

SCAVENGER HUNT



ANGLES OF ELEVATION AND DEPRESSION

Where Does the Angle Go?

Lighthouses, drones, kites and towers · angles of elevation and depression · the cards check the answers

FREE

ANSWER

203 ft

A straight kite string runs from a stake on level ground to a kite. The string is 366 feet long. The angle of elevation from the stake to the kite is 33° .

How high above the ground is the kite? Round to the nearest foot.

Draw the horizontal line at the eye first. Does your angle touch it?

H

chooseyourlesson.com

1. **Tape the 16 cards around the room**, in any order. Each card has a large letter in its bottom left corner. Start each group at a *different* one of these eight cards: *H A J P G B N F*.
2. **Say this once:** *“First draw the right triangle in the box on your sheet. Draw the horizontal line at the eye. The angle goes between that line and the line of sight. Use a calculator in degree mode. Round to the nearest foot. Then walk to the card with that number at the top.”*
3. **Each group writes one line per card.** Eight right answers bring the group back to its first card.

16 cards	pages 3–10, one copy. There are two cards on each sheet. Cut the whole stack once.
Record sheet	page 11, one per student. It shows the angle of elevation and the angle of depression as drawings.
Answers	pages 12–13, for you only. Do not put them up in the room.

No card has a drawing. Each card tells a sighting in words: a keeper on a lighthouse looking down at a boat, a kite on its string, a radio tower seen from the ground. One length and one angle are given. The student draws the right triangle and decides where the angle goes. That decision is the hard part of this lesson. Eight cards look up (an angle of elevation) and eight look down (an angle of depression).

Eight of the sixteen cards make the ring. A group reaches the other eight only by a wrong answer, but all the cards look the same. The wrong answer each ring card catches is the most common mistake of this lesson: the angle is put against the wall, the cliff or the tower, instead of against the horizontal line. For example, card A gives 181 ft and 71° . The right answer is 62 ft. A group that puts the 71° between the line of sight and the wall gets 526 ft and walks to that card. That card sends the group to the card it got wrong.

The check is the length of the group’s list. A clean run is **eight lines**. Each wrong answer adds two. Every card has a line in small type under the question. It tells a group that arrived by a wrong answer what to check. A group that arrived by a right answer skips it. If a group keeps coming back to the same cards, do not give the answer. Ask: *“Where is the horizontal line at the eye in your drawing? Which two lines does your angle sit between?”*



This is the free lesson this activity came from. The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.
chooseyourlesson.com — 135 free geometry lessons.

ANSWER

199 ft

A keeper on a lighthouse looks down at a boat on the level sea. Her eyes are 181 feet above the sea. The angle of depression from her eyes to the boat is 71° .

How far is the boat from the foot of the lighthouse? Round to the nearest foot.

The angle of depression starts at the horizontal line, never at the wall.

A

chooseyourlesson.com

ANSWER

66 ft

A hiker on a cliff top looks down at a tent on the level ground. Her eyes are 221 feet above the ground. The angle of depression from her eyes to the tent is 64° .

How far is the tent from the foot of the cliff? Round to the nearest foot.

The level ground and the horizontal line at the eye are parallel lines.

B

chooseyourlesson.com

ANSWER

307 ft

A straight kite string runs from a stake on level ground to a kite. The string is 242 feet long. The angle of elevation from the stake to the kite is 33° .

How far is the stake from the point right below the kite? Round to the nearest foot.

The angle of elevation is an angle in degrees. It is not a height.

C

chooseyourlesson.com

ANSWER

458 ft

A balloon is tied by a straight rope to a stake on level ground. The rope is 390 feet long. The angle of elevation from the stake to the balloon is 69° .

How far is the stake from the point right below the balloon? Round to the nearest foot.

The two acute angles of a right triangle always add up to a right angle.

D

chooseyourlesson.com

ANSWER

526 ft

A keeper on a lighthouse looks down at a boat on the level sea. The boat is 190 feet from the foot of the lighthouse. The angle of depression from her eyes to the boat is 17° .

How long is the straight line from her eyes to the boat? Round to the nearest foot.

Is the angle between the horizontal line and the line of sight on your drawing?

E

chooseyourlesson.com

ANSWER

120 ft

A balloon is tied by a straight rope to a stake on level ground. The rope is 216 feet long. The angle of elevation from the stake to the balloon is 20° .

How far is the stake from the point right below the balloon? Round to the nearest foot.

Check the calculator. It must be in degree mode.

F

chooseyourlesson.com

ANSWER

179 ft

A drone camera looks down at a cone on a level field. The cone is 130 feet from the point of the field right below the drone. The angle of depression from the camera to the cone is 27° .

How high above the field is the camera? Round to the nearest foot.

Write both acute angles of your triangle. Which one touches the horizontal line?

