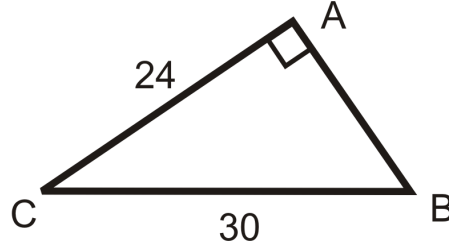# Trigonometry Applications Practice

Use the following information to answer the first question.

A math student was asked to solve the following triangle.


The work is shown below.

1. Finding Angle C	$\cos C = \frac{24}{30}$ $\cos^{-1}\left(\frac{24}{30}\right) = 36.869...$ $C = 37^0$
2. Finding Angle B	$A + B + C = 180^0$ $90^0 + B + 37^0 = 180^0$ $B = 53^0$
3. Finding AB	$(AB)^2 = 24^2 + 30^2$ $(AB)^2 = 1476$ $AB = 38.418...$ $AB = 38$

1. Which statement below is true?
   A) All 3 parts of the work are correct.
   B) All 3 parts of the work are incorrect.
   C) Only 1 part of the work is correct.
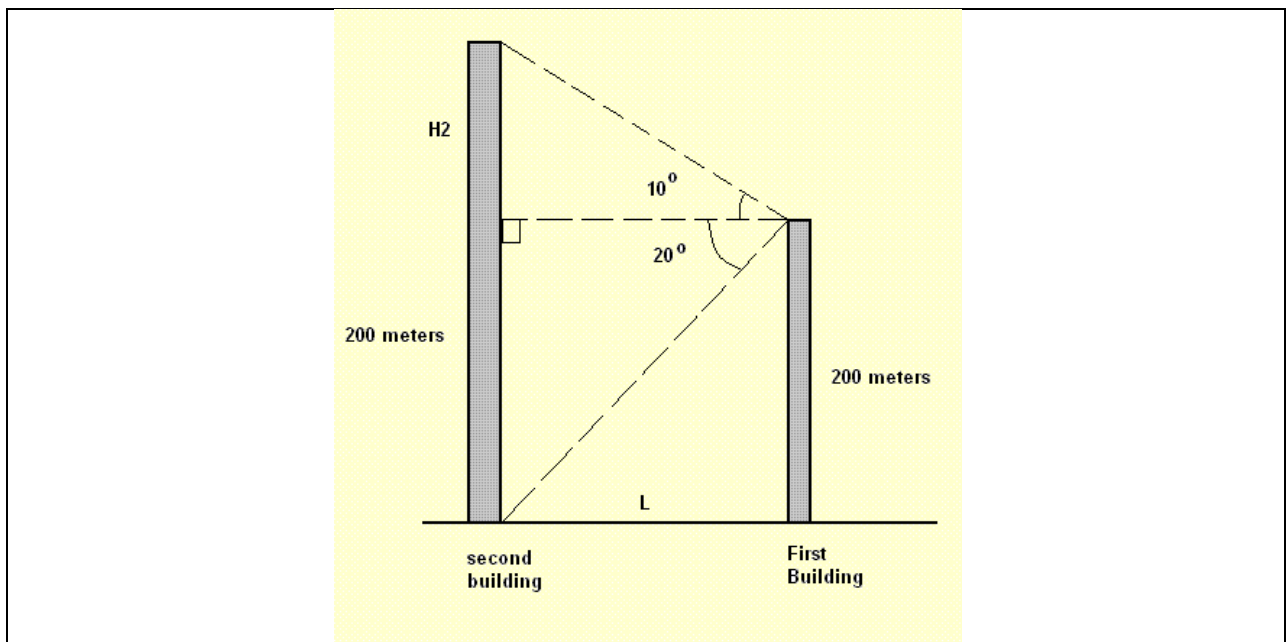   D) Only 2 parts of the work are correct.

Use the triangle below to answer the next question.
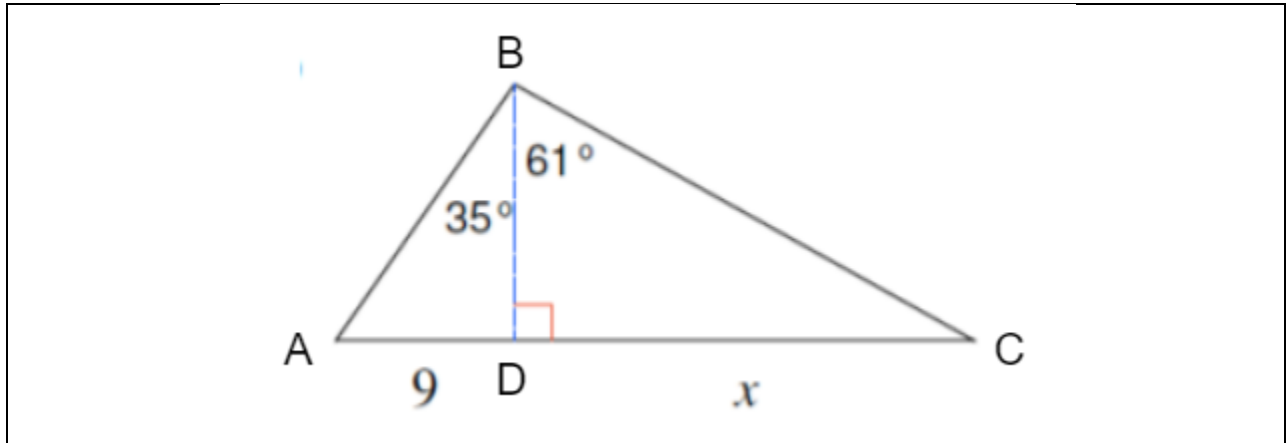
2. Which statement below is correct?

