

Algebra 1

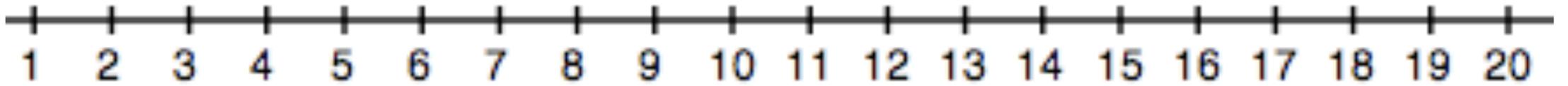
Predicting Patterns & Examining Experiments

Unit 5: Changing on a Plane

Section 1: How Far to the Corner

Unit 5 focuses strongly on geometry, but we will still see constant change and slope in the unit's lessons. Section 1 looks at the Pythagorean theorem, but is prefaced with a quick reminder on radicals. The first two problems are intended to be quick warm-ups into the material and the third can be short, or extended into a longer problem.

Where does $\sqrt{58}$ go on the number line?



$$\sqrt{58}$$

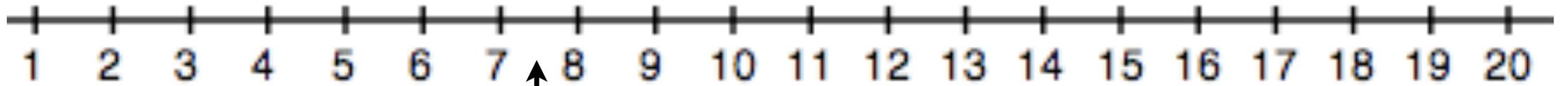
No calculators!

(Think, pair, share) Without calculators have students answer this question. You may even arrange a number line using paper/board and have students place themselves in the correct position.

One method is to just square numbers until we find the bounds:

$$\begin{aligned} 1^2 &= 1 \\ 2^2 &= 4 \\ 3^2 &= 9 \\ 4^2 &= 16 \\ 5^2 &= 25 \\ 6^2 &= 36 \\ 7^2 &= 49 \\ &\dots\dots\dots \\ 8^2 &= 64 \end{aligned}$$

Where does $\sqrt{58}$ go on the number line?



$$\sqrt{58}$$

$$7^2 = 49$$

$$7.?^2 = 58$$

$$8^2 = 64$$

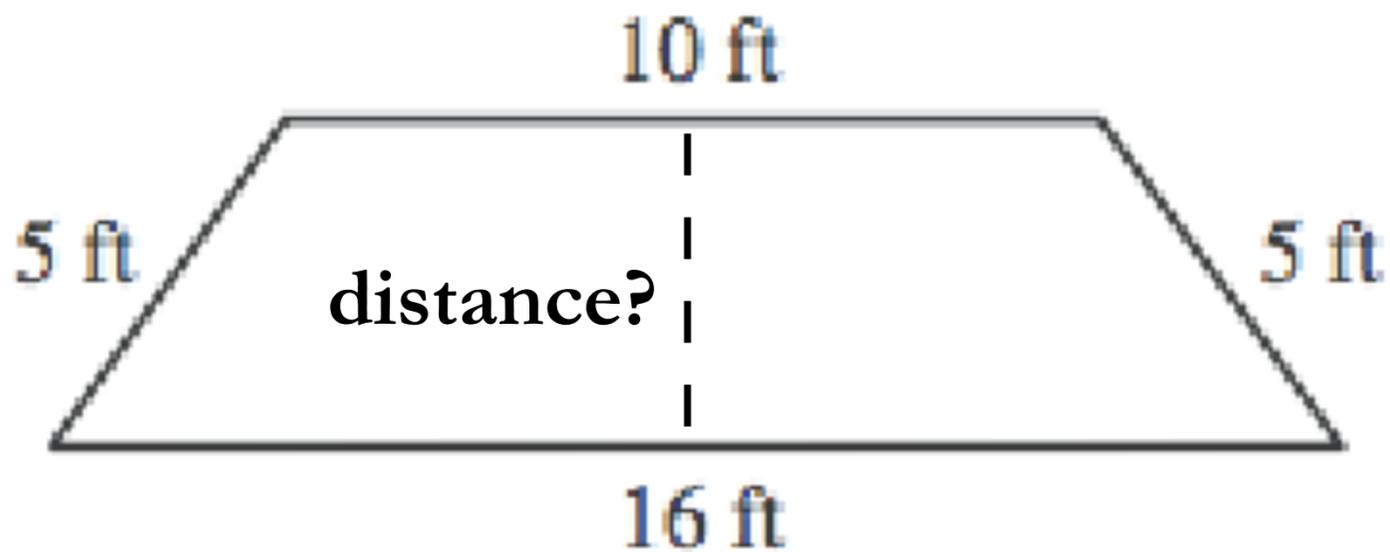
No calculators!

