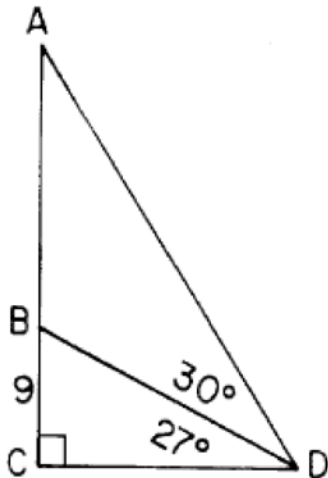


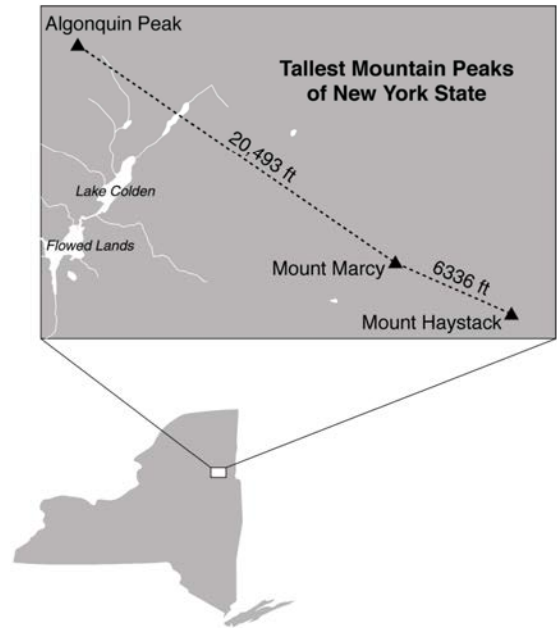
G.SRT.C.8: Using Trigonometry to Find a Side 4

- 1 At Mogul’s Ski Resort, the beginner’s slope is inclined at an angle of 12.3° , while the advanced slope is inclined at an angle of 26.4° . If Rudy skis 1,000 meters down the advanced slope while Valerie skis the same distance on the beginner’s slope, how much longer was the horizontal distance that Valerie covered?
- 1) 81.3 m
 - 2) 231.6 m
 - 3) 895.7 m
 - 4) 977.0 m

- 2 In the accompanying diagram of a right triangle ACD , B lies on AC , BD is drawn such that $m\angle CDB = 27$, $m\angle BDA = 30$, and $BC = 9$. Find AB to the nearest tenth.

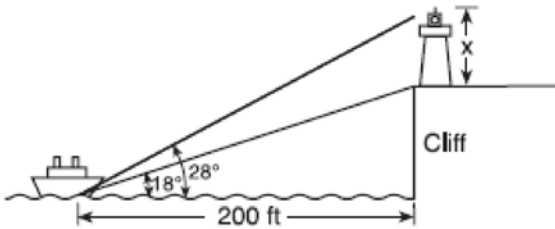


- 3 The map below shows the three tallest mountain peaks in New York State: Mount Marcy, Algonquin Peak, and Mount Haystack. Mount Haystack, the shortest peak, is 4960 feet tall. Surveyors have determined the horizontal distance between Mount Haystack and Mount Marcy is 6336 feet and the horizontal distance between Mount Marcy and Algonquin Peak is 20,493 feet.

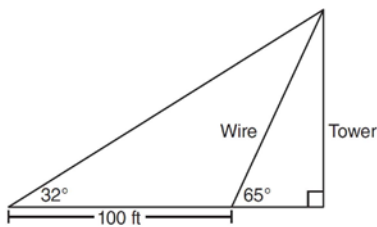


The angle of depression from the peak of Mount Marcy to the peak of Mount Haystack is 3.47 degrees. The angle of elevation from the peak of Algonquin Peak to the peak of Mount Marcy is 0.64 degrees. What are the heights, to the nearest foot, of Mount Marcy and Algonquin Peak? Justify your answer.

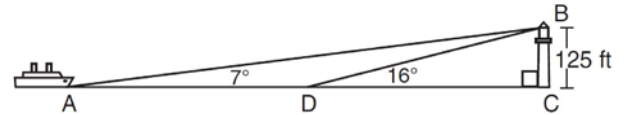
- 4 A lighthouse is built on the edge of a cliff near the ocean, as shown in the accompanying diagram. From a boat located 200 feet from the base of the cliff, the angle of elevation to the top of the cliff is 18° and the angle of elevation to the top of the lighthouse is 28° . What is the height of the lighthouse, x , to the nearest tenth of a foot?