   A) The first step is determine side length BD, and x = 23.2.
   B) The first step is determine side length BD, and x = 27.8.
   C) The first step is determine side length AB, and x = 23.2.
   D) The first step is determine side length AB, and x = 27.8.

Use the diagram(not drawn to scale) below to answer the next question.

The following statements are made.	
Statement 1	The height of the taller building is over 300 m.
Statement 2	The angle of elevation is 20^0.
Statement 3	The distance from the top of building one to the bottom of building two is about 585 m.
Statement 4	The distance between the buildings is about 550 m.

3. The two true statements are ____ and ____.
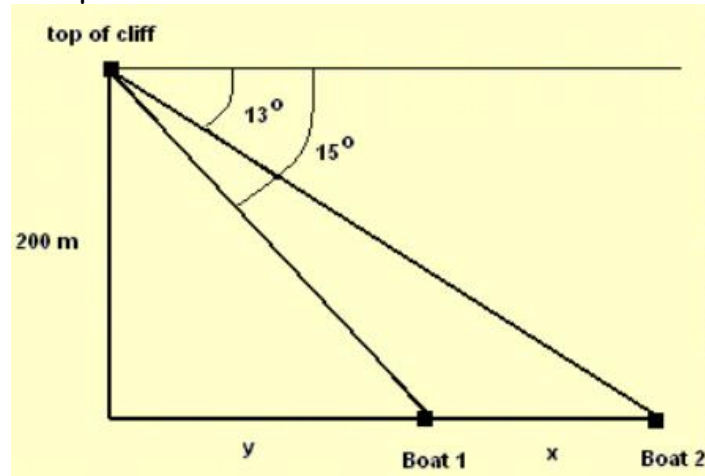
Use the following information to answer the next question.

The angle of elevation of a hot air balloon, climbing vertically, changes from 25^0 to 60^0 in three minutes. The angles are measured at a point 300 m from takeoff.

h2

h1

60^0

25^0

300 meters
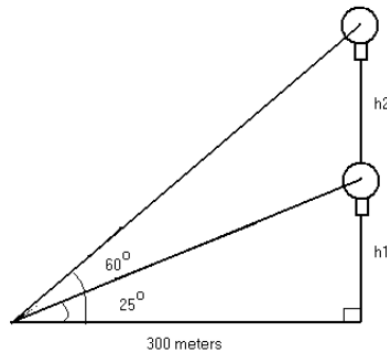
4. To the nearest metre, the value of h2 in the diagram is _____.
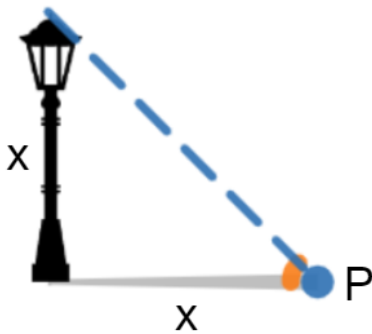
Use the following information to answer the next question.

The angle of depression from the top of a cliff to boat 2 is 13^0 and the angle of depression from the top of the same cliff to boat 1 is 15^0.

top of cliff

13^0

15^0

200 m

y

Boat 1   x   Boat 2

5. If the height of the cliff is 200 m, then determine the distance between the boats, x, to the nearest tenth of a metre. Show all work.
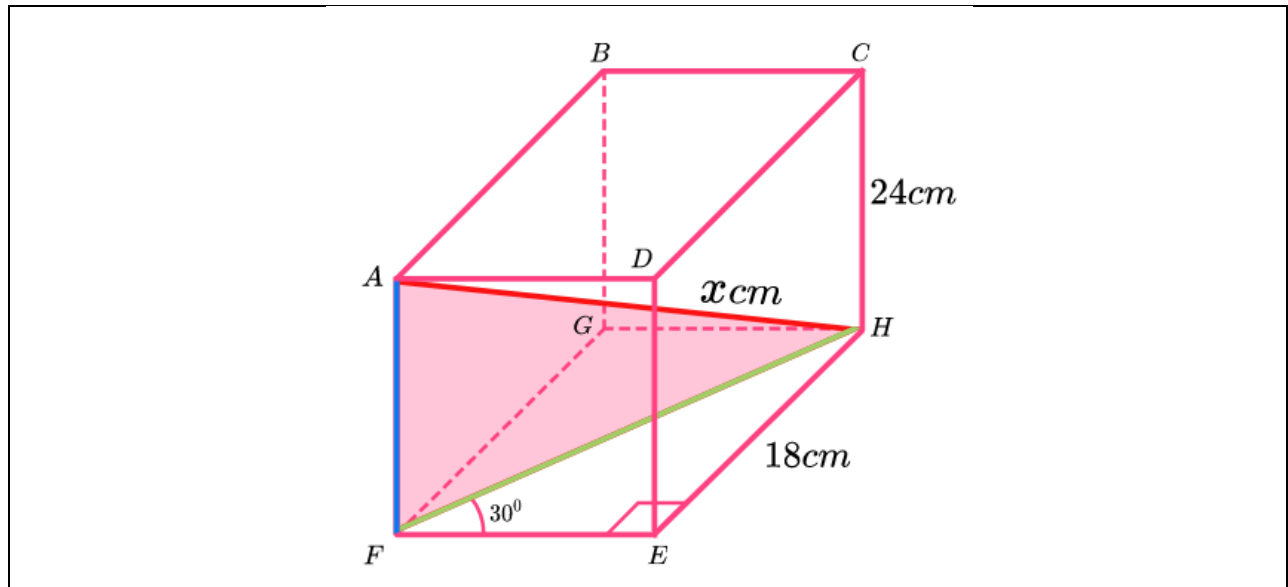
Use the following information to answer the next question.

