

ANSWER MAZE



ANGLES OF ELEVATION AND DEPRESSION

Which Angle Is It?

One page · 10–15 minutes · nothing to prepare

FREE

5

A keeper on a lighthouse looks down at a boat on the level sea. Her eyes are 120 feet above the sea. The boat is 76 feet from the foot of the lighthouse.

Find the angle of depression from her eyes to the boat.

$32^\circ \rightarrow$ **go to box 3**

$58^\circ \rightarrow$ **go to box 2**

Hint: Draw the horizontal line at her eyes. Which two lines meet at the angle asked?

2

Ana lies on level ground and looks up at the top of a straight tower. The tower is 95 feet tall. Ana is 160 feet from the foot of the tower.

Find the angle at the top of the tower between the tower and the line of sight.

$59^\circ \rightarrow$ **go to box 7**

$31^\circ \rightarrow$ **go to box 6**

Hint: Mark the top of the tower. Which two lines meet there?

1. **Hand out page 3**, one per student, with a calculator in degree mode. Nothing else is needed.
2. **Say this once:** *“Start at box 5. In every box, draw the right triangle and the horizontal line at the eye. The two answers in each box are the two acute angles of that triangle. Find them, then choose the one the question asks for. Write every box number in the row at the bottom as you go.”*
3. **Check a sheet quickly.** A student with no mistakes writes **5 2 7 4 1 8**: six boxes, then out.

Student sheet	page 3, one per student, and scrap paper for the drawings. No box has a drawing.
Answers	page 4.

The two answers in every box are the two acute angles of its triangle. They always add up to 90° . Both look like good answers, so the student must decide which angle the question asks for. That decision is the skill of this lesson.

In four of the eight boxes the question asks for the angle of elevation or depression. The wrong answer is the angle between the line of sight and the vertical line, such as the wall of a lighthouse. Box 5 gives 120 ft and 76 ft. The right answer is 58° , and the wrong one is 32° . These wrong answers send the student to box 3. In the other boxes the question asks for the angle against the vertical line, such as the angle at the top of a tower. There the wrong answer is the angle of elevation or depression itself, and it sends the student to box 6. Both of those boxes lead back to the route.

The row at the bottom is the check. A clean run is six numbers. Each wrong answer adds at least one more. Guessing does not get a student out: every simple guessing rule, such as always taking the smaller angle, goes wrong within the first three boxes.



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.

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Answer Maze — which angle is it?

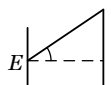
Start at box 5

Name _____

Period _____

Date _____

Start at box 5. Draw the right triangle on scrap paper. Draw the horizontal line at the eye. Use a calculator in degree mode. Find both acute angles to the nearest degree. Pick the one the question asks for, and go to the box it names. Write each box number in the row at the bottom as you go.



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.

1

From a boat on the level sea, Kim looks up at the top of a cliff. The cliff is 210 feet tall. The boat is 88 feet from the foot of the cliff.

Find the angle of elevation from the boat to the top of the cliff.

23° → go to box 3 67° → go to box 8

Hint: The boat is at sea level. Which line at the boat is horizontal?

2

Ana lies on level ground and looks up at the top of a straight tower. The tower is 95 feet tall. Ana is 160 feet from the foot of the tower.

Find the angle at the top of the tower between the tower and the line of sight.

59° → go to box 7 31° → go to box 6

Hint: Mark the top of the tower. Which two lines meet there?

3

Maya looks down from a balcony at a bus stop on the level street. Her eyes are 54 feet above the street. The straight line from her eyes to the bus stop is 96 feet long.

Find the angle of depression from her eyes to the bus stop.

56° → go to box 5 34° → go to box 2

Hint: Draw the horizontal line at her eyes first. Where does the angle asked sit?

4

A drone camera looks down at a cone on a level field. The camera is 190 feet above the field. The straight line from the camera to the cone is 230 feet long.

Find the angle at the camera between the line straight down and the line of sight.

56° → go to box 6 34° → go to box 1

Hint: Draw the line straight down from the camera. Where is the angle between it and the line of sight?

5

A keeper on a lighthouse looks down at a boat on the level sea. Her eyes are 120 feet above the sea. The boat is 76 feet from the foot of the lighthouse.

Find the angle of depression from her eyes to the boat.

32° → go to box 3 58° → go to box 2

Hint: Draw the horizontal line at her eyes. Which two lines meet at the angle asked?

6

A balloon is tied by a straight rope to a stake on level ground. The balloon is 100 feet above the ground. The point of the ground right below the balloon is 125 feet from the stake.

Find the angle at the balloon between the line straight down and the rope.

51° → go to box 7 39° → go to box 2

Hint: Draw the line straight down from the balloon. Which two lines meet at the angle asked?

7

A straight kite string runs from a stake on level ground to a kite. The kite is 140 feet above the ground. The string is 300 feet long.

Find the angle of elevation from the stake to the kite.

28° → go to box 4 62° → go to box 3

Hint: The stake is on level ground. Which line at the stake is horizontal?

