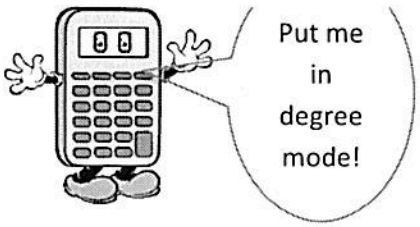
Name: Key

UNIT 6



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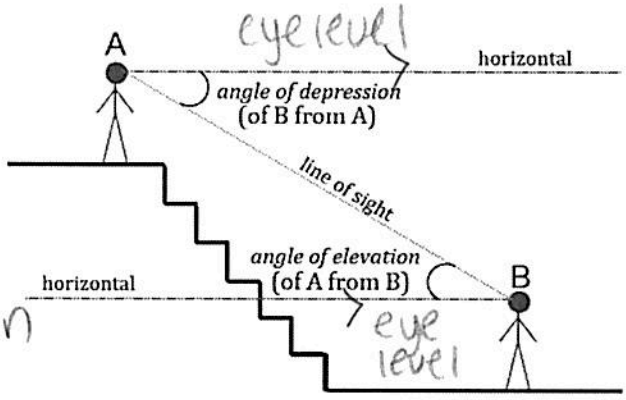
LESSON 4

AIM: HOW DO WE EVALUATE PROBLEMS INVOLVING ANGLE OF ELEVATION/ANGLE OF DEPRESSION?

Do Now: Consider the image to the right.



a. How would you describe the angle of elevation?

The line of sight looking up @ a person/object

b. How would you describe the angle of depression?

The line of sight looking down @ a person/object

c. In a case where two viewers can observe each other, such as in the above diagram, what do you notice about the angle of elevation and the angle of depression? Why?

They are ≅ & measures b/c the eyelevels are parallel forming alt. int. ∠'s

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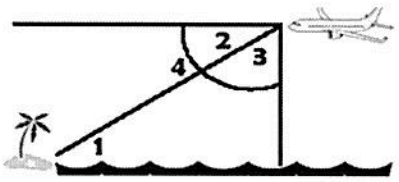
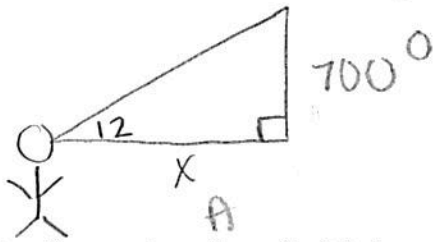
1. In the diagram to the right a line of sight is shown from a plane to an island. Fill in the blanks below using the diagram.

a. In the diagram the angle of elevation is 1

b. In the diagram the angle of depression is 2



2. Jason, 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 his location. He sees the airplane at an angle of elevation of 12° and notes that it is maintaining a constant altitude of 7000 feet. Determine the horizontal distance from Jason to a point directly below airplane at this time, to the nearest tenth. → height!



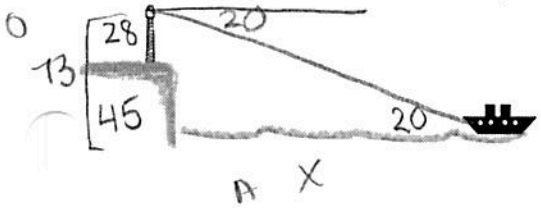
$\frac{\tan 12}{1} = \frac{700}{x}$

$700 = x \tan 12$

$\frac{700}{\tan 12} = \frac{x \tan 12}{\tan 12}$

$x = 32932.4 \text{ ft}$

3. Standing on the gallery of a lighthouse, a person spots a ship at an angle of depression of 20°. The lighthouse is 28 m tall and sits on a cliff 45 m tall as measured from sea level. What is the horizontal distance, to the nearest meter, between the lighthouse and the ship? Sketch a diagram to support your answer.



$\frac{\tan 20}{1} = \frac{13}{x}$

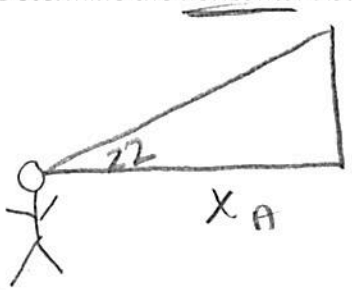
$13 = x \tan 20$

$\frac{13}{\tan 20} = \frac{x \tan 20}{\tan 20}$

$x = 201 \text{ m}$

4. Kevin, 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 his location. He sees the airplane at an angle of elevation of 22° and notes that it is maintaining a constant altitude of 5145 feet.

a) Determine the horizontal distance from Kevin to a point directly below airplane at this time, to the nearest tenth.