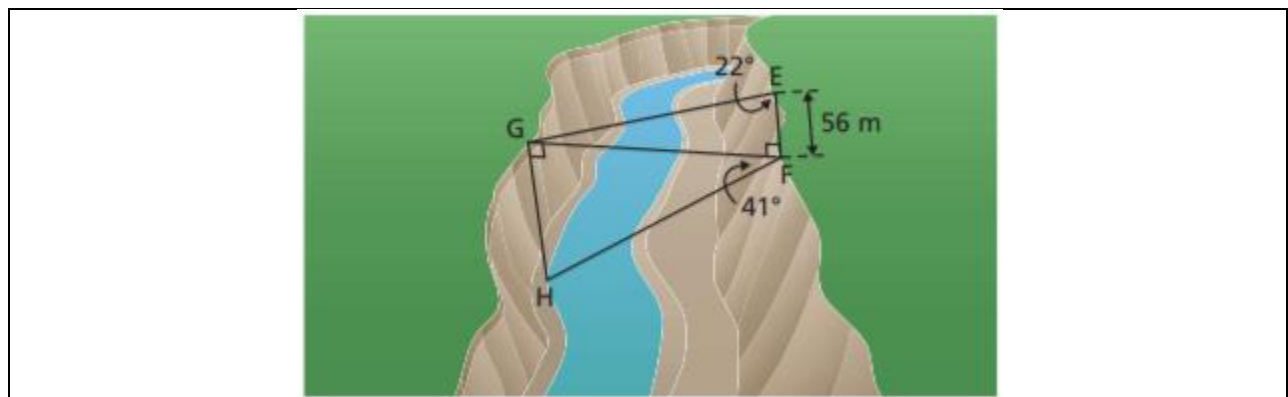The height of a light pole, x, is the same as the distance from the base of the light pole to a point P.

X

X

P

6. To the nearest degree, the angle of elevation of the top of the light pole is _____.
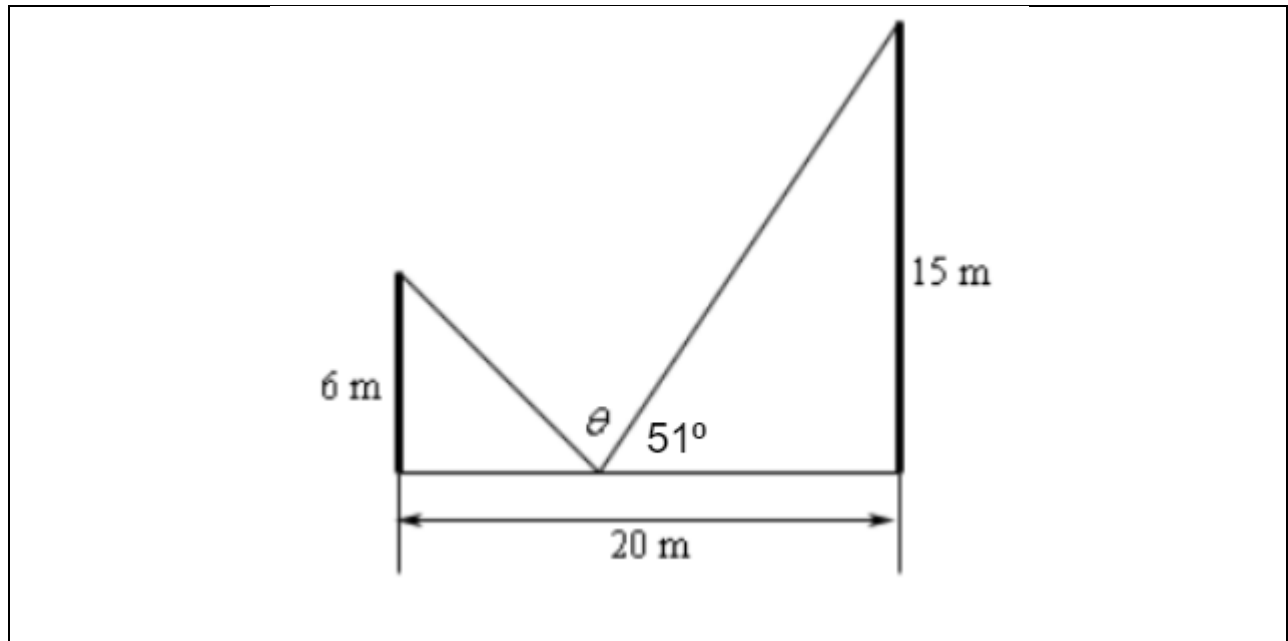
Use the following information to answer the next question.

7.The length of AH, to the nearest cm, is

A) 36   B) 38   C) 43   D) 46
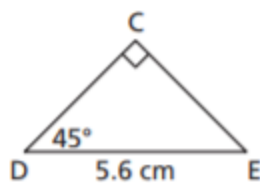
Use the following diagram to answer the next question.

8. To the nearest metre, the depth of this gorge (GH) is _____.

Use the diagram below to answer the next question.

9. To the nearest degree, the value of θ is _____. [Following the first step, round side lengths to the nearest hundredth]
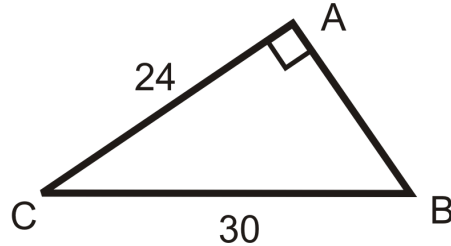
10. Determine the perimeter and area of the triangle shown below.

Use the following information to answer the first question.

A math student was asked to solve the following triangle.

The work is shown below.

