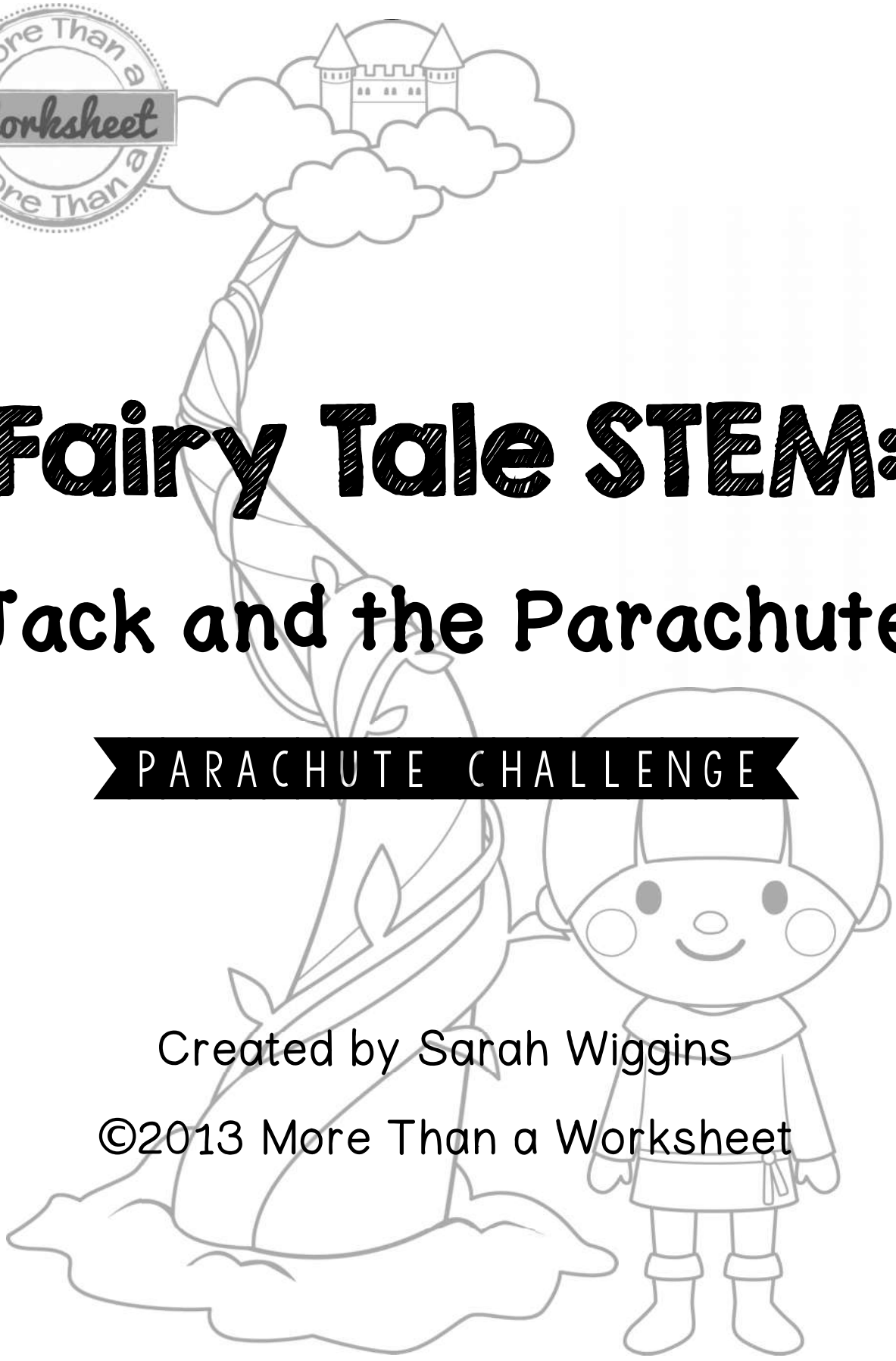
IN THIS ACTIVITY:

After a discussion about what a parachute is and how it works, students create parachutes using different materials that they think will work best. They test their designs, and then contribute to a class discussion to report which materials worked best.