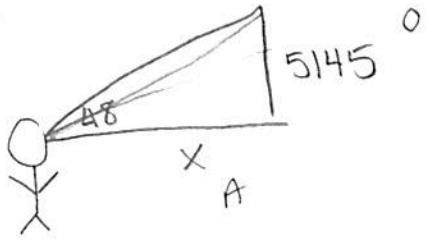


$\frac{\tan 22}{1} = \frac{5145}{x}$

$\frac{5145}{\tan 22} = \frac{x \tan 22}{\tan 22}$

$x = 12734.3 \text{ ft}$

b) One minute later, he sees the airplane maintaining the constant altitude but now at an angle of elevation of 48°. Determine the horizontal distance from Kevin to a point directly below the airplane at this time, to the nearest tenth.



$\frac{\tan 48}{1} = \frac{5145}{x}$

$\frac{5145}{\tan 48} = \frac{x \tan 48}{\tan 48}$

$x = 4632.6 \text{ ft}$

c) How far has the airplane traveled in this one minute time frame, to the *nearest foot*?

$12734.3 - 4632.6 = 8101.7 \approx 8102 \text{ ft/min}$

d) Determine and state the speed of the airplane, to the *nearest mile per hour*. [Use the conversions chart from your reference sheet below.]

$\frac{\text{ft}}{\text{mile}} \quad \frac{8102 \text{ ft}}{x} = \frac{5280 \text{ ft}}{1 \text{ mile}}$

$\frac{5280x}{5280} = \frac{8102}{5280}$

$x = 1.534469697 \text{ mi/min}$

$\times 60 = 92 \text{ mi/hr}$

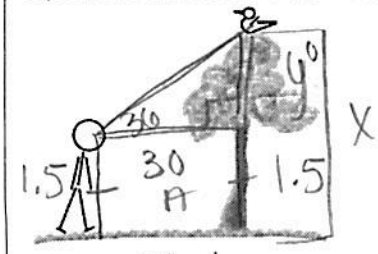
* need to convert to hours! 60 min = 1 hr *

Common Core High School Math Reference Sheet
(Algebra I, Geometry, Algebra II)

CONVERSIONS

1 inch = 2.54 centimeters	1 kilometer = 0.62 mile	1 cup = 8 fluid ounces
1 meter = 39.37 inches	1 pound = 16 ounces	1 pint = 2 cups
1 mile = 5280 feet	1 pound = 0.454 kilograms	1 quart = 2 pints
1 mile = 1760 yards	1 kilogram = 2.2 pounds	1 gallon = 4 quarts
1 mile = 1.609 kilometers	1 ton = 2000 pounds	1 gallon = 3.785 liters
		1 liter = 0.264 gallon
		1 liter = 1000 cubic centimeters

5. Scott, whose eye level is 1.5 m above the ground, stands 30 m from a tree. The angle of elevation of a bird at the top of the tree is 36°. How far above ground, to the nearest tenth of a meter, is the bird?



Plan: ① Find 'y' using SOHCAHTOA
② Add 1.5 for height of tree

30 ↳ rectangle!

$\frac{\tan 36}{1} = \frac{y}{30}$

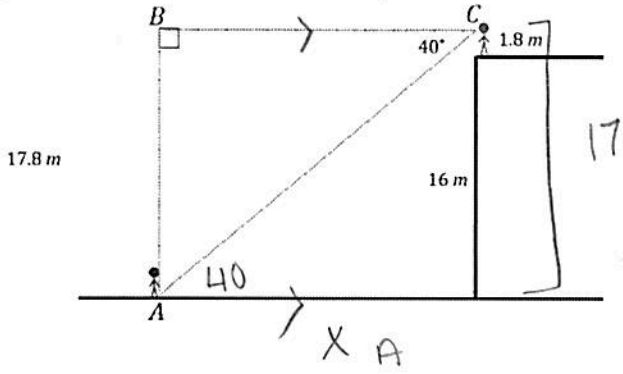
$y = 30 \tan 36$

$y = 21.7962$

$+1.5$

23.3 m

6. From an angle of depression of 40°, John watches his friend approach his building while standing on the rooftop. The rooftop is 16 m from the ground, and John's eye level is at about 1.8 m from the rooftop. What is the distance, to the nearest tenth of a meter, between John's friend and the building?