(Think, pair, share) Without calculators have students answer this question. You may even arrange a number line using paper/board and have students place themselves in the correct position.

One method is to just square numbers until we find the bounds:

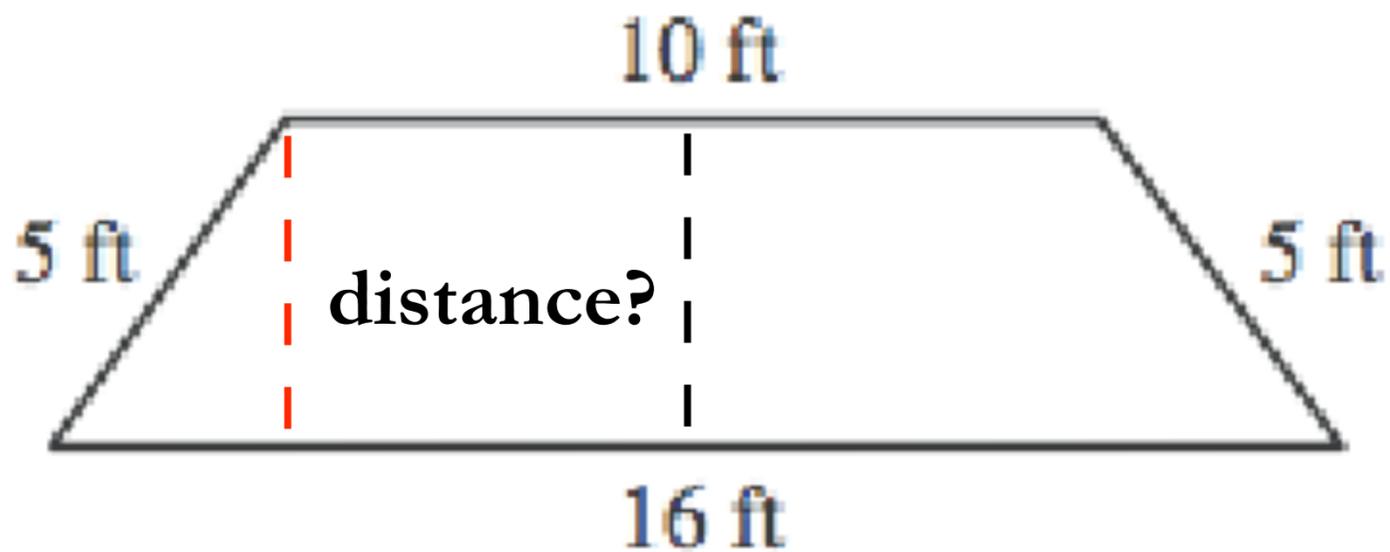
$$\begin{aligned} 1^2 &= 1 \\ 2^2 &= 4 \\ 3^2 &= 9 \\ 4^2 &= 16 \\ 5^2 &= 25 \\ 6^2 &= 36 \\ 7^2 &= 49 \\ &\dots\dots\dots \\ 8^2 &= 64 \end{aligned}$$

What is the distance between the 10 ft and 16 ft sides of this trapezoid?



