

ALEXANDRA THE ASTRONAUT

EXPLORE MARS

Hello engineers! My name is Alexandra and I'm an astronaut! When I was in fifth grade, I saw the brightest stars I've ever seen while on a camping trip with my family. I was fascinated and knew that I wanted to learn more! I went to Hancock for two years to study physics and then transferred to Cal Poly to study aerospace engineering. I was the first one in my family to go to college!

Physics is the study of how objects in our universe interact with each other. Physics explains the effect invisible forces, such as gravity, have on objects! Aerospace engineers design and create things that are used in space and for space travel, such as rockets. It is very important that aerospace engineers understand physics so they can understand how forces will act on the objects they design.

My current mission, Explore Mars, is to set up a communication base on the planet Mars which will help us collect data and information about the planet! Scientists across the globe are interested in learning if there is life on Mars, and with the help of this communication base, we could be one step closer to making that dream come true! I need your team's help to travel through space and find a safe path from Earth to Mars without crashing into anything so my robot, BOT, can set up the base. Let's get going!

ALEXANDRA THE ASTRONAUT

EXPLORE MARS

Hey space rangers, it's time for blast off! Our first challenge of entering outer space involves traversing Earth's atmosphere and I need your team to code our pathway. First, we need to set our rocketship to Lift Off mode. To do this, your team needs to **set all three of BOT's lights (left ear, right ear, and chest) to different colors** and **wait for 2 seconds** in between each color change.

Then, I need to **move a distance of 40 at speed 100.**

ALEXANDRA THE ASTRONAUT

EXPLORE MARS

Nice job space rangers, we made it through Earth's atmosphere! Now that we're in deep space, be careful! Avoid space objects that can get in our way to Mars. Let's zig zag our way through them. Start by **turning 135 degrees**, then **moving forward a distance of 20 at speed 50**. Turn **-50 degrees** and **move forward a distance of 20 at speed 50**. Now, **turn 50 degrees** and **move forward a distance of 20 at speed 50**. Finally, **turn 160 degrees** and **move forward a distance of 50 at speed 50**. Let's face the moon by **turning 75 degrees**!

ALEXANDRA THE ASTRONAUT

EXPLORE MARS

We must be extra cautious about avoiding the Moon! Your team must add code to help me move around the Moon. First, **turn 90 degrees**, then **move forward a distance of 25 at speed 20**. Turn back **-90 degrees** and **move forward a distance of 25 at speed 20**. Once more **turn -90 degrees**, **move forward a distance of 25 at speed 20**, and finally reposition me towards Mars by **turning 90 degrees**. Go for it!

ALEXANDRA THE ASTRONAUT

EXPLORE MARS

Awesome work space ranger, we're ready to land! To land safely, first **move BOT forward a distance of 15 at speed 20** to the edge of Mars' atmosphere. Second, **move BOT in a Figure 8 pattern** to pass through Mars' atmosphere. Finally, **move BOT a distance of 10 at speed 20** and **land on Mars with a Forward Spin**. Get started, it's landing time!

ALEXANDRA THE ASTRONAUT

EXPLORE MARS

Great teamwork everybody, we successfully traveled through space and set up a communication base on Mars! Thanks for all your help, I could not have done it alone! Remember to shoot for the stars, achieve your goals, and maybe someday YOU will be the reason us Earthlings can learn more about other planets!

FELIPE THE MECHANICAL ENGINEER

PHYSICS PHANTASY

Hi engineers! My name is Felipe and I am a mechanical engineer! When I was in fifth grade, I would help my dad fix cars on the weekends. I loved learning about how engines work and knew I wanted to learn more! I went to Cal Poly to study mechanical engineering. I was the first one in my family to go to college!

Physics is the study of how objects in our universe interact with each other. Physics explains the effect of invisible forces, such as gravity, on objects! Mechanical engineers design and create things that we use every day, such refrigerators and elevators. It is very important that mechanical engineers understand physics so they can understand how forces will act on the objects they design.

My most recent project was to build a roller coaster for the new theme park, Physics Phantasy, that explains the different types of energy in our world! After planning, calculating, and constructing, the roller coaster is finally ready to ride! I need your team's help to be the very first testers of the brand new Riding Energy Roller Coaster! A world of energy is waiting, let's get started!

