Spend a Million

You have accidentally entered the forbidden forest that Dumbledore has warned all the students not to enter. You didn't mean to, you were racing your pal on your Nimbus 2000 and you thought you'd found a clever shortcut through this wooded patch outside Hogwarts castle.

All of a sudden, a hologram of a robot is in front of you and you're trapped by laser beams. "Very funny, Hermione," you yell. "Call off the laser pointers."

"Negative badge-recognition. Isolation exercise now in effect. Password, please."

"I'm sorry, I don't know anything about recognition or passwords."

" 'I'm sorry' not recognized. Exit permission consideration mode. Do you agree to undertake a question to secure release?"

"Yes. Anything!"

"Affirmative. Here is the challenge: You have 1 million dollars. You spend 50 cents every second. How many days will it take you to run out of money? Round up or down to the nearest whole number. You have 5 minutes to answer, which commences now!"

And with the word "now," an old tree trunk gets zapped--and disappears. It's pressure time.

How long will it take you to spend $1,000,000 if you spend it at a rate of $0.50 every second, making sure to round to the nearest whole number.

Advice

You're working your way up through units of time here, from seconds to days, so that's the route that your solution should take.

Write down everything you know:

The rate per second is 50 cents.

From that you can work out the amount you'd spend in a minute, and then the amount per hour, and then the amount per day.

Remember to round up or down to the nearest whole number.

Scholar in the Tower

You are the very young centaur, Firenze, and you are on your way to rescue Hogwarts most trusted scholar, who is said to be able to make mathematical calculations at lightning speeds in her head without needing to write down the numbers. Someone that brilliant is of great use to the Voldemort, of course, so it's not strange that the girl should have been captured by Voldemort's henchmen.

You realize you're being chased by Death Eaters as you approach the tower where the Hogwart's scholar is being kept. It's a bright sunny day, the ground ahead of you is flat and easy to travel, and you have a perfect view of the top of the tower.

But, there's no ladder in sight! As the Death Eaters close in, you begin to feel defeated. . . until, wait! You'll knot together a rope made out of those extra sheets you packed in your bag, and use your trusty longbow to send one end of the rope to the top of the tower so the scholar can climb down. But how long does the rope need to be? There's no time for trial and error.

What do you know? You're exactly the same height as your 5-foot longbow, and your shadow is exactly the same length as 2.5 longbows. You get an idea and measure the length of the tower's shadow: 20 longbows. Yes, you've got enough information to figure out how tall the tower is now!

How tall is the tower? How long should you make the rope of sheets to rescue the Hogwart's scholar?

Advice

Write down everything you know:

It's a sunny day, so you can see your shadow. That means everything around you is casting a shadow.

You used your 5-foot long bow to measure your height (1 longbow), your shadow (2.5 longbows), and the tower's shadow (20 longbows).

With this information, you can draw two similar triangles, and create a proportion problem to solve for the missing side.

Shadows and Proportions

A sunny day, any flat surface, and an object casting a shadow are the main ingredients for using triangles to solve "real world" proportions. The height of the object is one side, the shadow it casts is another, and the angle at which a ray of sun hits the ground is the third. Taking for granted that the ground is flat, this triangle is a right-angled triangle. And remember that the sun's rays travel parallel lines to the ground. That means that if you have the height of one object, and can measure its shadow, you can find the height of a second object with a measurable shadow nearby. Why? Because of the conditions, you'll have similar triangles, which means the sides are in proportion to one another. Just set up proportional fractions and solve for the missing side.

A ray of sun

Object's
height

Object's shadow

Make it Last!

You are stuck in a dungeon cell with 3 other people. All you have to eat is a box full of cookies, and, thankfully, a 40-gallon barrel marked “Drinking Water.” Chained to that barrel is a metal measuring cup marked “1 cup.” The third year student, remarked that he had heard that a 40-gallon barrel of water had lasted 10 students for 16 days after they got stuck in a cell several years ago.

You know you must establish hard-and-fast rules now about how much water each person can drink each day before everyone becomes crazy with thirst.

How long will the barrel of water keep the 4 of you alive until you get rescued?

Advice

Write down everything you know:

The barrel contains 40 gallons of water.

A 40-gallon barrel kept 10 students alive for 16 days.

There are 4 of you.

A 1-cup measuring cup hangs on the barrel.

HINT: 1 gallon = 4 quarts
1 quart = 4 cups

Dragon on your Tail!

It's dark and you're speeding along a flat country road, with the biggest dragon appearing to follow you on your Firebolt racing broom--and it's getting closer.

It all started when the Triwizard Tournament got out of hand and one of the dragons, a female Hungarian Horntail, escaped its holding pen. It is now speeding through towns and villages, burning up everything in sight. You race left (west) out of town on the only clear road, and speed away as fast as you can on your broom. Before you left town, the radio news said that the Horntail is also moving westward, at 30 miles per hour, and that everyone is urged to take shelter--dragon-proof shelter, of course!

You're going as fast as you can to the nearest shelter. You slow down as you search for one of the dragon shelters that seem so easy to find when it's sunny. You stop your broom and look around when--flash . . . . roar!--the light from the dragon's flame and roar remind you of the approaching danger. Instinctively, you start to count. It takes 50 seconds for the sound of the dragon's roar to reach you. You know that the sound travels at about 0.2 miles per second at your altitude.

How much longer do you have to find shelter from the dragon before everything gets burned to a crisp by its flame?

Advice

Write down everything you know:

The dragon is heading for you at 30 miles per hour.

It takes 50 seconds for the sound of the dragon's roar to reach you.

You see the dragon's flame almost at the instant it flashed because light travels so quickly.

The sound of the roar covers that same distance at 0.2 miles per second.

The Final Countdown

You accidentally got yourself stuck in a Gringotts Wizarding Bank Vault 713, where the Sorcerer's stone was kept for a time, and there are no goblins within earshot to come let you out from the other side.

It's a good thing you never panic (because this is a prime panicking situation): No matter whether you're rereading your favorite book or being chased by a dragon, your pulse remains a steady 72 beats per minute.

Then you realize something else--you're currently stuck in an airtight vault. You figure there are 2 more minutes of oxygen in the vault, so it's time to open the door yourself. Think through what you know and what you have to do.

First of all, the vault door has some built-in defense mechanisms so it can't be opened accidentally. There's a combination you have to enter, but then you have to wait exactly 35 seconds before turning the handle to open the vault door. A second too soon, or too late, and you have to start from scratch. But just over 14 hours ago, you took off your wristwatch. You kissed your only means of timing goodbye when you did that. Or did you?

Using the information you have, how can you count 35 seconds exactly?

Advice

Write down everything you know:

Your heart beats at a steady 72 beats per minutes, no matter what.

You have 2 minutes worth of air left.

You need to wait exactly 35 seconds after entering in the code before opening the vault's door.