1. Finding Angle C	$\cos C = \frac{24}{30}$ $\cos^{-1}\left(\frac{24}{30}\right) = 36.869\ldots$ $C = 37^0$
2. Finding Angle B	$A + B + C = 180^0$ $90^0 + B + 37^0 = 180^0$ $B = 53^0$
3. Finding AB	$(AB)^2 = 24^2 + 30^2$ $(AB)^2 = 1476$ $AB = 38.418\ldots$ $AB = 38$

1. Which statement below is true?
   A) All 3 parts of the work are correct.
   B) All 3 parts of the work are incorrect.
   C) Only 1 part of the work is correct.
   D) Only 2 parts of the work are correct.

Solution

The first two parts are correct.

When using Pythagorean Theorem to find an unknown side (given 2 sides), the relationship is:

hypotenuse^2 = side^2 + side^2

Since the hypotenuse is known in this question, we have

30^2 = 24^2 + side^2 [AS YOU CAN SEE, THE ERROR IS AT THIS STEP]
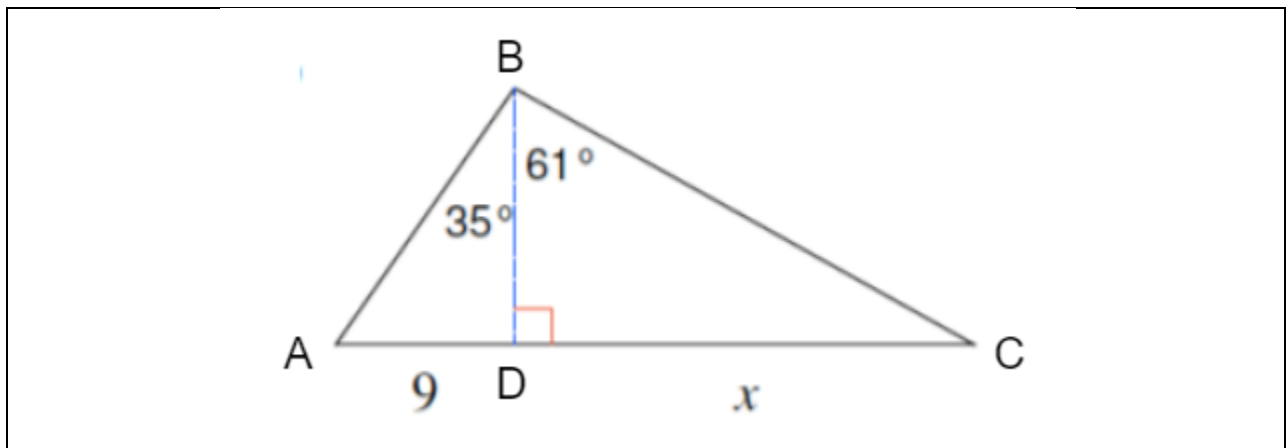
30^2 – 24^2 = side^2

900 – 576 = side^2

324 = side^2

Take the square root of both sides of the equal sign.

The length of the last side, AB, is 18.

The correct answer is D.

Use the triangle below to answer the next question.

2. Which statement below is correct?
   A) The first step is determine side length BD, and x = 23.2.
   B) The first step is determine side length BD, and x = 27.8.
   C) The first step is determine side length AB, and x = 23.2.
   D) The first step is determine side length AB, and x = 27.8.

Solution

The first step is to find the length of BD because this side is common in triangles BAD and BCD. In order to find x, we need more information in triangle BCD (the triangle on the right). We can use triangle BAD to find the common side, which in turn will provide enough information to find x.

$$\tan 35 = \frac{9}{BD}$$

$$BD = \frac{9}{\tan 35}$$

BD = 12.853…

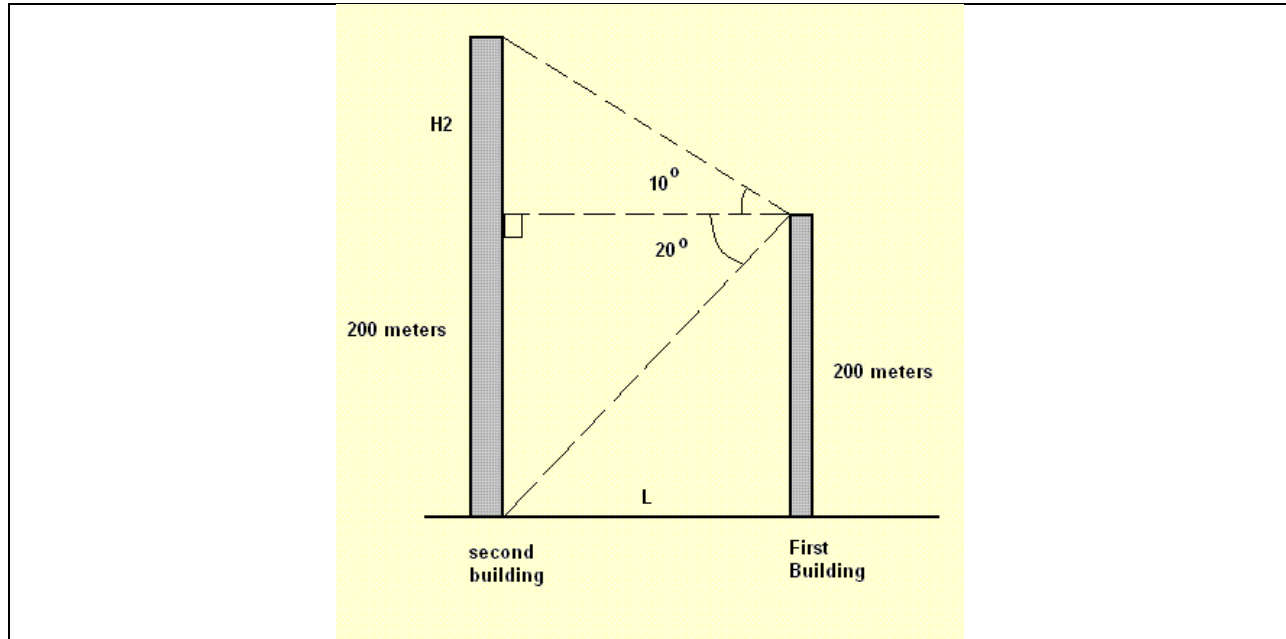Now use this information when working with triangle BCD.

$$\tan 61 = \frac{x}{BD}$$

$$(\tan 61)(BD) = x$$

23.188…

To the nearest tenth, x = 23.2.