Fairy Tale STEM:

Jack and the Parachute

PARACHUTE CHALLENGE



Created by Sarah Wiggins

Jack and the Parachute

Teacher Guide {page 1}

Materials Needed:

- small action figure or object to represent Jack
- variety of building materials (tissue paper, newspaper, plastic grocery bags, canvas, coffee filters, pipe cleaners, string, dental floss, rubber bands, etc..)
- timer

Note about Materials:

-A Lego guy works great since it is so small and lightweight. You could also use any small object and a little imagination.

-For the building materials, use whatever you have. You could also have students bring in materials. Part of the challenge is creating a working parachute with the materials available.

Notes About Time: I know that sometimes it is hard to fit STEM projects into your schedule. Do not feel like you have to spend several class periods on a project. You can complete most of the STEM challenges in my store in a single class period. This one may take a little longer, and you could break it up into two days. The first time you do STEM, it may take a little longer as students are getting used to your expectations. As you do more and more, you will be able to set tighter time limits. Anyone can build a successful parachute if they have all day to do it! With STEM engineering challenges, encourage students to work within time limits. This is an important life lesson: Sometimes you just have to make the best decision with the information you have and then tweak it if possible.

Here is a timeline that I used with third and fourth graders. I would stick roughly in these time frames. One thing that I did to save time was that I would allow students to test as they were ready, rather than having everyone test at the same time and watch others.

Suggested Time Frame:

5 minutes to explain
15 minutes to build first parachute
20 minutes to test first parachute
15 minutes to build second parachute (Day 2)
20 minutes to to test second parachute
10 minutes to discuss and reflect

Grouping Tips:

Projects like these make great team-building activities. I typically assigned students to random groups that would change with each new project. Try to keep groups to 2-3 students. When there are more than three in a group, I find that some students take the lead and others participate less. When I keep the groups small, everyone must participate in order to complete the task.

Jack and the Parachute Teacher Guide {page 2}

Introducing the Challenge:
This a great challenge to do after reading a version of Jack and the Beanstalk. If you haven't read it with your class recently, summarize the story together so that they will be familiar with it. When you are ready to start the challenge, read over the challenge page together. Go over the constraints and success criteria.

Ask: This question doesn't have to be answered in writing. This is just the basis of the challenge. Have students think about how they might do it.

Control: Do the control as a demonstration for the class. **I explained the control when introducing the project, but we did the control test when we went outside to test the parachutes, just as a matter of not going outside, back in, and out again. Explain that we need to do a control test to see how quickly Jack will fall without a parachute (poor Jack!). This will let us know if our parachutes helped Jack stay in the air longer. *Note, not all STEM Engineering Challenges lend themselves to a control test. This one does, yay! Be sure to take advantage of this opportunity to teach about controlling variables.

Imagine: Have students think about different parachutes they have seen. What shapes and materials are parachutes made of? What helps parachute catch the wind and seemingly float through the air? Give students time to brainstorm independently or with their groups.

Create: Explain that in order for their parachute to be successful, it should stay in the air longer than the control. To do this, we need the parachute to help Jack overcome the force of gravity. Encourage students to try a variety of sizes, shapes, and materials for their parachutes. Also remind them that it doesn't have to be perfect. The only way we can improve things is to have a starting design that can be improved upon. If we don't start in the first place, we can't improve. This is a hard, but very necessary, lesson for your perfectionists. Just try a design and go from there! Have students sketch their first creation. Or you could have them snap a pic if your school has the technology.

Test: To test, you will need a high spot to drop the parachutes. Drop the parachutes, and time how long it takes Jack to hit the ground. You will need a stopwatch that measures to the millisecond because the drops will be close in time. For the high spot, we had an outdoor stairwell that we used. I had the students wait at the bottom while I dropped the parachutes from the top. We also tried them once from the playground bridge. You could also stand on a chair to drop them. Just be safe. You don't want the entire class up on the playground equipment at the same time, and you don't want students climbing chairs to drop the parachutes themselves.