FELIPE THE PHYSICIST

PHYSICS PHANTASY

Hello, team! It looks like we need a launch code which is a secret message to start the roller coaster. This is actually an RGB (Red Green Blue) color value. Your team needs to write code which will **set all of my lights to be red 215 green 244 and blue 66**. Then **move our cart forward a distance of 15 at speed 35** so we can start the ride!

FELIPE THE PHYSICIST

PHYSICS PHANTASY

Awesome job getting the Riding Energy Roller Coaster started! We are getting excited about this roller coaster. Let's **animate a wiggle repeated 2 times** and **move our cart forward a distance of 10 at speed 40**. Now it's time to learn about potential energy as we climb up the first big drop!

FELIPE THE PHYSICIST

PHYSICS PHANTASY

Potential energy is the stored energy an object has because of its position or state. As we climb to the top of our drop, we are gaining potential energy because we are increasing our position, or distance, from the ground. It's time to code our pathway up the incline! Write code so that our cart will **wait until your team claps**, then **turn 45 degrees** and **move our cart a distance of 30 at speed 35**. Once we are at the top of the drop, **animate a forward spin** so I can look at how high up we are!

FELIPE THE PHYSICIST

PHYSICS PHANTASY

We made it to the top of the roller coaster thanks to potential energy and you! Let's get excited about being this high up with a **Woohoo expression!** Let's look down at the drop by **tilting the head to -13 degrees**. Then, **turn the head to 90 degrees** and **turn the head to -90 degrees**. Look back up by **tilting the head to 15 degrees** and **turn the head to 15 degrees**. Now it's time to let kinetic energy do all of the work as we speed down the drop!

FELIPE THE PHYSICIST

PHYSICS PHANTASY

You can think of kinetic energy as potential energy in action! Kinetic energy is the energy an object has due to its motion. As our velocity increases down this drop, so will our kinetic energy. And all of the potential energy we had stored up will decrease as our position from the ground decreases. Write code which will **turn our cart 90 degrees, move a distance of 15 at speed 80**, complete one **Forward Spin, turn to a -90 degree angle, move a distance of 10 at speed 60**, complete the second **Forward Spin, turn to a -45 degree angle**, complete the last **Forward Spin** of the track and celebrate with a **Woohoo expression!**

FELIPE THE PHYSICIST

PHYSICS PHANTASY

What an exciting roller coaster! Thanks for all your help with testing the Riding Energy Roller Coaster for the very first time!

I couldn't have asked for a better team to work with! Remember, always pay attention to the world around you, be curious, and ALWAYS ask questions! Maybe next time we meet, we'll be testing a roller coaster that you created!

MARIA THE MATHEMATICIAN

BREAKING THE BANK

Hey engineers! My name is Maria and I'm a mathematician! When I was in fifth grade, I would help my mom measure and count ingredients for different recipes. I was fascinated by math and wanted to learn more! I studied mathematics at Cal Poly. I was the first one in my family to go to college!

A mathematician is someone who studies math and how it relates to the world. Cryptologists use math to create and break codes. Cryptologists are very important because they make sure private information is kept safe, especially on the internet.

I work for a super secret spy agency where I break codes to help solve tough investigations! My agency just got word that an infamous thief, Harry Heist, is trying to break into the world's largest bank, World Enterprise, and steal all of the cash in the bank vault. I've been assigned to help the agency get into the vault and move the cash to a safe location before Harry Heist can get to it. This is an important mission so I'm going to need your team's help to crack the code! Let's get started, we don't have much time!

MARIA THE MATHEMATICIAN

BREAKING THE BANK

Our team has intercepted some of Harry Heist's messages and gathered some information about his plan to rob World Enterprise. Unfortunately, the plans have been mixed up to make sure no one can read them. However, let's get our game face on by **setting the face pattern to have each other light on with a brightness of 255** and **making a sound expression of clear throat**. Let's do this!

