

Saguaros and Trigonometry Problems

A white-winged dove is eating a saguaro fruit. As the dove finishes eating, the fruit falls to the ground. The saguaro is 7 meters tall. The dove line of sight from the top of the saguaro is at an angle of 37 degrees down to the fruit. Answer the following questions.

- 1. Is the distance from the where the fruit fell and the height of the saguaro the same? If not, why?
- 2. What is the distance between the fallen saguaro fruit and the saguaro?
- 3. What is the distance of the dove's flight from the top of the saguaro to the fallen fruit?
- 4. Sketch and label the diagram of the situation including all side and angle measurements.

A cactus wren is seeking shade under a bristle bush. It sees a fruit on top of a saguaro. The saguaro is 10 feet away from the bristle bush. The cactus wren's line of sight from the ground to the top of the saguaro is at an angle of 63 degrees up from horizontal.

- 1. Carefully sketch and label the diagram of the situation.
- 2. What is the height of the saguaro?



A bat is resting on top of a 9 meter saguaro. 2 meters from the saguaro is a pushpin cactus. The saguaro is perpendicular to the ground. The top of the saguaro to the ground where the pushpin is planted creates a 45 degree angle.

- 1. Carefully sketch and label the diagram of the situation.
- 2. Find the angle from the ground where the pushpin is planted to the top of the saguaro.

Jeffrey is a white winged dove who loves to eat saguaro fruit. One day, he spots a blooming 10 meter saguaro that is 3 meters away from where he's standing on the ground. The saguaro is perpendicular to the ground. The top of the saguaro to the ground where Jeffrey is standing creates a 45 degree angle.

- 1. Carefully sketch and label a diagram of the situation.
- 2. What is the angle from the ground where Jeffrey is standing to the top of the blooming saguaro?
- 3. Explain your reasoning.

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Norris is a cicada that loves to eat and rest on a barrel cactus. He is resting at the top of a 7 meter tall saguaro. There is a barrel cactus 5 meters away.

- 1. What is the distance Norris must fly in order to get to the barrel cactus?
- 2. Explain your reasoning.

Pythagorean	Theorem^^^^-
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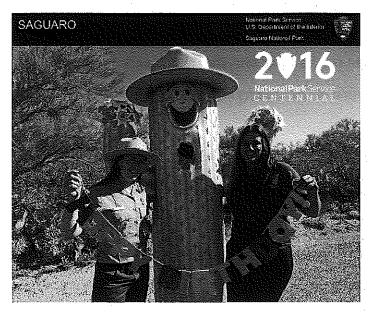
Saguaro Cactus Data Sheet

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	Average Age at a Given Height for a Saguaro in the Rincon Mountain District, Saguaro NP

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44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	77 17	16	15	14	13	12	11	10	9	8	Z	6	G	4	ω	2	1	Height (meters)
2.9674	2.8347	2.703	2.5725	2.4434	2.3159	2.1903	2.0666	1.9452	1.8263	1.71	1.5966	1.4862	1.379	1.2753	1.1752	1.0788	0.9863	0.8978	0.8135	0.7333	0.6575	0.5861	0.519	0.4565	0.3983	0.3447	0.2955	0.2506	0.2102	0.174	0.1421	0.1142	0.0903	0.07	0.0533	0.0398	0.0292	0.021	0.0149	0.0104	0.0073	0.0051	0.0035	2500
88	87	86	85	84	83	82	81	80	79	78	7	76	75	74	73	72	71	70	69	- 89	67	66	65	64	83	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	Height
8.3025	8.2037	8.1039	8.003	7,9009	7.7978	7.6936	7.5882	7,4817	7.374	7.2652	7.1552	7,0441	6.9317	6.8182	6.7035	6.5876	6.4705	6.3523	6.2328	61123	5.9905 -	5.8676	5.7436	5.6185	5.4923	5:3651	5.2369	5.1077	4.9776	4.8466	4.7148	4.5822	4,449	4.3152	4.1808	4.0461	3.911	3.7757	3,6404	3,5051	3.37	3.2353	3.101	Age
132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	Height
11.7873	11.7231	11.6582	11.5929	11.5269	11.4604	11.3933	11.3256	11.2573	11.1884	11.1188	11.0486	10.9778	10.9063	10.8342	10.7613	10.6878	10.6136	10.5387	10.4631	10.3867	10.3096	10.2317	10.1531	10.0737	9.9935	9.9125	9,8307	9.7481	9.6646	9.5803	9.4951	9.409	9.322	9.2342	9.1454	9.0556	8.965	8.8733	8.7807	8.6871	8.5925	8.4968	8.4002	Age
			173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	Height
			14.0306	13.9835	13.936	13.8881	13.84	13.7915	13.7427	13.6936	13.6441	13.5943	13.5442	13.4936	13,4428	13.3915	13,3399	13.2879	13.2356	13.1828	13,1297	13.0762	13.0222	12.9679	12.9132	12.858	12.8025	12.7465	12.69	12.6332	12.5759	12.5181	12.4599	12.4012	12.3421	12.2824	12,2223	12.1617	12.1006	12.039	11.9769	11.9142	11.851	

How much water can Sunny the Saguaro drink?



Rumors have it that Sunny the Saguaro is a one tall cactus! But who knows what his actual height might be? Desert animals speculate that he might be between 6 to 40 feet tall! However, the park rangers are more curious as to how much water Sunny can drink. Let's find out!

Essential Question/Objective

How big is Sunny the Saguaro? How does his age over the years compare to his height? The objective of this lesson is to help students learn about the relationship between the height of saguaros and their age while utilizing their geometric equations to calculate the volume of Sunny the Saguaro.

Background

The saguaro has been called monarch of the Sonoran Desert, supreme symbol of the American Southwest, and a plant with personality. It is renowned for the variety of odd, all-too-human shapes it assumes- shapes that inspire wild and fanciful imaginings. Since 1933 this extra ordinary giant cactus has been protected within Saguaro National Park.

Sunny the Saguaro has been the Park's official mascot since 2016. You can find him at different park events such as Find Your Park or you can see him hanging out with Jr. Rangers during one of the Jr. Ranger programs held every summer.

More About Sunny

As far as Sunny can remember he was 3 inches tall when he was 10 years old, 3 feet tall when he was 25 years old, and 16 feet tall when he was 60 years old! Now, sunny is 20 feet tall and still growing!

Can you guess how old Sunny the Saguaro is based on his height? Using his height, can you guess how big Sunny the Saguaro is and how much water he can drink?

Materials

Worksheet and Height to Age Table provided by the park

Saguaro Pamphlet found at the Visitors Center

Procedure

- #1: Talk to students about Saguaro National Park.
- #2: Show a variety of saguaros with different height and ask what could be the age of each.
- #3: Ask how big students think Sunny is as well as his age.
- #4: Ask what shape does Sunny resembles—hint: it's a cylinder!
- #5: Discuss how to calculate the volume of a cylinder and provide the formula needed for doing so.
- #6: Provide students with a measurement of the circumference of the saguaro.
- #7: Have students calculate the answer. How much water can Sunny the Saguaro drink?

Vocabulary and Formulas

Volume, Circumference, Radius, Cylinder, Saguaro

Extension

Find out how much water a saguaro cactus can store in itself more accurately by using multiple circumference**

Measure the circumference of multiple saguaros using a measuring tape prior to the activity.

Additional Resources

Table of height to age of saguaros

Related Lessons or Education Materials

This lesson was originally created by Wyoming Agriculture in the Classroom and inspired by Devils Tower Math- Volume of a Cylinder by Devils Tower National Monument.