- 5 The diagram below shows the plans for a cell phone tower. A guy wire attached to the top of the tower makes an angle of 65° with the ground. From a point on the ground 100 feet from the end of the guy wire, the angle of elevation to the top of the tower is 32° . Find the height of the tower, to the nearest foot.

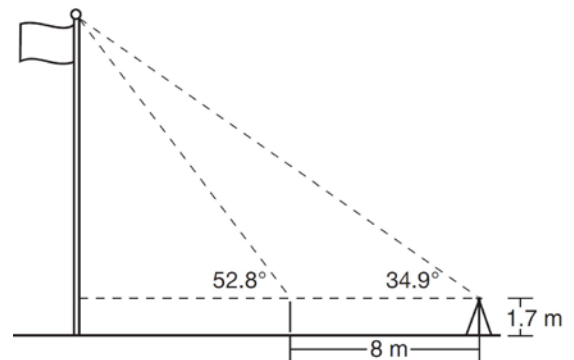


- 6 As shown in the diagram below, a ship is heading directly toward a lighthouse whose beacon is 125 feet above sea level. At the first sighting, point A , the angle of elevation from the ship to the light was 7° . A short time later, at point D , the angle of elevation was 16° .



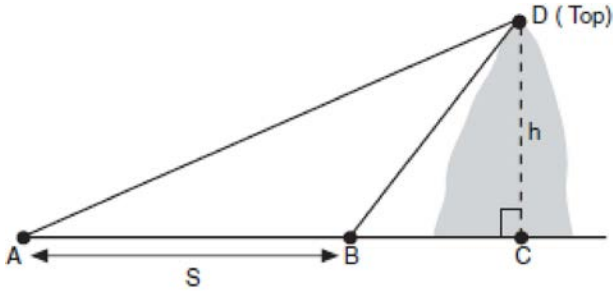
To the nearest foot, determine and state how far the ship traveled from point A to point D .

- 7 Cathy wants to determine the height of the flagpole shown in the diagram below. She uses a survey instrument to measure the angle of elevation to the top of the flagpole, and determines it to be 34.9° . She walks 8 meters closer and determines the new measure of the angle of elevation to be 52.8° . At each measurement, the survey instrument is 1.7 meters above the ground.

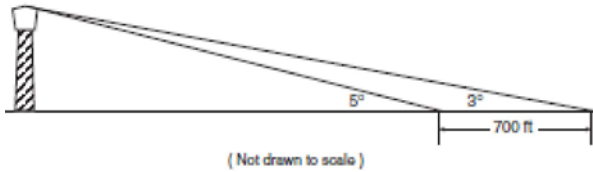


Determine and state, to the nearest tenth of a meter, the height of the flagpole.

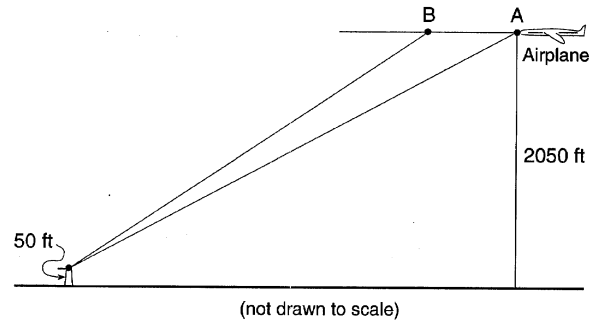
- 8 A ship at sea heads directly toward a cliff on the shoreline. The accompanying diagram shows the top of the cliff, D , sighted from two locations, A and B , separated by distance S . If $m\angle DAC = 30^\circ$, $m\angle DBC = 45^\circ$, and $S = 30$ feet, what is the height of the cliff, to the *nearest foot*?