MARIA THE MATHEMATICIAN

BREAKING THE BANK

It looks like Harry plans to flee with the money as soon as he gets his hands on it, so we have to work quickly! In order to crack the code for the vault, we need to work on unlocking one latch at a time. To unlock the first latch, we must complete a series of specific movements. First, **move a distance of 15 at speed 30**. Then **animate a swerving oval**. Next, I need to complete three animated movements in the following order: **look around**, **walk forward**, and **walk backward**.

MARIA THE MATHEMATICIAN

BREAKING THE BANK

If we hope to successfully complete our mission, we need to unlock this vault! Let's get started on the second latch; this latch has to be unlocked using a specific sequence of lights. First, **move a distance of 40 at speed 30**. Then **set my left ear light to blue**, **wait 1 second**, set my **right ear light to yellow**, **wait 1 second**, and my **chest light to green** and **wait 1 second**. Next, set my **left ear light to orange**, **wait 1 second**, my **right ear to purple**, **wait 1 second**, and my **chest light to red** and **wait 1 second**. Finally, **set all of my lights to a random color** and **wait 1 second**.

MARIA THE MATHEMATICIAN

BREAKING THE BANK

Great news team! The agency got their hands on an encrypted code that can open the bank vault. It's up to us to decrypt the code and give it to the agency before Harry Heist can get there! Start by having **the circle button set all lights to red when pressed down**, **the triangle button set all lights to blue when pressed down**, and **the square button set all lights to yellow when pressed down**. Now to decrypt the code, change the lights by pressing the buttons in the pattern of: red, blue, yellow, blue, red.

MARIA THE MATHEMATICIAN

BREAKING THE BANK

Great job decrypting that code, team! Now we can unlock the last latch! To do this, we must **move a distance 25 at speed 30**, then we have to **repeat a specific sequence 2 times**. The sequence is to **tilt my head to 45 degrees, turn a 190 degree angle, complete a forward spin, complete a head shake**, and **wait 2 seconds**. After that sequence is completed 2 times, the final step is to **make a mind blown expression!**

MARIA THE MATHEMATICIAN

BREAKING THE BANK

We did it team! The agency told me that they were able to get to the bank vault and move the cash before Harry Heist could get to it. They even caught Harry Heist trying to break in! The agency could not have done it without all of your help. Thank you! I loved working with all of you and I hope you remember that no matter what challenges may be in front of you, you can conquer them if you put your heart into it and work hard! If you decide to go into mathematical cryptology and ever need help cracking a code, you know where to find me!

ENRIQUE THE CIVIL ENGINEER

BUILDING ATLANTIS

Hello engineers! My name is Enrique and I'm a civil engineer! When I was in fifth grade, I helped my dad to build a shed in my neighbor's backyard. I loved building things and knew I wanted to learn more! I studied physics at Hancock for two years before transferring to Cal Poly to study civil engineering. I was the first one in my family to go to college!

Physics is the study of how objects in our universe interact with each other. Physics explains the effect invisible forces, such as gravity, have on objects! Civil engineers design and create building and structures, such as bridges. It is very important that civil engineers understand physics so they can understand how forces will act on the buildings and structures they design.

Right now, I am working with an architecture company in Amsterdam to build the very first underwater city! Amsterdam, like many cities on Mother Earth, is growing faster than space allows. To make more space for the people of Amsterdam while keeping our planet safe and healthy, we are going to build another city UNDERNEATH Amsterdam! You heard that right -- underneath, in the water! There are many challenges that come with trying out new ideas, especially ones as complicated as this, so I need your team's help to make the fictional underwater world of Atlantis become a reality! Let's get started!

ENRIQUE THE CIVIL ENGINEER

BUILDING ATLANTIS

Our first step in building Atlantis is to drain the water from the area we are building on! Let's get started by entering the excavated space; we must **move a distance of 60 at speed 60**. Since our team is focused on crafting an environment that contributes to a healthy Earth, we are going to save the drained water so that we can refill the space later without wasting any additional water! Since we will have to do this twice, it will be more efficient to make a function for draining and refilling rather than writing the same code twice. To do this, write a function called **DrainAndRefill**. In the **DrainAndRefill function** I need to **repeat a forward spin 3 times**. Then I need to **set a face pattern** which will signal that the job is finished!