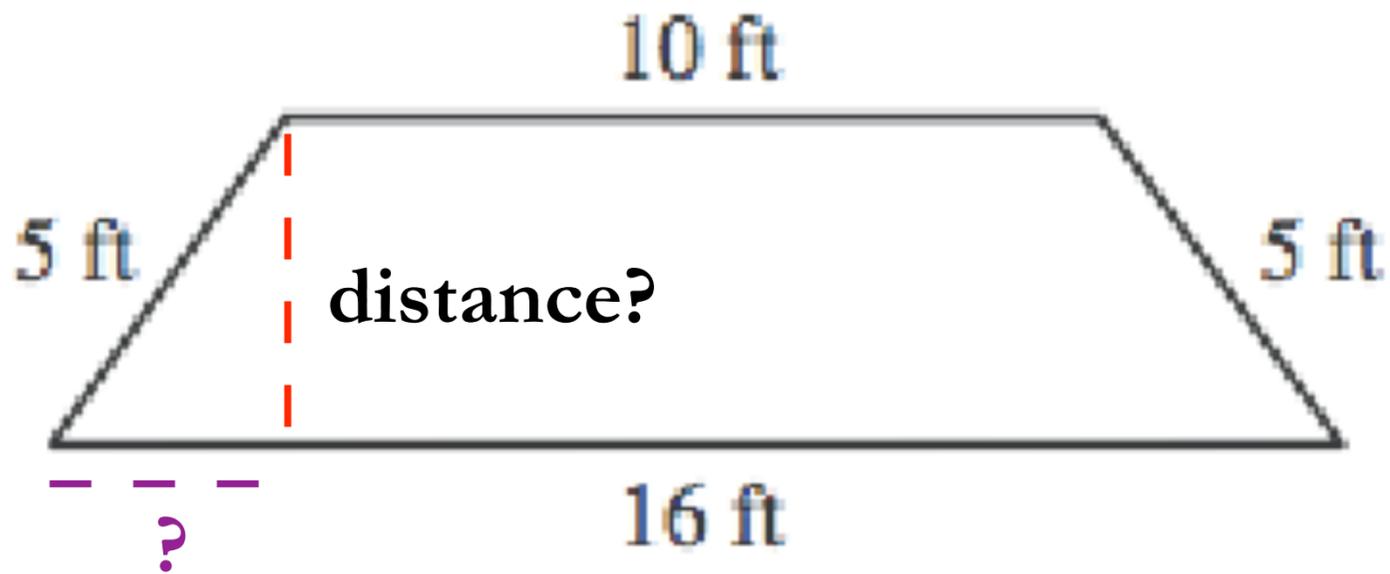
(Think, pair, share) This is another ACT practice problem. Students need to utilize the Pythagorean theorem to solve.

What is the distance between the 10 ft and 16 ft sides of this trapezoid?



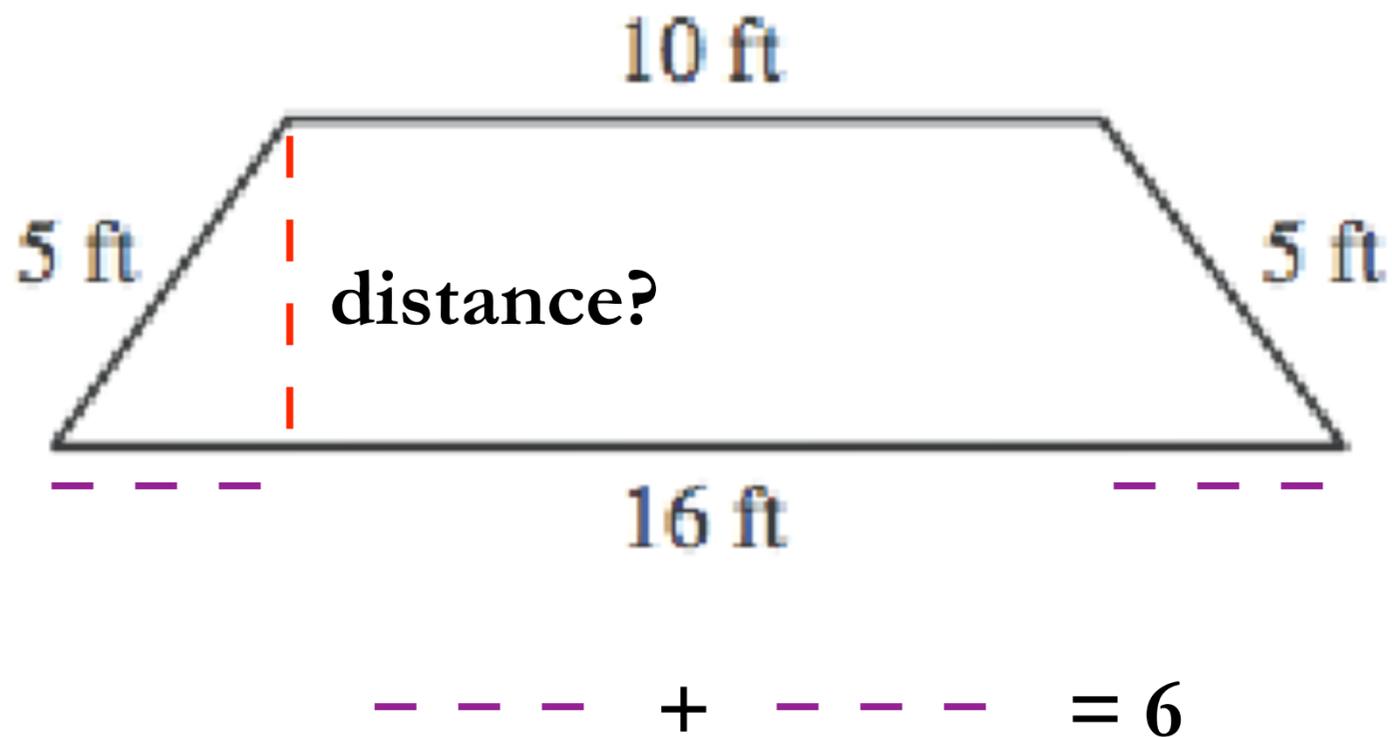
(Think, pair, share) First, we need to realize that the distance requested is the height of the triangle created above.