G

chooseyourlesson.com

ANSWER

203 ft

A straight kite string runs from a stake on level ground to a kite. The string is 366 feet long. The angle of elevation from the stake to the kite is 33° .

How high above the ground is the kite? Round to the nearest foot.

Draw the horizontal line at the eye first. Does your angle touch it?

H

chooseyourlesson.com

ANSWER

62 ft

Maya looks down from a balcony at a bus stop on the level street. Her eyes are 48 feet above the street. The angle of depression from her eyes to the bus stop is 20° .

**How long is the straight line from her eyes to the bus stop?
Round to the nearest foot.**

Is the line of sight the longest side of your triangle?

J

chooseyourlesson.com

ANSWER

453 ft

Leo looks down from a bridge at a boat on the level river. The straight line from his eyes to the boat is 274 feet long. The angle of depression from his eyes to the boat is 14° .

How high above the water are his eyes? Round to the nearest foot.

Does the answer make sense for this place? Picture the real distance.

K

chooseyourlesson.com

ANSWER

51 ft

Ben lies on level ground and looks up at the top of a straight tree. Ben is 248 feet from the foot of the tree. The angle of elevation from Ben to the top of the tree is 14° .

How tall is the tree? Round to the nearest foot.

A steep line of sight goes with a large angle of elevation.

L

chooseyourlesson.com

ANSWER

74 ft

Maya looks down from a balcony at a bus stop on the level street. Her eyes are 84 feet above the street. The angle of depression from her eyes to the bus stop is 35° .

How far is the bus stop from the foot of the building? Round to the nearest foot.

Mark the right angle where the vertical line meets the level ground.

M

chooseyourlesson.com

ANSWER

108 ft

From a boat on the level sea, Kim looks up at the top of a cliff. The boat is 97 feet from the foot of the cliff. The angle of elevation from the boat to the top of the cliff is 36° .

**How long is the straight line from the boat to the top of the cliff?
Round to the nearest foot.**

Which side is opposite the angle? Which side touches it? Name both before the ratio.

N

chooseyourlesson.com

ANSWER

140 ft

Ana lies on level ground and looks up at the top of a straight tower. Ana is 286 feet from the foot of the tower. The angle of elevation from Ana to the top of the tower is 32° .

How tall is the tower? Round to the nearest foot.

Is the angle of elevation under half a right angle? Then the height is less than the distance.

P

chooseyourlesson.com

ANSWER

165 ft

Ana lies on level ground and looks up at the top of a straight tower. Ana is 105 feet from the foot of the tower. The angle of elevation from Ana to the top of the tower is 14° .

**How long is the straight line from Ana to the top of the tower?
Round to the nearest foot.**

Is the unknown on the bottom of the fraction? Then the final step is a division.

Q

chooseyourlesson.com

ANSWER

255 ft

A drone camera looks down at a cone on a level field. The camera is 170 feet above the field. The angle of depression from the camera to the cone is 72° .

**How long is the straight line from the camera to the cone?
Round to the nearest foot.**

The vertical line is never where an angle of elevation or depression starts.

R

chooseyourlesson.com

Scavenger Hunt — where I went

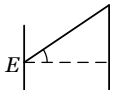
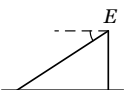
Elevation and depression

Name _____

Period _____

Date _____

Draw the right triangle first, on one line below. Draw the horizontal line at the eye and mark the angle. Use a calculator in degree mode. Round your answer to the nearest foot. Then find the card with your answer at the top. A clean run is eight lines. Each card has a line in small type under the question. **If you are on a card because you went wrong, its line says what to check. If you were right, skip it.**

 Angle of elevation: from the horizontal line at the eye E up to the line of sight.	 Angle of depression: from the horizontal line at the eye E down to the line of sight.	
The dashed line is the horizontal line at the eye. If the eye is on level ground, the ground is that line.	The line of sight runs from the eye to the thing seen. It is always the hypotenuse.	Ground is level. Cliffs, towers, poles and walls stand straight up.

Card letter	My right triangle	My answer
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Why did the angle of depression feel sad?

Every number stands for a letter. Write the letter for each answer in the box above its number. Read the boxes you filled, left to right. **If they do not spell the answer, one of your answers is wrong.**

51 = W 62 = I 66 = T 74 = O 108 = W 120 = A 140 = S 165 = L 179 = L 199 = O 203 = W 255 = S 307 = A
453 = T 458 = I 526 = W

51	62	66	74	108	120	140	165	179	199	203	255	307	453	458	526	



135 free geometry lessons — worksheets, worked answers and lesson plans.
chooseyourlesson.com

Scavenger Hunt — answers

For the teacher

The ring in order, with the answer found on each card. A group may begin anywhere on it. Wherever it begins, eight right answers bring it back to that card. Every answer is rounded to the nearest foot, with the calculator in degree mode.