ENRIQUE THE CIVIL ENGINEER

BUILDING ATLANTIS

Nice work crew! Now that the canal has been drained, our construction team can start building Atlantis! Do a **WooHoo expression** and **animate a forward spin** to celebrate that we got this step done! During construction, it can be hard to keep track of all the different tasks going on at once. Let's do an **animated Zig Zag** to help our construction team and untangle the mess of tasks ahead!

ENRIQUE THE CIVIL ENGINEER

BUILDING ATLANTIS

To help with the construction process we will need to inspect the different building levels. Add lines of code which will help me **turn at a 100 degree angle, move a distance of 45 and speed 45**, and **complete a head nod** to signal that the level passed inspection. Then **turn at a 120 degree angle, move a distance of 35 at speed 45**, and **complete a head nod**. Finally **turn at a -90 degree angle, move a distance of 25 at speed 45**, and **complete a final head nod**!

ENRIQUE THE CIVIL ENGINEER

BUILDING ATLANTIS

Construction is almost done, crew! One of the most important parts of engineering is testing! We need to make sure our city can do everything we hoped it would before we can refill the canal with water and open Atlantis to the public. When **pressing the center main button set all the lights to the color blue** and **do a Woohoo expression**. Then **tilt the head to -13 degrees down** and then **tilt the head 20 degrees up**. Now press the button and see if it works. Testing is done!

ENRIQUE THE CIVIL ENGINEER

BUILDING ATLANTIS

Now to refill the space and put the finishing touch on Atlantis!

Since we already made the **DrainAndRefill** function, we can use that to complete the refilling task! First, let's get to ground level! **Turn at a 45 degree angle** then **move a distance of 20 at speed 35**. Now **call the DrainAndRefill function** to watch the water that we drained earlier to be refilled into Atlantis! Finally, celebrate our victory with a **mission success sound**!

ENRIQUE THE CIVIL ENGINEER

BUILDING ATLANTIS

Great job team, we successfully built Atlantis! It's so awesome making dreams, like the first underwater city, become reality; and I couldn't have done it without all of your team's help! Thank you! I hope you all remember that no matter how crazy an idea may sound, if you work hard and exercise good teamwork, you can make anything happen! Keep dreaming up new ideas and maybe one day you'll get to walk in an underwater city that you engineered!

CARLOS THE CHEMIST

FIRE FIASCO

Hello engineers! My name is Carlos and I am a forensic chemist! When I was in fifth grade, I loved reading mystery novels and watching detective movies. I was fascinated and knew I would love to learn more! I went to college and studied chemistry at Cal Poly. I was the first one in my family to go to college!

Chemistry is the study of what everything is made of. Chemists use the word “matter” to describe anything that takes up space, from water to your pencil to you! Chemists also study the changes that take place when certain substances are mixed together. They call these changes chemical reactions. Forensic chemists use their knowledge of matter and chemical reactions to solve crimes!

I work for a big detective agency and could use your help on a tricky case I was just assigned.. Last week, an old restaurant in town, First Street Diner, was destroyed in a fire. The owner, Fred, has told police that he thinks Sergio, the owner of Second Street Cafe, set the fire that burned down First Street Diner. Second Street Cafe is a new diner that opened across the street. The weeks before the fire, Fred and Sergio were always fighting because each felt the other was stealing business from their restaurants. I need your team's help to investigate what caused the fire at First Street Diner and who was behind it! Let's get started team, it's time to solve the fire fiasco mystery!

CARLOS THE CHEMIST

FIRE FIASCO

Now that we are all caught up on the story, it's time to look into some new evidence! The detectives found fingerprints on the scene and need us to identify who they belong to. Move over to the fingerprinting lab area by **turning at a 45 degree angle** and **moving a distance on 30 at speed 25**. To identify the fingerprints, we need to dust graphite powder on them to clearly outline the prints. I need to **repeat** my **wiggle movement 3 times** to make sure the entire fingerprint is covered!