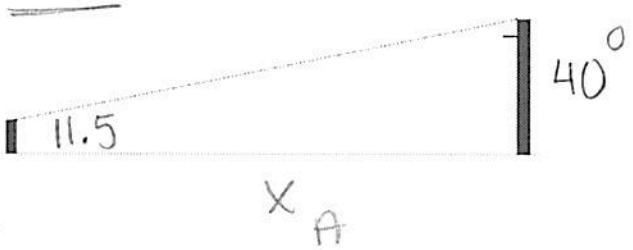
17.8m
0

$\frac{\tan 40}{1} = \frac{17.8}{x}$

$\frac{17.8}{\tan 40} = \frac{x \tan 40}{\tan 40}$

$x = 21.2\text{m}$

7. Samuel is at the top of a tower and will ride a trolley down a zip-line to a lower tower. The total vertical drop of the zip-line is 40 ft. The zip line's angle of elevation from the lower tower is 11.5°. What is the horizontal distance between the towers?

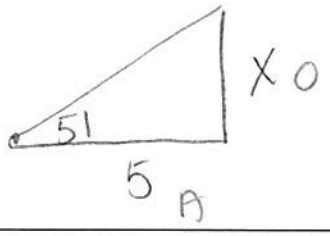


$\frac{\tan 11.5}{1} = \frac{40}{x}$

$\frac{40}{\tan 11.5} = \frac{x \tan 11.5}{\tan 11.5}$

$x = 196.6\text{ ft}$

8. An anchor cable supports a vertical utility pole forming a 51° angle with the ground. The cable is attached to the top of the pole. If the distance from the base of the pole to the base of the cable is 5 meters, how tall, to the nearest hundredth of a meter, is the pole?

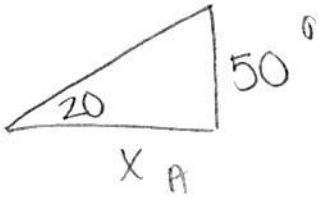


$\frac{\tan 51}{1} = \frac{x}{5}$

$x = 5 \tan 51$

$x = 6.17\text{ m}$

9. Suppose the angle of elevation to the top of a light pole is 20°. The light pole is 50 feet tall. How far are you standing from the pole?



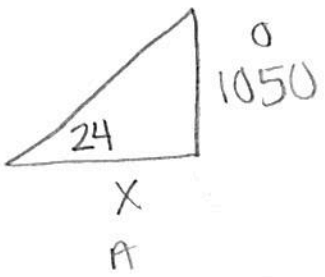
$\frac{\tan 20}{1} = \frac{50}{x}$

$\frac{50}{\tan 20} = \frac{x \tan 20}{\tan 20}$

$x = 137.4\text{ ft}$

10. Zoha, who is training to use a radar system, detects a blimp 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 24° and notes that it is maintaining a constant altitude of 1050 feet.

a) Determine the horizontal distance from Zoha to a point directly below airplane at this time, to the nearest tenth.

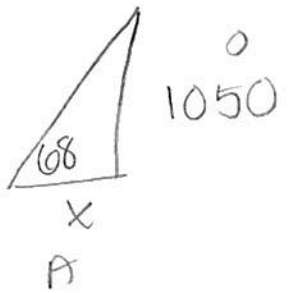


$\frac{\tan 24}{1} = \frac{1050}{x}$

$\frac{1050}{\tan 24} = \frac{x \tan 24}{\tan 24}$

$x = 2358.3 \text{ ft}$

b) One minute later, she sees the airplane maintaining the constant altitude but now at an angle of elevation of 68°. Determine the horizontal distance from Zoha to a point directly below the airplane at this time, to the nearest tenth.



$\frac{\tan 68}{1} = \frac{1050}{x}$

$\frac{1050}{\tan 68} = \frac{x \tan 68}{\tan 68}$

$x = 424.2$

c) How far has the airplane traveled in this one minute time frame, to the *nearest foot*?

$2358.3 - 424.2 = 1934.1 \approx 1934 \text{ ft/min}$

d) Determine and state the speed of the airplane, to the *nearest mile per hour*. [Use the conversions chart from your reference sheet below.]