H (199 ft) → A (62 ft) → J (140 ft) → P (179 ft) → G (66 ft) → B (108 ft) → N (120 ft) → F (203 ft) → H

Why did the angle of depression feel sad? The answer is *IT WAS LOW!* It is read along the boxes of the record sheet, which run from the smallest number to the largest.

Card	The question on the card	Answer, and why	The wrong answer it catches	Letter of its top
1 H	A straight kite string runs from a stake on level ground to a kite. The string is 366 feet long. The angle of elevation from the stake to the kite is 33° . How high above the ground is the kite?	199 ft. The 33° stands at the ground. From it, the line of sight (366 ft) is the hypotenuse and the height is the opposite side. $x = 366 \times \sin 33^\circ = 199.34$.	307 ft. The 33° is put against the vertical line at the top: $x = 366 \times \cos 33^\circ = 306.95$.	W
2 A	A keeper on a lighthouse looks down at a boat on the level sea. Her eyes are 181 feet above the sea. The angle of depression from her eyes to the boat is 71° . How far is the boat from the foot of the lighthouse?	62 ft. The 71° stands at the far end, on the ground. From it, the height (181 ft) is the opposite side and the distance along the ground is the adjacent side. $x = 181 \div \tan 71^\circ = 62.32$.	526 ft. The 71° is put against the vertical line under the eyes: $x = 181 \times \tan 71^\circ = 525.66$.	O
3 J	Maya looks down from a balcony at a bus stop on the level street. Her eyes are 48 feet above the street. The angle of depression from her eyes to the bus stop is 20° . How long is the straight line from her eyes to the bus stop?	140 ft. The 20° stands at the far end, on the ground. From it, the height (48 ft) is the opposite side and the line of sight is the hypotenuse. $x = 48 \div \sin 20^\circ = 140.34$.	51 ft. The 20° is put against the vertical line under the eyes: $x = 48 \div \cos 20^\circ = 51.08$.	I
4 P	Ana lies on level ground and looks up at the top of a straight tower. Ana is 286 feet from the foot of the tower. The angle of elevation from Ana to the top of the tower is 32° . How tall is the tower?	179 ft. The 32° stands at the ground. From it, the distance along the ground (286 ft) is the adjacent side and the height is the opposite side. $x = 286 \times \tan 32^\circ = 178.71$.	458 ft. The 32° is put against the vertical line at the top: $x = 286 \div \tan 32^\circ = 457.70$.	S
5 G	A drone camera looks down at a cone on a level field. The cone is 130 feet from the point of the field right below the drone. The angle of depression from the camera to the cone is 27° . How high above the field is the camera?	66 ft. The 27° stands at the far end, on the ground. From it, the distance along the ground (130 ft) is the adjacent side and the height is the opposite side. $x = 130 \times \tan 27^\circ = 66.24$.	255 ft. The 27° is put against the vertical line under the eyes: $x = 130 \div \tan 27^\circ = 255.14$.	L
6 B	A hiker on a cliff top looks down at a tent on the level ground. Her eyes are 221 feet above the ground. The angle of depression from her eyes to the tent is 64° . How far is the tent from the foot of the cliff?	108 ft. The 64° stands at the far end, on the ground. From it, the height (221 ft) is the opposite side and the distance along the ground is the adjacent side. $x = 221 \div \tan 64^\circ = 107.79$.	453 ft. The 64° is put against the vertical line under the eyes: $x = 221 \times \tan 64^\circ = 453.12$.	T
7 N	From a boat on the level sea, Kim looks up at the top of a cliff. The boat is 97 feet from the foot of the cliff. The angle of elevation from the boat to the top of the cliff is 36° . How long is the straight line from the boat to the top of the cliff?	120 ft. The 36° stands at the ground. From it, the distance along the ground (97 ft) is the adjacent side and the line of sight is the hypotenuse. $x = 97 \div \cos 36^\circ = 119.90$.	165 ft. The 36° is put against the vertical line at the top: $x = 97 \div \sin 36^\circ = 165.03$.	W
8 F	A balloon is tied by a straight rope to a stake on level ground. The rope is 216 feet long. The angle of elevation from the stake to the balloon is 20° . How far is the stake from the point right below the balloon?	203 ft. The 20° stands at the ground. From it, the line of sight (216 ft) is the hypotenuse and the distance along the ground is the adjacent side. $x = 216 \times \cos 20^\circ = 202.97$.	74 ft. The 20° is put against the vertical line at the top: $x = 216 \times \sin 20^\circ = 73.88$.	A

Scavenger Hunt — the cards off the ring

For the teacher

A group reaches these eight cards only by a wrong answer. The number at the top of each one is the wrong answer from one ring card. Its right answer is the number at the top of that ring card, so the group goes to the card it got wrong and tries it again. If the group makes the same kind of mistake here, its answer is at the top of no ring card. So a second wrong answer never moves a group forward.