CARLOS THE CHEMIST

FIRE FIASCO

The tests came back from our fingerprints and it seems that none of them were Sergio's. Interesting...only Fred's fingerprints were found. Well, let's look at our next piece of evidence; what seems to be a blank piece of paper. Even though it looks blank, traces of invisible ink were found on the paper! Change **all the lights to blue** and tilt **my head all the way down so -13 degrees** to be able to see the ink clearly. Now **repeat** my **swerving oval 2 times** to go around the ink to read what is there.

CARLOS THE CHEMIST

FIRE FIASCO

Hmm... that secret message sure does seem suspicious. Looks like Fred hasn't been very honest with the story he told the detectives. We just discovered that he filed for property insurance just one month ago! This insurance says that if anything damages the First Street Diner, such as a burglary or a fire, Fred will be given half a million dollars to make up for his losses. This seems pretty fishy to me! Let's put the message in a preserving solution so the detectives can look at it later. I need to **turn at a -105 degree angle** and **move a distance of 50 at speed 25**. To preserve the letter we must let it soak in the solution and saturate it with light. **Set all of my lights to pink, wait 1 second, then blue, wait 1 second**, and finally a **random color**. Then, **turn at a 105 degree angle** and **move a distance of 30 at speed 25** to the next station.

CARLOS THE CHEMIST

FIRE FIASCO

The detectives have sent me some ashes collected from First Street Diner's kitchen! To test the ashes using chemical reactions, I need to swirl the chemicals and ashes together. I need to **repeat a forward spin 3 times** to achieve the reaction. Finally, I need to move the chemical reaction into the fume hood to ensure that we won't breathe in any of the reactive gases. Help me **turn at a -135 degree angle** and **move a distance of 20 at speed 25**.

CARLOS THE CHEMIST

FIRE FIASCO

The tests from the ashes came back and we found out someone poured gasoline all over the restaurant and lit it on fire! I told the detectives our findings and they revealed that Fred lit First Street Diner on fire himself and framed Sergio in order to get the insurance money; can you believe it?! Congratulations team, we solved the case of the First Street Diner fire fiasco! I am so grateful for all your help, I never would've been able to do it without you! If you all enjoyed helping me solve this mystery, you should really think about becoming forensic chemists yourselves! Who knows, maybe you'll be needing my help on one of your mystery cases in the future!

BELLA THE MARINE BIOLOGIST

DOLPHIN TALES

Hey engineers! My name is Bella and I'm a marine biologist! When I was in fifth grade, my family and I would go to the beach play in the waves during the summertime. I was fascinated by the different animals that live in the ocean and knew I wanted to learn more! I studied biology at Hancock for two years and then transferred to Cal Poly to study marine biology.

Biology is the study of living things. Marine biology is the study of the ocean and the plants and animals that live in it. For my job as a marine biologist, I focus mainly on injured ocean animals. I analyze the problems affecting them and try to find solutions that protect both the ocean and creatures!

Recently, my team and I discovered a baby dolphin named Diana who had washed up on the shore. Diana became sick after a cargo ship dumped chemical waste into the waters where she lives. My team and I have been working very hard to get Diana back to good health and it looks like she's finally ready to get back to her home and family! I need your team's help to dive into the ocean, check if the water is good to make sure Diana won't get sick again, and return her home with her family! Are you ready to get deep diving? Let's go!

BELLA THE MARINE BIOLOGIST

DOLPHIN TALES

Now that we've learned a little bit about what causes the ocean's movement, let's dive in to see it for ourselves! I need your team to code our path through the ocean. First, we need to make sure that it is safe to go under. I will **wait until your voices say "DIVE IN!"**, then I need to **dive a distance of 30 at speed 45**. Then, I need to **repeat two Figure Eight** movements so Diana and I can adjust to the waters.

BELLA THE MARINE BIOLOGIST

DOLPHIN TALES

Navigating the sea can get pretty tricky, especially with a baby dolphin at your side! So that means it's very important that the baby dolphin knows where we are! Let's **set all the light colors to blue** and **change the face pattern** to something the dolphin can recognize. Now let's make a **sound of look here**.