$\frac{ft}{mi} = \frac{1934 ft}{x mi} = \frac{5280 ft}{1 mi}$

$\frac{1934}{5280} = \frac{5280x}{5280}$

$x = .366288 \text{ mi/min}$

$\times 60$

$21.977 \approx 22 \text{ mi/hr}$

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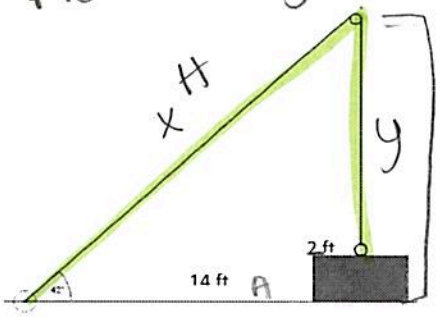
(Algebra I, Geometry, Algebra II)

CONVERSIONS

1 inch = 2.54 centimeters	1 kilometer = 0.62 mile	1 cup = 8 fluid ounces
1 meter = 39.37 inches	1 pound = 16 ounces	1 pint = 2 cups
1 mile = 5280 feet	1 pound = 0.454 kilograms	1 quart = 2 pints
1 mile = 1760 yards	1 kilogram = 2.2 pounds	1 gallon = 4 quarts
1 mile = 1.609 kilometers	1 ton = 2000 pounds	1 gallon = 3.785 liters
		1 liter = 0.264 gallon
		1 liter = 1000 cubic centimeters

11. A winch is a tool that rotates a cylinder, around which a cable is wound. When the winch rotates in one direction, it draws the cable in. Joey is using a winch and a pulley (as shown in the diagram) to raise a heavy box off the floor and onto a cart. The box is 2 ft. tall, and the winch is 14 ft. horizontally from where cable drops down vertically from the pulley. The angle of elevation to the pulley is 42°. What is the approximate length of cable required to connect the winch and the box?



Plan: x + y = cable

Find y:

$\frac{\tan 42}{1} = \frac{y}{14}$

$y = 14 \tan 42$

$y = 12.6056$

$y = 10.6056$

Find this 1st

then -2

Find x:

$\frac{\cos 42}{1} = \frac{14}{x}$

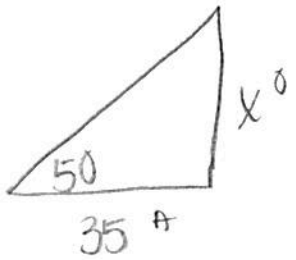
$\frac{14 = x \cos 42}{\cos 42 \quad \cos 42}$

$x = 18.8388$

$+ 10.6056$

29.4 ft

12. Suppose the angle of elevation of the top of a tree is 50°. If you are standing 35 feet from the tree, how tall is the tree?

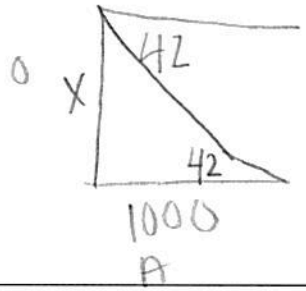


$\frac{\tan 50}{1} = \frac{x}{35}$

$x = 35 \tan 50$

$x = 41.7$ ft

13. At an angle of depression of 42°, an airplane pilot is able to view a target that is at a distance of 1,000 meters from the pilot. Find to the nearest 10 meters, the altitude of the plane.



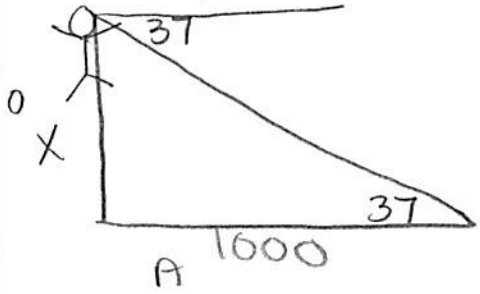
$\frac{\tan 42}{1} = \frac{x}{1000}$

$x = 1000 \tan 42$

$x = 669.1306$

$x = 670$ m

14. A man observes the angle of depression from the top of a cliff overlooking the ocean to a ship to be 37°. If at this moment the ship is 1,000 meters from the foot of the cliff, find, to the nearest meter, the height of the cliff.



$\frac{\tan 37}{1} = \frac{x}{1000}$

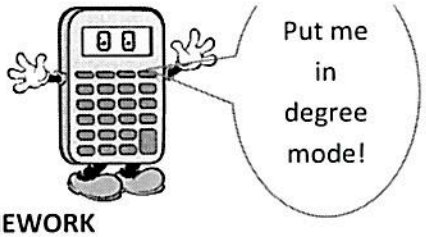
$x = 1000 \tan 37$

$x = 753.5540$

$x = 754$ m

Name: _____

UNIT 6



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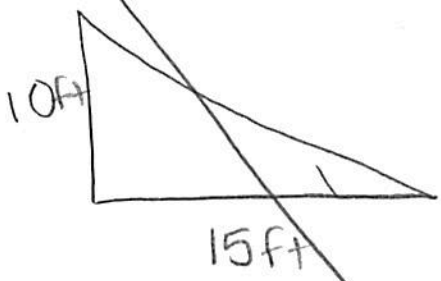
LESSON 4

HOMEWORK

1. At noon, a tree having a height of 10 feet casts a shadow 15 feet in length. Find, to the nearest degree, the angle of elevation of the sun at this time.