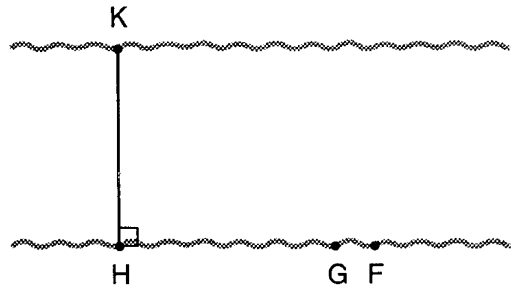
- 9 While sailing a boat offshore, Donna sees a lighthouse and calculates that the angle of elevation to the top of the lighthouse is 3° , as shown in the accompanying diagram. When she sails her boat 700 feet closer to the lighthouse, she finds that the angle of elevation is now 5° . How tall, to the *nearest tenth of a foot*, is the lighthouse?



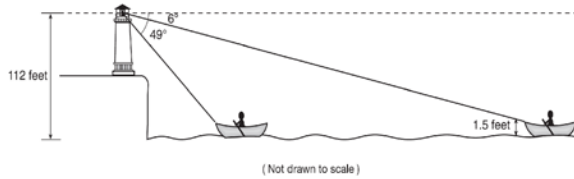
- 10 An airplane traveling at a level altitude of 2050 feet sights the top of a 50-foot tower at an angle of depression of 28° from point A . After continuing in level flight to point B , the angle of depression to the same tower is 34° . Find, to the *nearest foot*, the distance that the plane traveled from point A to point B .



- 11 To determine the distance across a river, a surveyor marked three points on one riverbank: H , G , and F , as shown below. She also marked one point, K , on the opposite bank such that $KH \perp HGF$, $m\angle KGH = 41^\circ$, and $m\angle KFH = 37^\circ$. The distance between G and F is 45 meters. Find KH , the width of the river, to the *nearest tenth of a meter*.



- 12 As shown below, a canoe is approaching a lighthouse on the coastline of a lake. The front of the canoe is 1.5 feet above the water and an observer in the lighthouse is 112 feet above the water.



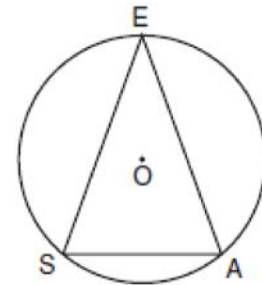
At 5:00, the observer in the lighthouse measured the angle of depression to the front of the canoe to be 6° . Five minutes later, the observer measured and saw the angle of depression to the front of the canoe had increased by 49° . Determine and state, to the *nearest foot per minute*, the average speed at which the canoe traveled toward the lighthouse.

- 13 A ship captain at sea uses a sextant to sight an angle of elevation of 37° to the top of a lighthouse. After the ship travels 250 feet directly toward the lighthouse, another sighting is made, and the new angle of elevation is 50° . The ship's charts show that there are dangerous rocks 100 feet from the base of the lighthouse. Find, to the *nearest foot*, how close to the rocks the ship is at the time of the second sighting.

- 14 A sign 46 feet high is placed on top of an office building. From a point on the sidewalk level with the base of the building, the angle of elevation to the top of the sign and the angle of elevation to the bottom of the sign are 40° and 32° , respectively. Sketch a diagram to represent the building, the sign, and the two angles, and find the height of the building to the *nearest foot*.

- 15 Freda, who is training to use a radar system, detects an airplane flying at a constant speed and heading in a straight line to pass directly over her location. She sees the airplane at an angle of elevation of 15° and notes that it is maintaining a constant altitude of 6250 feet. One minute later, she sees the airplane at an angle of elevation of 52° . How far has the airplane traveled, to the *nearest foot*? Determine and state the speed of the airplane, to the *nearest mile per hour*.

- 16 A machine part consists of a circular wheel with an inscribed triangular plate, as shown in the accompanying diagram. If $\overline{SE} \cong \overline{EA}$, $SE = 10$, and $m\widehat{SE} = 140$, find the length of \overline{SA} to the *nearest tenth*.