BELLA THE MARINE BIOLOGIST

DOLPHIN TALES

Okay team, before we return Diana to her family, we need to check that the water quality is safe for them! To do this, I must **turn at a 90 degree angle, swim a distance of 30 at speed 35**, and **turn all of my lights to green** to show that the water is clear. **Wait 1 second**. Then, I must **turn 180 degrees, swim a distance of 60 at a speed 35**, again **flash my green lights** and **wait 1 second**. Finally, I must **turn another 180 degrees, swim a distance of 25 at speed 35**, and **complete a Forward Spin** to finish the water quality check!

BELLA THE MARINE BIOLOGIST

DOLPHIN TALES

We're finally ready to reunite Diana with her pod! All we have left to do is **turn -90 degrees, swim down a distance of 50 at speed 100, complete one Forward Spin** to release Diana, and celebrate with a **mission success sound**!

BELLA THE MARINE BIOLOGIST

DOLPHIN TALES

Awesome work team! Thanks to all your amazing help, Diana is back with her family! You all make such great sea adventurers and animal lovers, I hope you consider becoming marine biologists! Remember that your work can help marine life, the ocean, and even the entire world! Keep up the hard work and maybe I'll be joining you on your own sea adventure one day!

SARA THE SOFTWARE ENGINEER

TECHNOLOGY TUNES

Hi engineers! My name is Sara and I'm a software engineer! When I was in fifth grade, I loved using online apps to create different types of music. I was fascinated and knew I wanted to learn how to make more complex songs through technology! I studied computer science at Cal Poly. I was the first one in my family to go to college!

Computer science is the study of computers and how they work. Software engineers write code that's used by computers to do different tasks. As an audio software engineer, I write code to design some amazing songs!

Right now, I'm working on making a very special song for a huge Hollywood movie company's newest hit movies! I've been assigned to make the theme song for a brand new superhero movie and I could really use your team's help! What do you say? Let's get this song started!

SARA THE SOFTWARE ENGINEER

TECHNOLOGY TUNES

To get started on making the beat for our son, we need to move over to our drums! **Turn at a -45 degree angle** and **move a distance of 30 at speed 25**. Then have your team **create a custom sound** to illustrate an idea of what you want the beat of the song to sound like!

SARA THE SOFTWARE ENGINEER

TECHNOLOGY TUNES

Great start to our superhero theme song! One of my favorite things about audio software engineering is how it brings together creative and technical skills! Music is all about creativity, storytelling, and trying new things. For example, **change the color of my left ear to blue** and **change the color of my right ear to green**. Now use your creativity to **change my face pattern**. Coding is more precise, logical, and focused. For example, make me **move of a distance of 20 at a speed of 30**. Then make me **move of a distance of -20 at a speed of 40**. I never get bored of what I'm working on because I have to use all areas of my brain!

SARA THE SOFTWARE ENGINEER

TECHNOLOGY TUNES

Let's move over to the smaller instruments to see what other sounds we can add to our song! First, **wait 5 seconds**, then **turn 90 degrees** and **move a distance of 45 at speed 25**. I'm loving the beat your team came up with and I can't help but dance along! Make me dance by **repeating a sequence 4 times**. In the sequence, **set all of my lights to a random color**, make me **complete a forward spin, then a head shake**, and **finally a wiggle!**

SARA THE SOFTWARE ENGINEER

TECHNOLOGY TUNES

Lastly, we need to add in a harmony for our song! Harmony when is a second sound added on top of our original one. Let's head to the piano! **Turn at a -30 degree angle** and **move a distance of 35 at speed 25**. Then **turn -95 degrees** and **move a distance of 40 at speed 25** to play a key on the piano. Now **play a sound snippet called Red**. Next **turn 180 degrees** and **move a distance of 45 at speed 25**. Play another **sound snippet, this time called Green**, and **wait 1 second**. We've finally finished our song! Celebrate by **playing the Sigh sound, wait 1 second, followed by a Woohoo sound!**

SARA THE SOFTWARE ENGINEER

TECHNOLOGY TUNES

Great work team! Our superhero space theme song is one of the best I've ever made and I can't wait to share it with the movie's cast and crew! I couldn't have done it without all of your team's help, thank you! I hope all of you consider going into audio software engineering because you showed that you have all the skills it takes to be great at it! Who knows, maybe one day I'll be helping you make an awesome new theme song for a movie you're working on!