The correct answer is A.

Use the diagram(not drawn to scale) below to answer the next question.

| The following statements are made.	
Statement 1	The height of the taller building is over 300 m.
Statement 2	The angle of elevation is 20^0.
Statement 3	The distance from the top of building one to the bottom of building two is about 585 m.
Statement 4	The distance between the buildings is about 550 m.

3. The two true statements are __3__ and __4__.

Solution

Statement 1

To find the height of the taller building, we first need to find the distance between the buildings.
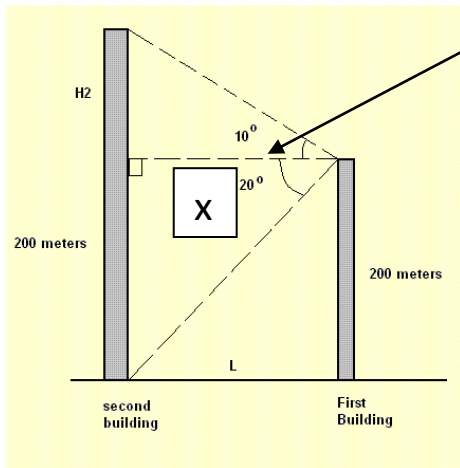
Let x = distance between the buildings.

$$\tan 20 = \frac{200}{x}$$

$$x = \frac{200}{\tan 20}$$

x = 549.495…

The distance between the buildings is 549.495…

We now have enough information to find H2.

$$\tan 10 = \frac{H2}{549.495\ldots}$$

(tan 10) (549.495) = H2

H2 = 96.890…

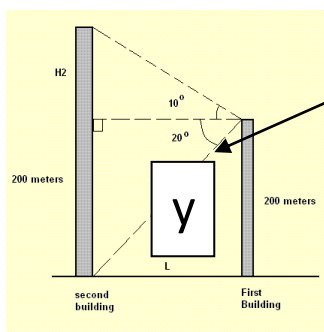Adding 200 to 96.890… means the height of the second building is less than 300 m.

Statement 1 is **false.**

Statement 2

The angle of elevation is 10^0 and the angle of depression is 20^0.

Statement 2 is **false.**

Statement 3

Let y = the distance from the top of the first building to the bottom of the second building.

$$\sin 20 = \frac{200}{y}$$

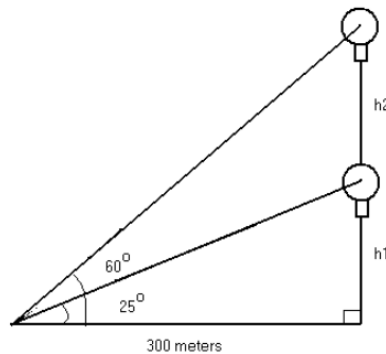$$y = \frac{200}{\sin 20}$$

y = 584.760…

Statement 3 is **true.**

Use the following information to answer the next question.

The angle of elevation of a hot air balloon, climbing vertically, changes from 25^0 to 60^0 in three minutes. The angles are measured at a point 300 m from takeoff.

4. To the nearest metre, the value of h2 in the diagram is _380_.

Solution

What is the strategy?

We can find the height of h1 since we have an angle and a side in that triangle.

We can then find the height of h1 and h2 combined because we have an angle and a side in the large triangle.

The difference between the two previous answers will result in our final answer.

Step One

Use a tangent ratio to find h1. A tangent ratio is used because we know the *adjacent* side and we are trying to determine the *opposite* side.

$\tan 25 = \dfrac{h1}{300}$

(tan 25) (300) = h1

h1 = 139.892…

Step Two

Use a tangent ratio to find (h1 + h2).

$\tan 60 = \dfrac{h1+h2}{300}$

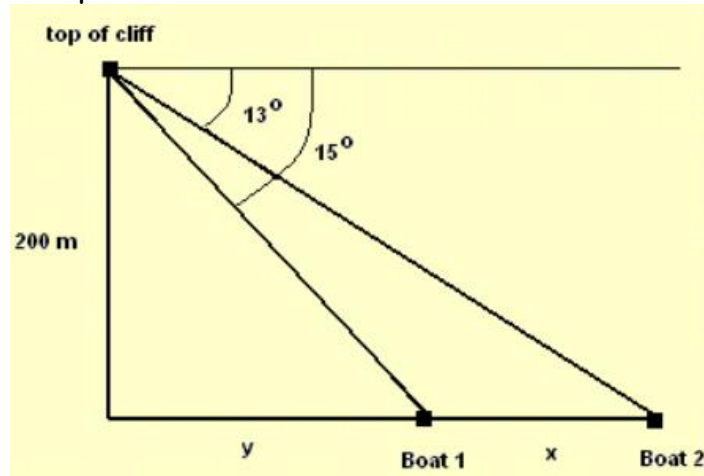(tan 60) (300) = h1 + h2

h1 + h2 = 519.615…

Step Three

h2 = (h1 + h2) – h1

h2 = 519.615… - 139.892…

h2 = 379.723…

To the nearest metre, the value of h2 in the diagram is __380__.