G.SRT.C.8: Using Trigonometry to Find a Side 4 Answer Section

1 ANS: 1

$$\cos 12.3 = \frac{\text{adjacent}}{1000} \quad \cos 26.4 = \frac{\text{adjacent}}{1000} \quad 977 - 895.7 = 81.3$$

$$\text{adjacent} \approx 977 \text{ feet} \quad \text{adjacent} \approx 895.7 \text{ feet}$$

REF: 080108b

2 ANS:

$$\tan 27 = \frac{9}{\overline{CD}} \quad \tan 57 = \frac{x+9}{\overline{CD}} \quad \frac{9}{\tan 27} = \frac{x+9}{\tan 57}$$

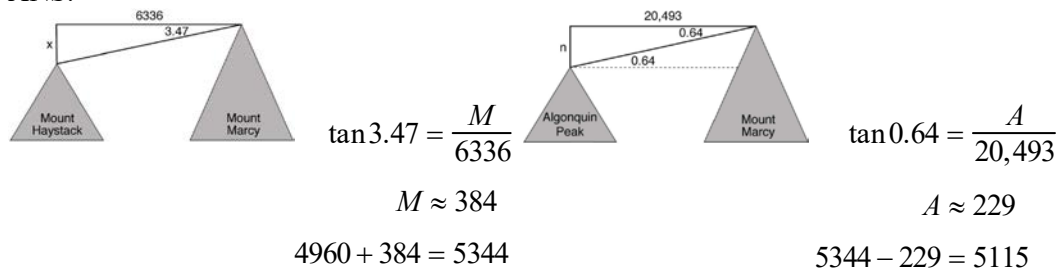
$$\overline{CD} = \frac{9}{\tan 27} \quad \overline{CD} = \frac{x+9}{\tan 57} \quad \tan 27(x+9) = 9 \tan 57$$

$$x+9 = \frac{9 \tan 57}{\tan 27}$$

$$x = \frac{9 \tan 57}{\tan 27} - 9 \approx 18.2$$

REF: 018938siii

3 ANS:



REF: fall1413geo

4 ANS:

$$41.4. \quad \tan 18 = \frac{x}{200} \quad \tan 28 = \frac{x}{200} \quad 106.34 - 64.98 \approx 41.4$$

$$x \approx 64.98 \quad x \approx 106.34$$

REF: 010838a

5 ANS:

$$\frac{100}{\sin 33} = \frac{x}{\sin 32} \cdot \sin 65 \approx \frac{T}{97.3} \quad \text{or} \quad \tan 32 = \frac{T}{x+100} \quad \tan 65 = \frac{T}{x}$$

$$x \approx 97.3 \quad t \approx 88 \quad x \tan 32 + 100 \tan 32 = T \quad x = \frac{T}{\tan 65}$$

$$x = \frac{T - 100 \tan 32}{\tan 32}$$

$$\frac{T - 100 \tan 32}{\tan 32} = \frac{T}{\tan 65}$$

$$T \tan 32 = T \tan 65 - 100 \tan 32 \tan 65$$

$$T \tan 32 - T \tan 65 = 100 \tan 32 \tan 65$$

$$T(\tan 32 - \tan 65) = 100 \tan 32 \tan 65$$

$$T = \frac{100 \tan 32 \tan 65}{\tan 32 - \tan 65} \approx 88$$

REF: 011236a2

6 ANS:

$$\tan 7 = \frac{125}{x} \quad \tan 16 = \frac{125}{y} \quad 1018 - 436 \approx 582$$

$$x \approx 1018 \quad y \approx 436$$

REF: 081532geo

7 ANS:

$$\tan 52.8 = \frac{h}{x} \quad x \tan 52.8 = x \tan 34.9 + 8 \tan 34.9 \quad \tan 52.8 \approx \frac{h}{9} \quad 11.86 + 1.7 \approx 13.6$$

$$h = x \tan 52.8$$

$$x \tan 52.8 - x \tan 34.9 = 8 \tan 34.9$$

$$x \approx 11.86$$

$$\tan 34.9 = \frac{h}{x+8}$$

$$x(\tan 52.8 - \tan 34.9) = 8 \tan 34.9$$

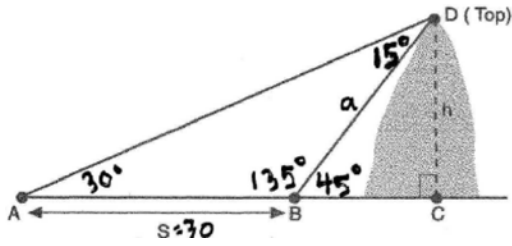
$$x = \frac{8 \tan 34.9}{\tan 52.8 - \tan 34.9}$$