Card	The question on the card	Answer, and why	The wrong answer it catches	Letter of its top
C	A straight kite string runs from a stake on level ground to a kite. The string is 242 feet long. The angle of elevation from the stake to the kite is 33° . How far is the stake from the point right below the kite?	203 ft. The 33° stands at the ground. From it, the line of sight (242 ft) is the hypotenuse and the distance along the ground is the adjacent side. $x = 242 \times \cos 33^\circ = 202.96$.	132 ft. The 33° is put against the vertical line at the top: $x = 242 \times \sin 33^\circ = 131.80$.	A
E	A keeper on a lighthouse looks down at a boat on the level sea. The boat is 190 feet from the foot of the lighthouse. The angle of depression from her eyes to the boat is 17° . How long is the straight line from her eyes to the boat?	199 ft. The 17° stands at the far end, on the ground. From it, the distance along the ground (190 ft) is the adjacent side and the line of sight is the hypotenuse. $x = 190 \div \cos 17^\circ = 198.68$.	650 ft. The 17° is put against the vertical line under the eyes: $x = 190 \div \sin 17^\circ = 649.86$.	W
L	Ben lies on level ground and looks up at the top of a straight tree. Ben is 248 feet from the foot of the tree. The angle of elevation from Ben to the top of the tree is 14° . How tall is the tree?	62 ft. The 14° stands at the ground. From it, the distance along the ground (248 ft) is the adjacent side and the height is the opposite side. $x = 248 \times \tan 14^\circ = 61.83$.	995 ft. The 14° is put against the vertical line at the top: $x = 248 \div \tan 14^\circ = 994.67$.	W
D	A balloon is tied by a straight rope to a stake on level ground. The rope is 390 feet long. The angle of elevation from the stake to the balloon is 69° . How far is the stake from the point right below the balloon?	140 ft. The 69° stands at the ground. From it, the line of sight (390 ft) is the hypotenuse and the distance along the ground is the adjacent side. $x = 390 \times \cos 69^\circ = 139.76$.	364 ft. The 69° is put against the vertical line at the top: $x = 390 \times \sin 69^\circ = 364.10$.	I
R	A drone camera looks down at a cone on a level field. The camera is 170 feet above the field. The angle of depression from the camera to the cone is 72° . How long is the straight line from the camera to the cone?	179 ft. The 72° stands at the far end, on the ground. From it, the height (170 ft) is the opposite side and the line of sight is the hypotenuse. $x = 170 \div \sin 72^\circ = 178.75$.	550 ft. The 72° is put against the vertical line under the eyes: $x = 170 \div \cos 72^\circ = 550.13$.	S
K	Leo looks down from a bridge at a boat on the level river. The straight line from his eyes to the boat is 274 feet long. The angle of depression from his eyes to the boat is 14° . How high above the water are his eyes?	66 ft. The 14° stands at the far end, on the ground. From it, the line of sight (274 ft) is the hypotenuse and the height is the opposite side. $x = 274 \times \sin 14^\circ = 66.29$.	266 ft. The 14° is put against the vertical line under the eyes: $x = 274 \times \cos 14^\circ = 265.86$.	T
Q	Ana lies on level ground and looks up at the top of a straight tower. Ana is 105 feet from the foot of the tower. The angle of elevation from Ana to the top of the tower is 14° . How long is the straight line from Ana to the top of the tower?	108 ft. The 14° stands at the ground. From it, the distance along the ground (105 ft) is the adjacent side and the line of sight is the hypotenuse. $x = 105 \div \cos 14^\circ = 108.21$.	434 ft. The 14° is put against the vertical line at the top: $x = 105 \div \sin 14^\circ = 434.02$.	L
M	Maya looks down from a balcony at a bus stop on the level street. Her eyes are 84 feet above the street. The angle of depression from her eyes to the bus stop is 35° . How far is the bus stop from the foot of the building?	120 ft. The 35° stands at the far end, on the ground. From it, the height (84 ft) is the opposite side and the distance along the ground is the adjacent side. $x = 84 \div \tan 35^\circ = 119.96$.	59 ft. The 35° is put against the vertical line under the eyes: $x = 84 \times \tan 35^\circ = 58.82$.	O

Where the angle stands, in every reason on these two pages. An angle of elevation is at the point on the ground, between the ground and the line of sight. An angle of depression is at the eyes, between the horizontal line there and the line of sight. That horizontal line and the level ground are parallel, and the line of sight crosses both. So the same angle is also at the far end, between the ground and the line of sight, inside the triangle.

Other mistakes lead to no card. A group might multiply where it should divide, or leave the calculator in radian mode. Its answer is then not the number at the top of any card.