Use the following information to answer the next question.

The angle of depression from the top of a cliff to boat 2 is 13^0 and the angle of depression from the top of the same cliff to boat 1 is 15^0.


5. If the height of the cliff is 200 m, then determine the distance between the boats, x, to the nearest tenth of a metre. Show all work.

Solution

What is the strategy?

Determine the value of y. Then determine the value of (y + x). The difference between these two values will result in the distance, x, between the boats.

Since the angle of depression to the first boat is 15^0, the angle inside the triangle we will be using is 75^0. [$90^0 – 15^0 = 75^0$]
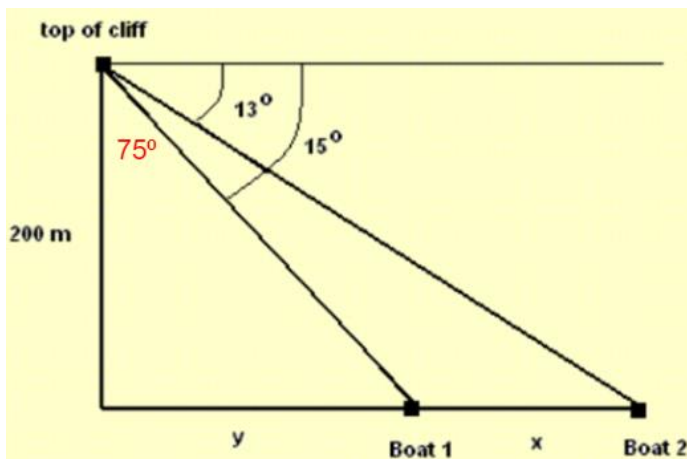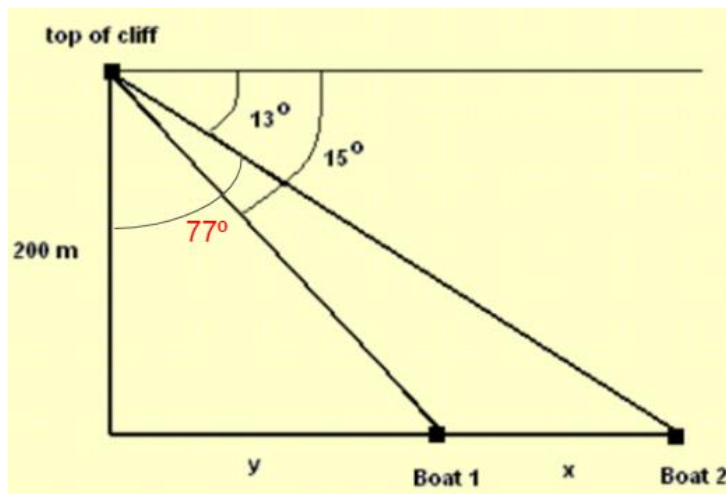
$\tan 75 = \dfrac{y}{200}$

$(\tan 75)(200) = y$

$y = 746.410\ldots$

Since the angle of depression to the second boat is 13^0, the angle inside the triangle we will be using is 77^0. $[90^0 - 13^0 = 77^0]$

Step Two

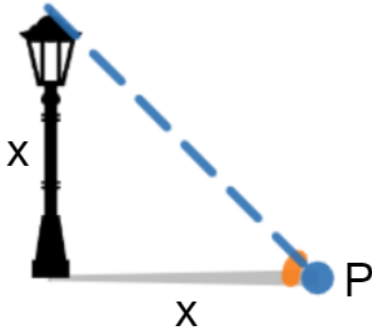$\tan 77 = \dfrac{y+x}{200}$

$(\tan 77)(200) = y + x$

$(x + y) = 866.295\ldots$

Step Three

The distance between the boats is $866.295\ldots - 746.410\ldots = 119.9$ m.

Use the following information to answer the next question.

The height of a light pole, x, is the same as the distance from the base of the light pole to a point P.

6. To the nearest degree, the angle of elevation of the top of the light pole is ___45⁰___.

Solution

The angle of elevation is created at point P, between the dotted line and the line showing the distance from P to the base of the light pole.
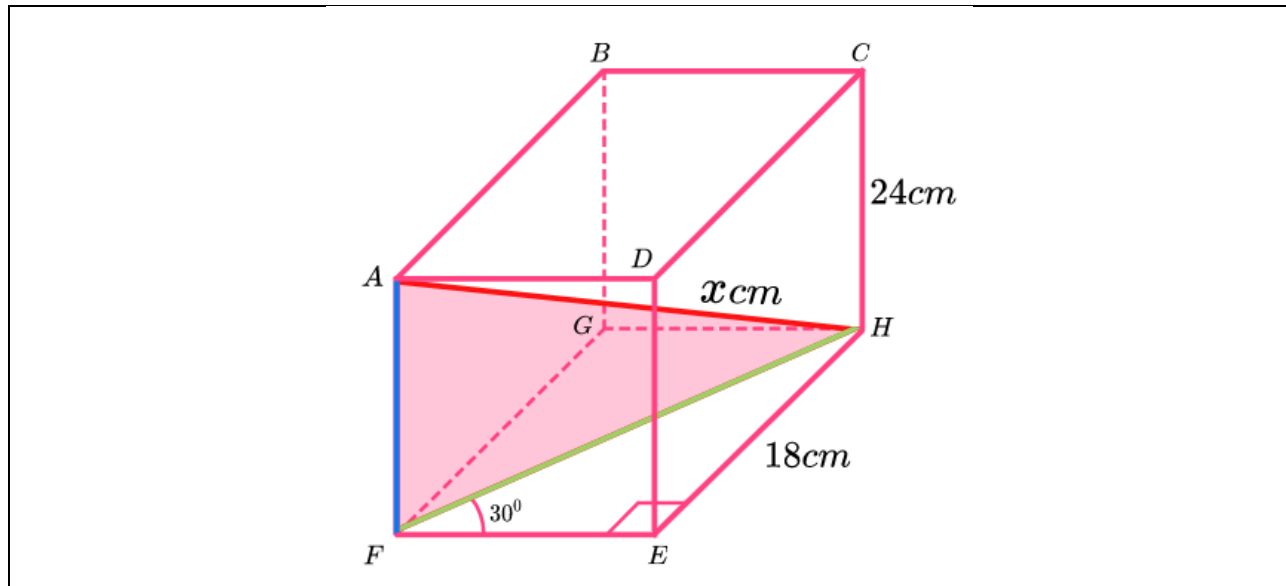
The side opposite the angle and the side adjacent the angle are the same (x). Using a tangent ratio, of $\frac{opposite}{adjacent}$, we have tan P = $\frac{x}{x}$, or 1.