****Common confusion**—Students often think that the fastest time is the winner, but with parachutes the goal is for the action figure to stay in the air longer.

Jack and the Parachute

Teacher Guide {page 3}

Improve: After they test, send students back to improve their design. Improving and retesting is a great way to encourage students to learn from the mistakes. With a project such as creating parachutes, the initial building takes a little longer than other challenges. Also, there is the added factor of finding a place to test. Because of this, it may be hard to fit in the "improve," and that's ok, too. If you don't have time to do it again, have students discuss what they would do differently. The majority of other STEM challenges in my store are much quicker and leave time for improvements.

Reflect: Encourage students to think about the project and their successes and failures. If there is time, you could debrief as a whole class. Have students "Think-Pair-Share" or discuss at their tables. Here are some questions to guide reflections:
-Was your parachute successful? How could you tell?
-Which designs worked best?
-Why is it important to have designs that fail?
-What was the most challenging?
-Were there any surprises?

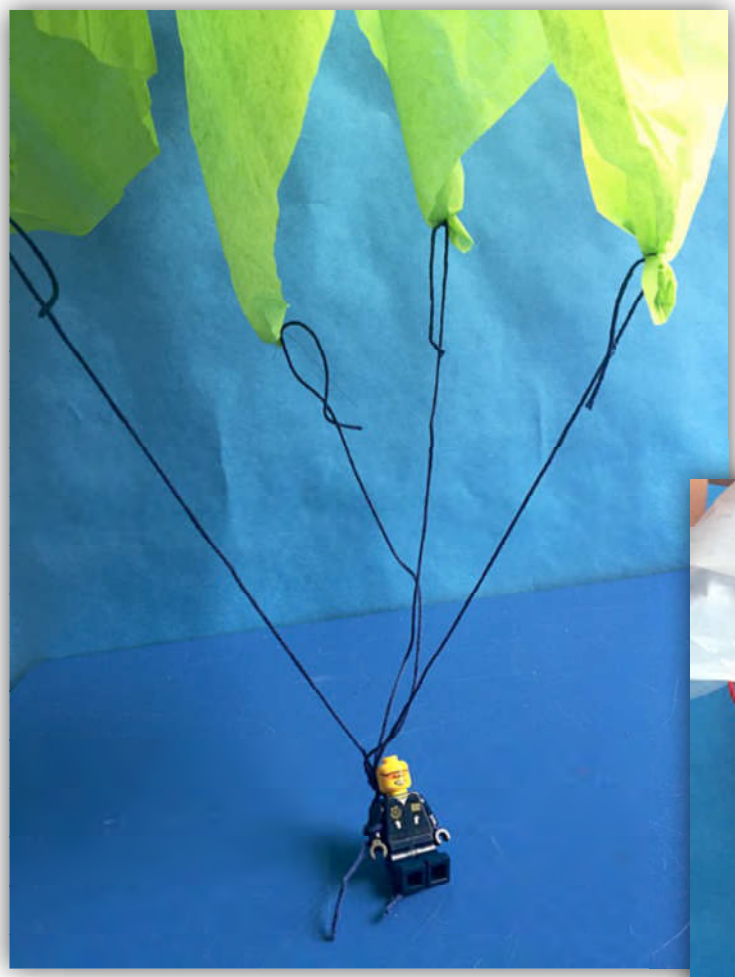
Differentiation Options: -There are several recording sheet options. Choose the one that works best for your students. It's ok if some students have a different one.
-For students who need extra help, you can have them work at a station with you and guide them through the first try. Note: many times, students who struggle in other areas of the curriculum may excel with STEM challenges.
-For students who need additional challenges, you can give them a copy of the extension menu to work with.
-Adjust the time allowed for construction to meet students' needs. For students who can handle it, give them shorter time and require them to work quickly which adds to the challenge.
-You could also limit the parachutes to say three materials to make it a little more challenging, and students will have to choose their materials wisely.

Extension Ideas: -For individual students, the extension menu provides choices for early finishers or students who need a little more.
-Parent Letter—send home the included letter for students to try this challenge at home. Encourage students to bring in pictures or share their experiences at home.

