The Problem Solvers

by ReadWorks

Problems-whether they are scientific, medical, creative, culinary, personal, communal, or any other type-require solutions. The best way to find a solution that fits is to first research the problem. Find out as much as you can about what the difficulty is. Say, for instance, the issue is architectural in nature. A boutique hotel was built several years ago on a beach, facing the sea, in Los Angeles, California. Its owners have pointed out that the building is not handicap-accessible and would like for you to make it so. To begin, you will need to study the hotel, look into what makes a physical space handicap-accessible, and understand what the owners' needs are. Where exactly is the hotel? How big is it, how is it laid out and how many floors? Is it important that only the lobby be made wheelchair-accessible, or will handicapped guests also need to get from the hotel down to the sand? How much money do the hotel's owners have to spend on solving this problem?

Once you properly comprehend the problem and all of the details surrounding it, it's time to brainstorm. No matter what stage you find yourself in, it is usually helpful to share proposed ideas with your peers. More heads are better than one, and shared ideas can lead to improved projects and designs. Now imagine that just the hotel's lobby and rooms need to be made wheelchair-friendly. How might this be accomplished? You will have discovered, from your research, that a surface that is firm and level will allow for wheelchair traffic, and will also have traction for walkers. The easiest way to make an entry accessible is to install a ramp. According to the U.S. Department of Justice, a ramp should use the least possible slope and be at least 36 inches wide to accommodate a person in a wheelchair. To prevent slipping, you might consider handrails and curbs. What about the front door leading to the lobby? Ensuring the outdoor entrance is protected from elements like rain will make it

safer.

Clearing paths of travel through doorways and hallways is also important. If there are potted plants on the ground, one solution could be to replace them with hanging plants. In the individual guestrooms, it could be helpful to install adjustable rods in closets, and certify that light switches are low enough and electrical outlets high enough. Throw rugs have the ability to move around, so it would be wise to go with other flooring choices instead. Showers are easier to roll into than baths for those with limited mobility. How about installing a seat or a hand-held showerhead? Grab-bars and a taller toilet would work to make the bathroom more accessible, too.

It is crucial to come up with more than one solution. Now that you've thought of as many answers as possible to the problem at hand, test them and adjust them according to your test results. There are countless ways to evaluate solutions with respect to how well they meet the particular criteria and constraints of an issue. Maybe the best way to test out a ramp would be to build one or more prototypes. Then you can experiment with different materials and location. Tests are usually designed to identify points of failure. In other words, you will want to submit your ramp to tough conditions to see if it will be successful even under these circumstances. Try out a particularly heavy wheelchair. Will your prototype support it? Try out a manual chair, an electric mobility scooter and a walker. Will a permanent access ramp work better, or is a fold-up portable ramp more suitable in this situation? How does wood hold up in comparison to aluminum or concrete?

Sometimes, different solutions can be combined to create a result that is better than any of the ones that have come before it. Perhaps during the brainstorming process, your peers suggested two equally good solutions to the problem at hand. One proposed using a ramp to help handicapped guests bypass the stairs. The other proposed using a stairlift, a mobilized chair with the ability to transport people right to the top of the steps. It is possible that the best solution will be some combination of these two suggestions. How might both of these ideas work together? Maybe the least costly solution would be to eliminate the ramp and the stairlift, and simply clear a path to an elevator. Test it out. Is the route leading to the elevator wide enough for a wheelchair? Is the elevator itself wide enough? When thinking up solutions and performing tests, you must take into consideration a whole variety of variables-in this case, factors like cost, efficiency and safety levels.

These same steps can be applied to any kind of problem, from simple science experiments in the classroom to big, real-world difficulties. For people who have practiced problem solving, running through these stages comes as second-nature. Picture an experienced cook in a kitchen, readying herself to bake a chocolate cake for a birthday party. The birthday party begins in an hour or two, so she will need to work quickly! Suddenly, the cook realizes that she has run out of butter and the recipe calls for some. What to do? She does not have time to run to the grocery store. After rapidly examining the problem and brainstorming, she might come up with a list of butter substitutes. Some common ones are canola oil, olive oil, margarine and shortening. Sometimes butter can also be replaced with pureed fruits, like apples, bananas or dates.