Using the calculator, $\tan^{-1}(1) = 45^0$.

To the nearest degree, the angle of elevation of the top of the light pole is 45^0.

7.The length of AH, to the nearest cm, is

A) 36   B) 38   C) 43   D) 46

Solution

With a 3-dimensional object, such as this prism, we will be working with triangles in two different planes. In order to find x, or AH, which cuts through the inside of this prism, we first have to find FH, which is the hypotenuse in the bottom triangle that has a 30^0 angle and one side length of 18 cm.

$\sin 30 = \dfrac{18}{FH}$

$FH = \dfrac{18}{\sin 30}$

$FH = 36$

We now use this side length with two other side lengths in a different plane; i.e. sides AF and AH. (the right angle is at angle AFH)
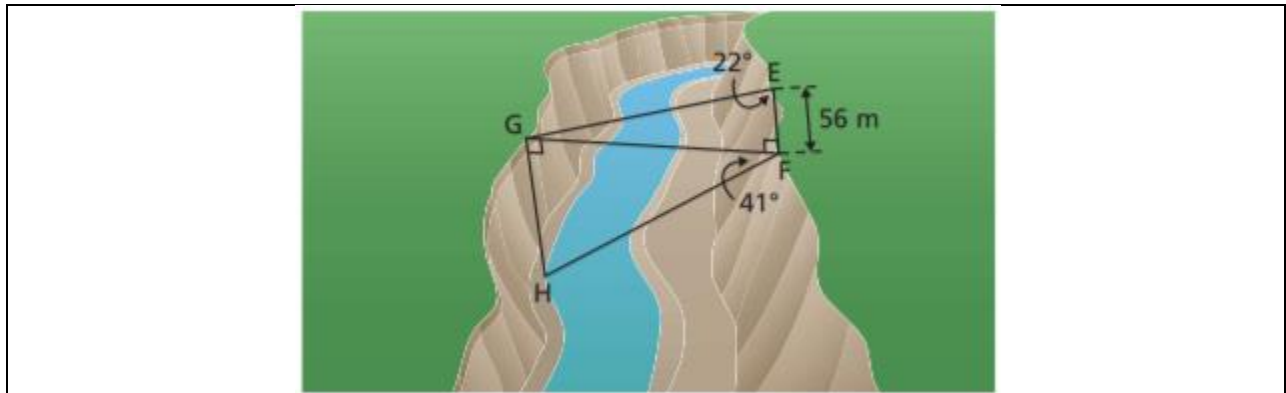
$hypotenuse^2 = side^2 + side^2$

$(AH)^2 = 24^2 + 36^2$

$(AH)^2 = 576 + 1296$

$(AH)^2 = 1872$

$AH = 43.266...$

The correct answer is C.

Use the following diagram to answer the next question.

8. To the nearest metre, the depth of this gorge (GH) is __20__.

Solution

In triangle FGH, where we are trying to find GH, we only have one piece of information, and that is a 41⁰.

We can first use triangle EFG to find the common side of both triangles (FG), and then use side FG to find the depth of the gorge GH.