8

Ben lies on level ground and looks up at the top of a straight tree. Ben is 40 feet from the foot of the tree. The straight line from Ben to the top of the tree is 75 feet long.

Find the angle at the top of the tree between the tree and the line of sight.

32° → you are out 58° → go to box 6

Hint: Mark the top of the tree. Which two lines meet at the angle asked?

Write every box number here, in order.

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The route, in order. Boxes 3 and 6 are not on it. A student reaches them only by a wrong answer. They are the last two rows of the table. Every answer is rounded to the nearest degree, with the calculator in degree mode.

5 → 2 → 7 → 4 → 1 → 8 → out

	The box's question	Right answer, and why	Wrong answer, and why a student picks it
1	Box 5 A keeper on a lighthouse looks down at a boat on the level sea. Her eyes are 120 feet above the sea. The boat is 76 feet from the foot of the lighthouse. Find the angle of depression from her eyes to the boat.	58°. At the angle at the far end, on the ground, 120 is opposite and 76 is adjacent, so $\tan = 120 \div 76$ gives 57.65°. It equals the angle of depression, because the horizontal line at the eye is parallel to the ground. The other acute angle is 32.35°.	"32°" goes to box 3. It is the angle between the vertical line and the line of sight.
2	Box 2 Ana lies on level ground and looks up at the top of a straight tower. The tower is 95 feet tall. Ana is 160 feet from the foot of the tower. Find the angle at the top of the tower between the tower and the line of sight.	59°. At the angle at the ground, 95 is opposite and 160 is adjacent, so $\tan = 95 \div 160$ gives 30.70°. That is the angle of elevation. The angle asked is the other one: $90^\circ - 30.70^\circ = 59.30^\circ$.	"31°" goes to box 6. It is the angle of elevation, against the horizontal line.
3	Box 7 A straight kite string runs from a stake on level ground to a kite. The kite is 140 feet above the ground. The string is 300 feet long. Find the angle of elevation from the stake to the kite.	28°. At the angle at the ground, 140 is opposite and 300 is the hypotenuse, so $\sin = 140 \div 300$ gives 27.82°. That is the angle of elevation. The other acute angle is 62.18°.	"62°" goes to box 3. It is the angle between the vertical line and the line of sight.
4	Box 4 A drone camera looks down at a cone on a level field. The camera is 190 feet above the field. The straight line from the camera to the cone is 230 feet long. Find the angle at the camera between the line straight down and the line of sight.	34°. At the angle at the far end, on the ground, 190 is opposite and 230 is the hypotenuse, so $\sin = 190 \div 230$ gives 55.70°. It equals the angle of depression, because the horizontal line at the eye is parallel to the ground. The angle asked is the other one: $90^\circ - 55.70^\circ = 34.30^\circ$.	"56°" goes to box 6. It is the angle of depression, against the horizontal line.
5	Box 1 From a boat on the level sea, Kim looks up at the top of a cliff. The cliff is 210 feet tall. The boat is 88 feet from the foot of the cliff. Find the angle of elevation from the boat to the top of the cliff.	67°. At the angle at the ground, 210 is opposite and 88 is adjacent, so $\tan = 210 \div 88$ gives 67.26°. That is the angle of elevation. The other acute angle is 22.74°.	"23°" goes to box 3. It is the angle between the vertical line and the line of sight.
6	Box 8 Ben lies on level ground and looks up at the top of a straight tree. Ben is 40 feet from the foot of the tree. The straight line from Ben to the top of the tree is 75 feet long. Find the angle at the top of the tree between the tree and the line of sight.	32°. At the angle at the ground, 40 is adjacent and 75 is the hypotenuse, so $\cos = 40 \div 75$ gives 57.77°. That is the angle of elevation. The angle asked is the other one: $90^\circ - 57.77^\circ = 32.23^\circ$.	"58°" goes to box 6. It is the angle of elevation, against the horizontal line.
	Box 3 Maya looks down from a balcony at a bus stop on the level street. Her eyes are 54 feet above the street. The straight line from her eyes to the bus stop is 96 feet long. Find the angle of depression from her eyes to the bus stop.	34°. At the angle at the far end, on the ground, 54 is opposite and 96 is the hypotenuse, so $\sin = 54 \div 96$ gives 34.23°. It equals the angle of depression, because the horizontal line at the eye is parallel to the ground. The other acute angle is 55.77°.	"56°" goes to box 5. It is the angle between the vertical line and the line of sight.
	Box 6 A balloon is tied by a straight rope to a stake on level ground. The balloon is 100 feet above the ground. The point of the ground right below the balloon is 125 feet from the stake. Find the angle at the balloon between the line straight down and the rope.	51°. At the angle at the ground, 100 is opposite and 125 is adjacent, so $\tan = 100 \div 125$ gives 38.66°. That is the angle of elevation. The angle asked is the other one: $90^\circ - 38.66^\circ = 51.34^\circ$.	"39°" goes to box 2. It is the angle of elevation, against the horizontal line.

A student can find the last four boxes of the route by following the arrows backward from "you are out." So ask a student with a clean row to explain one box.