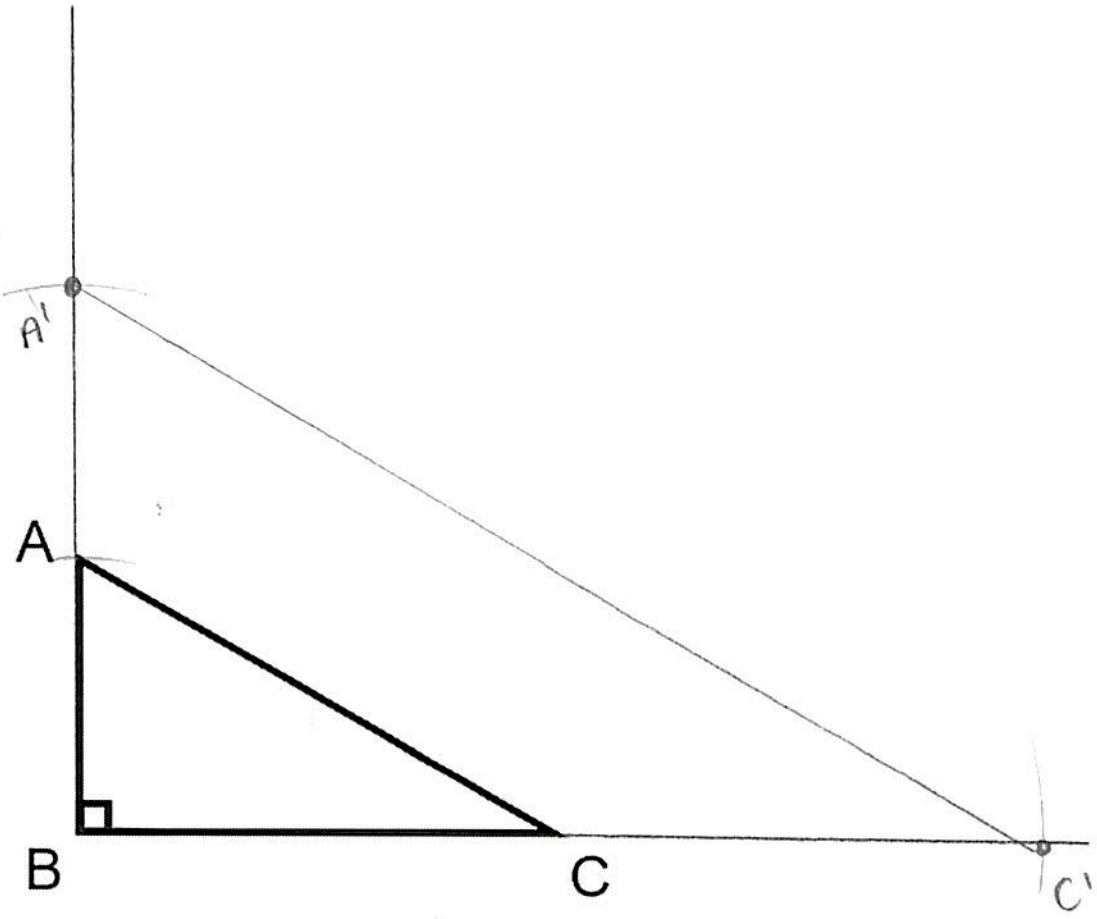


2. When the altitude of a plane is 800 meters, the pilot spots a target at a distance of 1,200 meters. At what angle of depression does the pilot observe the target?

DO NOT DO!

3. Find, to the nearest degree, the angle of elevation of the sun when a man 6 feet tall casts a shadow 4 feet long.

4. Triangle ABC is shown below, with $\overline{AB} \perp \overline{BC}$. Using a compass and straightedge, construct $\Delta A'B'C'$, the dilation of $\triangle ABC$ centered at B with a scale factor of 2. *[Leave all construction marks.]*



Is $\triangle ABC$ similar to $\Delta A'B'C'$? Explain why.

yes b/c dilations preserve ∠ measure and keep sides in proportion making $\Delta ABC \sim \Delta A'B'C'$

If $AB = 4$ and the $BC = 6$, find the measure of $\overline{A'C'}$. Round your answer to the nearest hundredth.

$4^2 + 6^2 = x^2$

$\sqrt{52} = \sqrt{x^2}$

$x = 7.21$

$\times 2 \rightarrow$ scale factor!

14.42