Step One

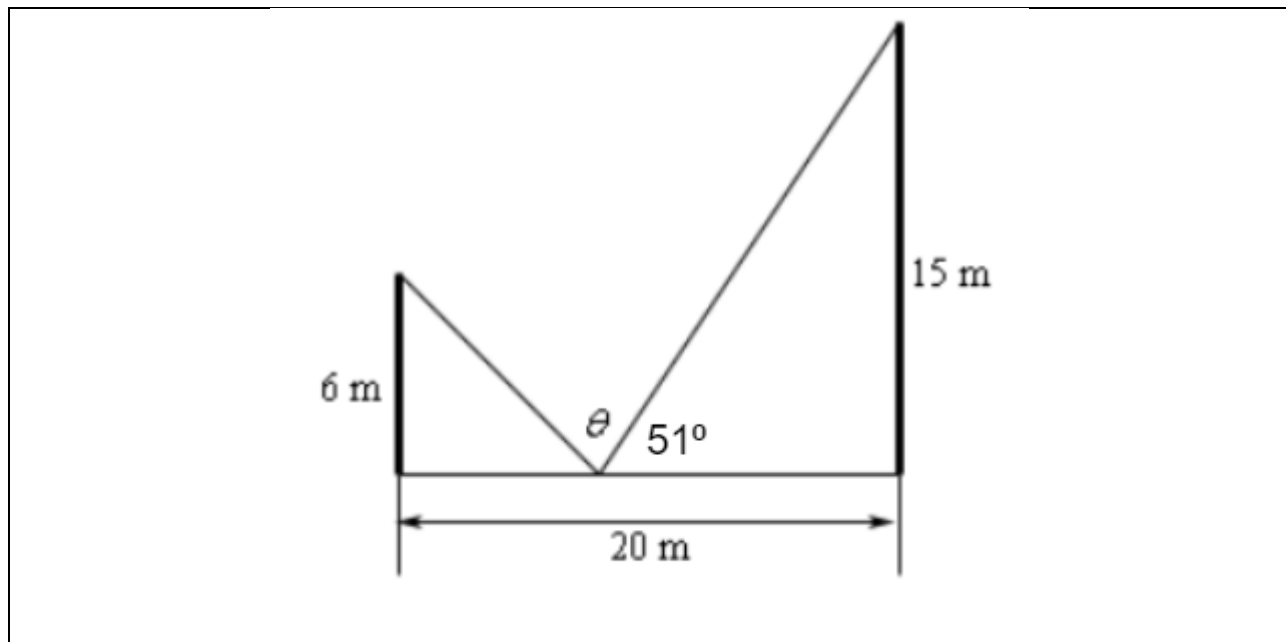$\tan 22 = \dfrac{FG}{56}$

$(\tan 22)(56) = FG$

$FG = 22.625...$

$\tan 41 = \dfrac{GH}{22.625\ldots}$
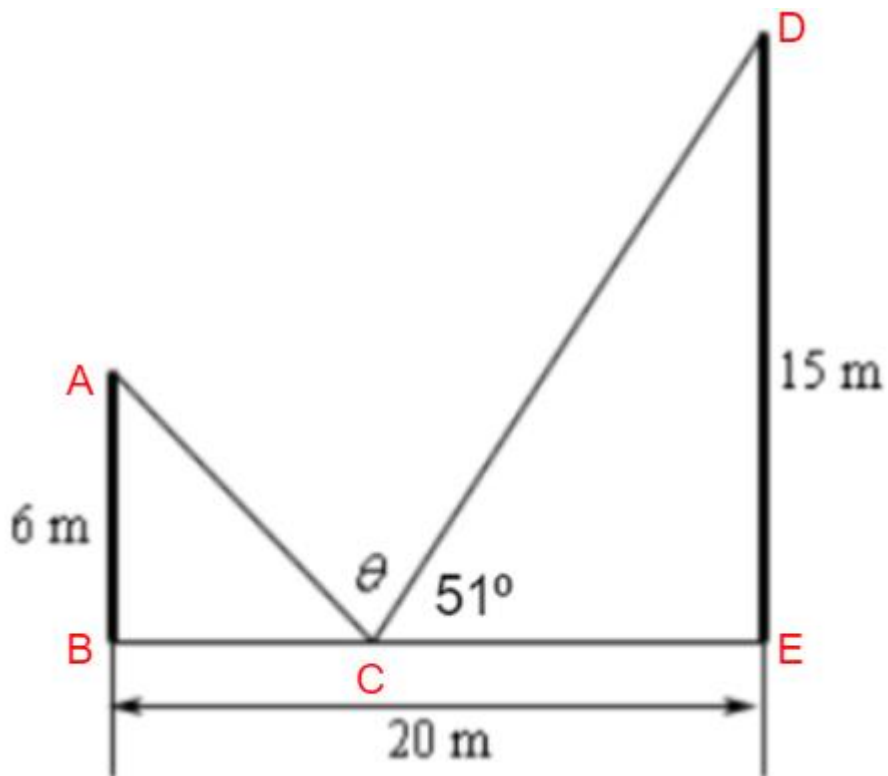
$(\tan 41)(22.625\ldots) = GH$

$GH = 19.668\ldots$

To the nearest metre, the depth of the gorge, (GH) is 20.

Use the diagram below to answer the next question.

9. To the nearest degree, the value of θ is __95⁰__. [Following the first step, round side lengths to the nearest hundredth]

Solution

Determine CE.

$\tan 51 = \dfrac{15}{CE}$

$CE = \dfrac{15}{\tan 51}$

CE = 12.146...

CE = 12.15

Now we can determine the length of side BC.

BC = 20 – 12.15

BC = 8.75

Let Angle ACB = C

$\tan C = \dfrac{6}{8.75}$

$C = 34^0$

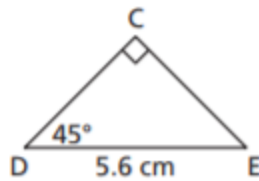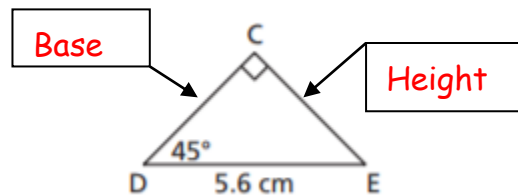$34^0 + \theta + 51^0 = 180^0$

$85^0 + \theta = 180^0$

$\theta = 95^0$

To the nearest degree, the value of θ is 95^0.

10. Determine the perimeter and area of the triangle shown below.

Solution

The formula for the **area** of a triangle is A = $\dfrac{(base)(height)}{2}$

$\cos 45^0 = \dfrac{base}{5.6}$

$(\cos 45^0)(5.6) = base$

base = 3.959…

The **base** is 4.0.

$\sin 45^0 = \dfrac{height}{5.6}$

$(\sin 45^0)\,(5.6) = height$

height = 3.959…

The **height** is 4.0.

The area is $\dfrac{(4)(4)}{2}$.

The area is 8 cm^2.

The perimeter is the distance around the outside of the triangle. It is found by adding all 3 sides.

Perimeter = 4 + 4 + 5.6.

The perimeter is 13.6 cm.