By performing various tests, the cook will be able to determine which butter stand-in will work best in her cake. From her research, she will understand that the process of creaming butter together with granulated sugar helps achieve the rich, fluffy, spongy texture that is so important to cakes, cupcakes and other baked goods. In her tests, she will likely discover that because of this "creaming" step, using oil on its own, instead of butter in this case, will not yield the results she is looking for. It could be that combining two of the butter substitutes would be best. Maybe the cook only has margarine with salt in it, when the recipe calls for unsalted butter. The solution here could be to use the

margarine, but to then reduce the amount of salt added to the mixture. The cook will need to consider several variables here, including taste and texture.

Next time you have a problem to solve, think back to these guidelines. What is the quickest way to get to school when you've missed the bus? How to block the light from coming through your windows when you don't have any curtains or blinds? How to make a plant grow in a room that's too dark, or a space in which the sun only shines in a single spot? What happens when you'd like to play a game with six people, but only have enough parts for five? What to use instead, when you have no face paints, but have promised your little cousin that you'd dress her up like a clown for Halloween? The keys are these: research the issue, brainstorm alone or with peers, list a variety of solutions, test those solutions, modify them on the basis of your tests, and then select the best one. In most instances, this should lead you to an answer that works well. Just follow our cook's lead. She must have landed on the right solution because the kitchen smells great!

determine de · ter · mine

Definition

verb

1. to decide or set.

We determined the date for our wedding.

Advanced Definition

transitive verb

1. to decide or settle (a question, controversy, or the like) finally and authoritatively.

The jury will determine the outcome of this trial.

Have you determined a date for the wedding?

2. to conclude or ascertain following investigation and observation.

The students needed some time to determine the answer to the question.

Scientists were brought in to determine the age of the skeleton.

Specialists determined that the painting was a fake.

3. to bring about; produce.

Training is what determines the result of a race like this.

4. to set limits to.

The budget determined the scope of the project.

5. to firmly decide on a course of action, or to cause one to make a firm decision; resolve.

Despite their worries, her parents determined to let her make her own decisions.

Seeing his best friend go to prison determined him to give up his illegal activities.

intransitive verb

1. to make a decision; have a fixed resolve or intention.

They determined on an investigation of his debts.

Spanish cognate

determinar: The Spanish word *determinar* means determine.

These are some examples of how the word or forms of the word are used:

1. In the United States, people accused of a crime are innocent until proven guilty. They must have a trial to **determine** if they are guilty.
2. If jewelers or scientists aren't sure what type of metal something is, they can subject it to high temperatures and **determine** its identity based on the minimum temperature needed to melt it.
3. Ground-based telescopes at the W. M. Keck Observatory in Hawaii, for example, are used to **determine** a possible planet's mass. Astronomers do that by measuring a star's wobbles-the tiny back-and-forth movements caused by the pull of a planet's gravity. Once size and mass are determined, as well as the type of star an exoplanet orbits, astronomers can make an educated guess as to what the planet is composed of.
4. The greater the force, the faster the ball will go, and the farther it will travel. How much force you apply to the ball, that is, will often **determine** whether you score a goal or not.
5. You may be surprised to learn that the human eye can't see in 3-D. "We only have access to 2-D images," says Schowengerdt. "It's the job of the brain to interpret a host of cues to **determine** depth and create a 3-D image."
6. Teen popularity doesn't**determine** whether you'll be a winner or a loser in the long run. Actors Megan Fox and Leonardo DiCaprio both say they were unpopular in high school. Even singer Taylor Swift has said she was excluded from the popular clique in junior high.
7. They also plugged in what they knew about the animal's bone structure. "The more details you add to [the computer], the more accurate it gets," Mehling says. "Scientists can then apply rules of physics and biomechanics [the science of body movement] to **determine** how [dinosaurs] move."
8. What is the budget? What materials are available? If questions like these can be answered early on in the design process, it is more likely that the designed solution will be successful. Therefore, it's important to go through each consideration one by one to **determine** the best possible solution.

evaluate e · val · u · ate

Definition

verb

1. to judge or set the value of.

   The magazine evaluated ten new cars.

2. to judge or measure something by studying it with care.

   Teachers use tests to evaluate how much their students have learned.

Advanced Definition

transitive verb

1. to determine the level, value, or worth of; appraise.

   Teachers give tests to evaluate what their students have learned.

   The researchers are evaluating the effectiveness of the drug.