$$h = (x+8) \tan 34.9$$

$$x \approx 9$$

REF: 011636geo

8 ANS:



$$\frac{\alpha}{\sin 30} = \frac{30}{\sin 15}$$

$$\alpha = \frac{30 \sin 30}{\sin 15} \quad \sin 45 \approx \frac{h}{58} \quad \text{or} \quad h \approx 41$$

$$\alpha \approx 58$$

$$\tan 30 = \frac{h}{BC + 30}$$

$$\tan 30(BC + 30) = h$$

$$\overline{BC} + 30 = \frac{h}{\tan 30}$$

$$\overline{BC} = \frac{h}{\tan 30} - 30$$

$$\tan 45 = \frac{h}{BC} \quad \frac{h}{\tan 30} - 30 = \frac{h}{\tan 45}$$

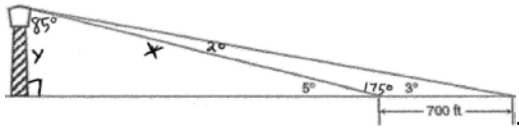
$$\overline{BC} = \frac{h}{\tan 45} \quad \frac{h}{\tan 30} - \frac{h}{\tan 45} = 30$$

$$h \left(\frac{1}{\tan 30} - \frac{1}{\tan 45} \right) = 30$$

$$h = \frac{30}{\frac{1}{\tan 30} - \frac{1}{\tan 45}} \approx 41$$

REF: 060231b

9 ANS:



$$\frac{x}{\sin 3} = \frac{700}{\sin 2}$$

$$x = \frac{700 \sin 3}{\sin 2} \quad \sin 5 \approx \frac{y}{1049.7} \quad \text{or } \tan 5 = \frac{L}{z} \quad \tan 3 = \frac{L}{z+700}$$

$$x \approx 1049.7 \quad y \approx 91.5$$

$$z = \frac{L}{\tan 5} \quad z = \frac{L}{\tan 3} - 700$$

$$\frac{L}{\tan 5} = \frac{L}{\tan 3} - 700$$

$$\frac{L}{\tan 5} - \frac{L}{\tan 3} = -700$$

$$L \left(\frac{1}{\tan 5} - \frac{1}{\tan 3} \right) = -700$$

$$L = \frac{-700}{\frac{1}{\tan 5} - \frac{1}{\tan 3}} \approx 91.5$$

REF: 060332b

10 ANS:

$$\tan 34 = \frac{2000}{x} \quad \tan 28 = \frac{2000}{x+y} \quad \frac{2000}{\tan 34} = \frac{2000 - y \tan 28}{\tan 28}$$

$$x = \frac{2000}{\tan 34} \quad x \tan 28 + y \tan 28 = 2000 \quad \frac{2000 \tan 28}{\tan 34} = 2000 - y \tan 28$$

$$x \tan 28 = 2000 - y \tan 28 \quad \frac{2000 \tan 28}{\tan 34} - 2000 = -y \tan 28$$

$$x = \frac{2000 - y \tan 28}{\tan 28} \quad y = \frac{\frac{2000 \tan 28}{\tan 34} - 2000}{-\tan 28} \approx 796$$

REF: 019642siii

11 ANS:

$$\tan 41 = \frac{KH}{x} \quad \tan 37 = \frac{KH}{x+45} \quad \frac{KH}{\tan 41} = \frac{KH - 45 \tan 37}{\tan 37}$$

$$x = \frac{KH}{\tan 41} \quad x \tan 37 + 45 \tan 37 = KH \quad KH \tan 37 = KH \tan 41 - 45 \tan 37 \tan 41$$

$$x \tan 37 = KH - 45 \tan 37 \quad KH \tan 37 - KH \tan 41 = -45 \tan 37 \tan 41$$

$$x = \frac{KH - 45 \tan 37}{\tan 37} \quad KH(\tan 37 - \tan 41) = -45 \tan 37 \tan 41$$

$$KH = \frac{-45 \tan 37 \tan 41}{\tan 37 - \tan 41} \approx 254.7$$

REF: 089941siii

12 ANS:

x represents the distance between the lighthouse and the canoe at 5:00; y represents the distance between the