Grading STEM: I provided a rubric for this STEM project. In my opinion, STEM is challenging to grade because there is no black and white, right or wrong answer. With STEM challenges, we encourage students to think critically and be willing to try different solutions. Those thinking skills are difficult to assess, but I created a rubric that you can use. Use the rubric as a learning tool so that students know what you expect of them during STEM time.

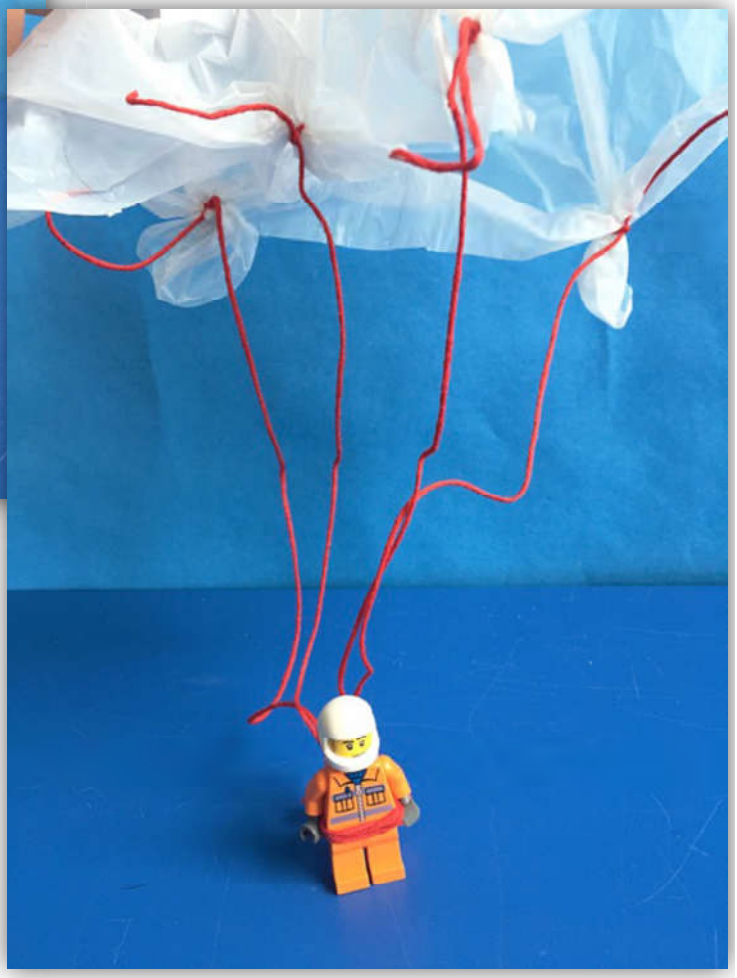
The Science Behind It: Parachutes overcome gravity by collecting air and floating to the ground. It is important for them to be lightweight and have a wide surface area. They are gathered in the center because it creates a pocket or a bubble to hold the air. The action figure will weigh it down, but the pocket of air creates drag which will slow down the force of gravity and keep Jack in the air longer.

Example Parachutes:



This is made with tissue paper and string. It was a rectangle shape.

This one was made from a cut up Target bag and string. It was a circle shape.



<u>A note about pictures and examples:</u>

When you show students examples or pictures, they tend to imitate what they see. I recommend that you use these pictures for your purposes only and do not show to students ahead of time. Part of the challenge is thinking creatively and outside the box. One of the benefits of STEM is that the challenges are open-ended with no one right answer. This allows students to apply critical thinking skills in ways they can't always do with typical classroom assignments. You will be amazed at what your students come up with on their own!

Name_____ Date_____

Jack and the Parachute

Oh no! Jack has done it again. He can't resist magic beans, and he is once again being pursued by the giant. The giant, having learned from past mistakes, has lined the beanstalk with barbed wire. Jack needs another plan of escape. That's where YOU come in.

Your challenge:

Build a parachute to help Jack escape from the giant.

Constraints:

*Your parachute can be no larger than the top of your desk.

*You must have string or some way to attach the parachute to Jack.