2. to study carefully and judge; assess.

   They need time to evaluate the situation before making their decision.

Spanish cognate

evaluar: The Spanish word *evaluar* means evaluate.

These are some examples of how the word or forms of the word are used:

1. Will power lines be attached to the bridge? These are all factors that must be addressed when selecting the type and design of a bridge. Designers will also **evaluate** how many cars, trucks and people will be passing over the bridge each day, and whether there will be heavy traffic on the bridge. It is important to know all of these numbers before building a bridge, because you want everyone to be safe.

variable

var · i · a · ble

Advanced Definition

adjective

1. likely to change; not constant.
2. capable of changing or being changed; alterable; flexible.

noun

1. something that tends to change or vary.

Spanish cognate

variable: The Spanish word *variable* means variable.

These are some examples of how the word or forms of the word are used:

1. While scientists understand some of how these feedback loops work, they lack a deep knowledge of them, making them extremely unpredictable. This is because, like any complex system, these feedback loops include many **variables**.
2. "There are so many **variables** to consider- not only things like trees and birds, but the bacteria and other creatures you can only see with a microscope. Not to mention, we haven't exactly figured out how to change the weather."
3. Imahara identified all the variables in the test. A **variable** is a factor in an experiment that can change and affect the result. The variables included the bus's velocity (the rate at which it moved in a specific direction), the angle of the ramp, and the length of the gap.
4. During that split second, scientific instruments record temperature, pressure, and other **variables**. After the blast, Stewart collects the smashed sample to examine how it changed and pours over the data collected by the instruments. Then she plugs every detail into a computer model to help her understand how a similar impact might affect a real planet.
5. Although big weapons are good for fighting, it takes a lot of energy for males to grow and maintain such heavy body parts. Within a given species, some males will be well nourished enough to develop huge claws or horns, Emlen explains. Males that aren't as well fed may have no oversize features. "Weapons are extremely **variable**," Emlen says. "A wimpy guy can't produce a huge weapon."
6. When two organisms-in this case, those organisms would be Alice and Jake's parents: Pete and Rachel-create a third organism through reproduction, many **variables** come into play. It's a complex lottery in which offspring of the first two organisms inherits a combination of their genetic material. The possible variations inherent in recombining the parents' DNA is very, very broad-larger than the pool of entries in the state lotto jackpot!

Name: _____ **Date:** _____

1. What is the best way to start solving a problem?

A. test possible solutions

B. list a variety of solutions

C. brainstorm with peers

D. research the problem

2. The problem with the hotel described in the passage is that it is not accessible to handicapped people. What is one possible solution?

A. building a ramp

B. putting a throw rug in every room

C. placing potted plants in the hallways

D. removing hand-held showerheads from the bathrooms

3. A problem can have more than one solution.

What evidence from the passage supports this statement?

A. The best way to begin solving a problem is to research the problem.

B. According to the U.S. Department of Justice, a wheelchair ramp should be at least 36 inches wide.

C. Throw rugs can move around on a floor, making a room less wheelchair-friendly.

D. A cook who needs a butter substitute could use canola oil, olive oil, margarine, or shortening.

4. Why is testing ideas for solving a problem important?

A. Testing ideas shows people that their ideas are not as good as they thought.

B. Tests can show whether an idea for a solving a problem will actually work.

C. Tests show people that wood is always a better material for building than concrete.

D. Tests make cooks feel foolish when they have run out of butter.

5. What is this passage mainly about?

A. a cook who runs out of butter

B. the U.S. Department of Justice

C. canola oil, olive oil, margarine, and shortening

D. the process of solving problems

6. Read the following sentence: "When thinking up solutions and performing tests, you must take into consideration a whole variety of **variables**-in this case, factors like cost, efficiency and safety levels."

What does the word **variables** mean?

A. problems

B. solutions

C. things that can change

D. things that stay the same

7. Choose the answer that best completes the sentence below.

There are several steps in the process of problem solving, _____ research and brainstorming.

A. including

B. last

C. before

D. meanwhile

8. As described in the passage, what is the first step in making a hotel handicap-accessible?

_____

_____

_____

9. What does the cook in the passage do when she realizes that she needs butter but does not have time to get some?

10. How is making a hotel handicap-accessible similar to finding a butter substitute? Support your answer with evidence from the passage.