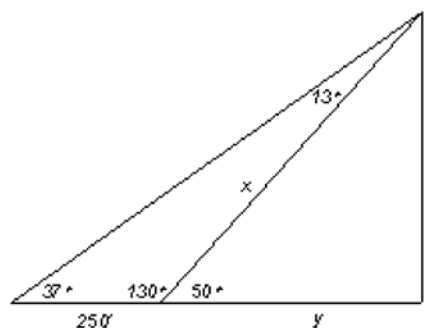
lighthouse and the canoe at 5:05. $\tan 6 = \frac{112 - 1.5}{x}$ $\tan(49 + 6) = \frac{112 - 1.5}{y}$ $\frac{1051.3 - 77.4}{5} \approx 195$

$$x \approx 1051.3$$

$$y \approx 77.4$$

REF: spr1409geo

13 ANS:



$$\frac{250}{\sin 13} = \frac{x}{\sin 37}$$

$$x = \frac{250 \sin 37}{\sin 13} \quad \cos 50 = \frac{y}{668.8} \quad \text{Because the rocks are 100 feet from}$$

$$x \approx 668.8$$

$$y \approx 430$$

the base, the ship is 330 (430-100) feet from the rocks at the second sighting. or $\tan 50 = \frac{L}{z + 100}$

$$L = z \tan 50 + 100 \tan 50$$

$$\tan 37 = \frac{L}{z + 350}$$

$$z \tan 37 + 350 \tan 37 = z \tan 50 + 100 \tan 50$$

$$L = z \tan 37 + 350 \tan 37$$

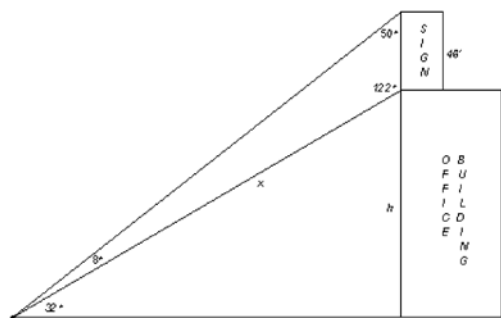
$$z \tan 37 - z \tan 50 = 100 \tan 50 - 350 \tan 37$$

$$z(\tan 37 - \tan 50) = 100 \tan 50 - 350 \tan 37$$

$$z = \frac{100 \tan 50 - 350 \tan 37}{\tan 37 - \tan 50} \approx 330$$

REF: 010334b

14 ANS:



134.
$$\frac{x}{\sin 50} = \frac{46}{\sin 8}$$

$$x = \frac{46 \sin 50}{\sin 8} \quad \sin 32 \approx \frac{h}{2532} \quad \text{or } \tan 32 = \frac{h}{z}$$

$$x \approx 2532 \quad h \approx 134 \quad z = \frac{h}{\tan 32}$$

$$\tan 40 = \frac{h + 46}{z} \quad \frac{h}{\tan 32} = \frac{h + 46}{\tan 40}$$

$$z = \frac{h + 46}{\tan 40} \quad h \tan 40 = h \tan 32 + 46 \tan 32$$

$$h \tan 40 - h \tan 32 = 46 \tan 32$$

$$h(\tan 40 - \tan 32) = 46 \tan 32$$

$$h = \frac{46 \tan 32}{\tan 40 - \tan 32} \approx 134$$

REF: 010534b

15 ANS:

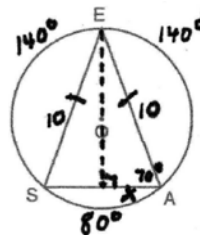
$$\tan 15 = \frac{6250}{x} \quad \tan 52 = \frac{6250}{y} \quad 23325.3 - 4883 = 18442 \quad \frac{18442 \text{ ft}}{1 \text{ min}} \left(\frac{1 \text{ mi}}{5280 \text{ ft}} \right) \left(\frac{60 \text{ min}}{1 \text{ h}} \right) \approx 210$$

$$x \approx 23325.3 \quad y \approx 4883$$

REF: 061736geo

16 ANS:

6.8. Equal chords intercept equal arcs. If $m\widehat{SE} = 140$, then $m\widehat{AE} = 140$. And $m\widehat{AS} = 80$ ($360 - (140 + 140)$). The measure of an inscribed angle is half that of its intercepted arc. So $m\angle A = 70$. Draw altitude \overline{EA} and use the cosine function to find the leg of the right triangle created,



which is half the length of \overline{SA} .
$$\cos 70 = \frac{x}{10}$$

$$x \approx 3.4 \times 2 \approx 6.8$$

REF: 080629b