Success Criteria:

Your parachute should hold Jack in the air longer than the control drop.

ASK How can I create a parachute for Jack?

CONTROL Drop Jack from the designated height with no parachute. Measure the time it takes for him to hit the ground.

Control Drop Time _____

IMAGINE Now think about ways that you can keep Jack in the air longer than the control drop. Brainstorm materials and shapes that would make a good parachute.

CREATE Create your parachute, and sketch your design. Label your diagram with the materials that you used.

TEST

Trial 1—How long did Jack stay in the air?	
Time	

Did your parachute fall slower than the control? Yes ___ No ___

IMPROVE What can you do to make your parachute better? Try it! Sketch your second parachute. Label your materials.

TEST

Trial 2—How long did Jack stay in the air?	
Time	

Did your parachute fall slower than the control? Yes ___ No ___

Did it fall slower than your first parachute? Yes ___ No___

REFLECT Were your changes effective? Explain.

Was your parachute a success? Explain.

Name_____ Date_____

Jack and the Parachute

Write an explanation or draw a picture that tells what you did to build a parachute for Jack. Then, circle if your parachute was successful or not.

First

Next

Then

Last

Was your parachute a success? Circle: Yes No

Name_____

Jack and the Parachute

This is your assessment for your "Jack and the Parachute" STEM engineering challenge. As engineers, growing and improving is very important so that we can become skilled and model engineers.

STEM Engineering Levels:

N	G	S	M
Novice Engineer	Growing Engineer	Skilled Engineer	Model Engineer
Criteria is not attempted or is attempted incorrectly.	Criteria is attempted correctly, and there is room for improvement with the results.	Criteria is attempted correctly and met accurately.	Criteria is attempted and met accurately and in an exemplary way that serves as an example for other engineers.

Jack and the Parachute STEM Engineering Challenge Criteria	Engineering Level
Imagine & Create—Brainstorm multiple possible solutions to meet the design challenge. Discuss materials and shapes to use for the parachute. Create a parachute that meets design criteria (falls more slowly than the control drop) and also adhere to the constraints for time and materials.	
Test, Improve, & Reflect—Conduct the test carefully by dropping Jack with his parachute and measuring the time it takes for him to fall. Accurately record results of the test. Consider multiple possibilities for improvement, and design a new parachute. Reflect on the successes and failures of your design.	
Participation and Teamwork—Participate cooperatively with teammates. Contribute ideas and suggestions to the group discussion, and be respectful of the ideas from other group members. Share in the responsibilities of this project. Focus on the task at all times.	
Effort and Determination—Demonstrate best effort, and maintain a determined attitude. Do not give up when a design flops, but instead keep trying and looking for other solutions. Be willing to try new things and learn from and appreciate both successes and failures.	

Grade: **Comments:**

Jack and the Parachute
Extension Menu

Engineering Try making more parachutes out of various materials. Try different sizes and shapes. Test them.	**Technology & Writing** Write and record a video commercial convincing others to buy your parachute.	**Creative Writing & Art** Write a comic strip that shows what happens when the giant sees Jack escaping with the parachute.
Math Create a bar graph or a double bar graph of the class data from this project.	**Creative Thinking & Art** Design a travel brochure for adventurers who want to parachute from the beanstalk.	**Science** Plant a variety of bean seeds. Observe and compare them. Record your notes and observations, and share your findings with your class.
Writing Re-write a version of Jack and the Beanstalk that includes your parachute as part of the story.	**Reading** Read and compare several different versions of Jack and the Beanstalk.	**Engineering & Math** Create parachutes that are a variety of geometric shapes (circle, triangle, rhombus, octagon, etc...) Conduct a test to determine which shape is best.

THANK YOU!

SPECIAL THANKS TO:

Josh the Science Demo Guy for his lesson plan on marshmallow catapults You can visit his store at:

https://www.teacherspayteachers.com/Store/Science-Demo-Guy

AND

Sarah from More Than A Worksheet for her lesson plan 'Jack and the Parachute". You can visit her store at:

https://www.teacherspayteachers.com/Store/More-Than-A-Worksheet