What is the distance between the 10 ft and 16 ft sides of this trapezoid?



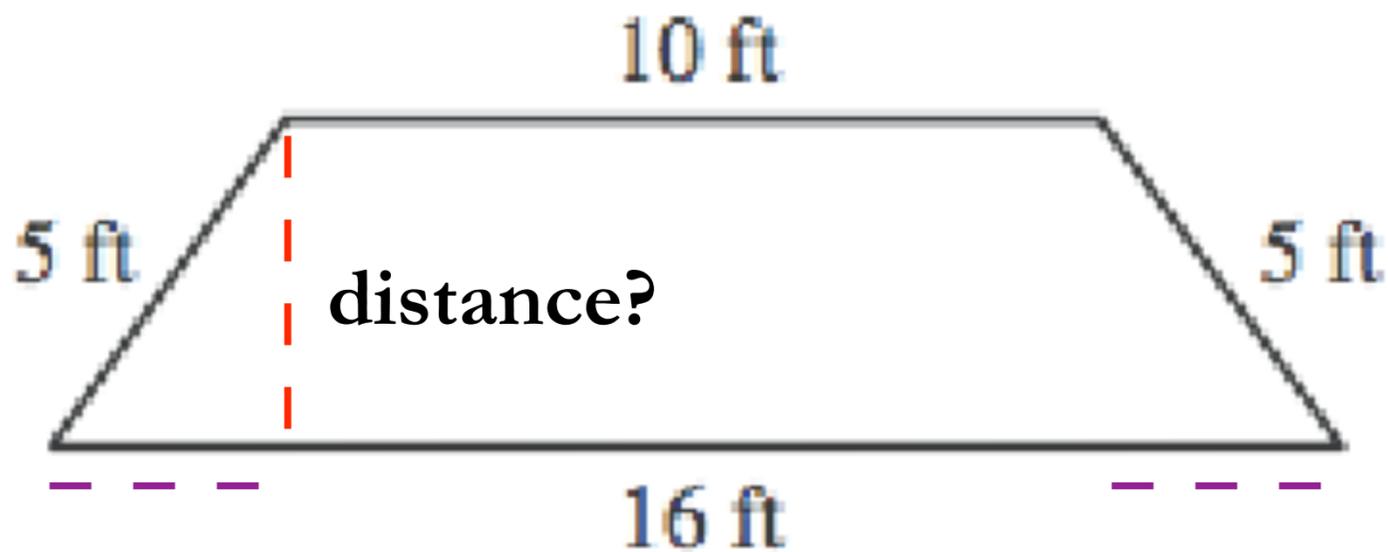
(Think, pair, share) Second we need to determine the base of this triangle.

What is the distance between the 10 ft and 16 ft sides of this trapezoid?



(Think, pair, share) Second we need to determine the base of this triangle, the base of the trapezoid is six longer than the top.

What is the distance between the 10 ft and 16 ft sides of this trapezoid?

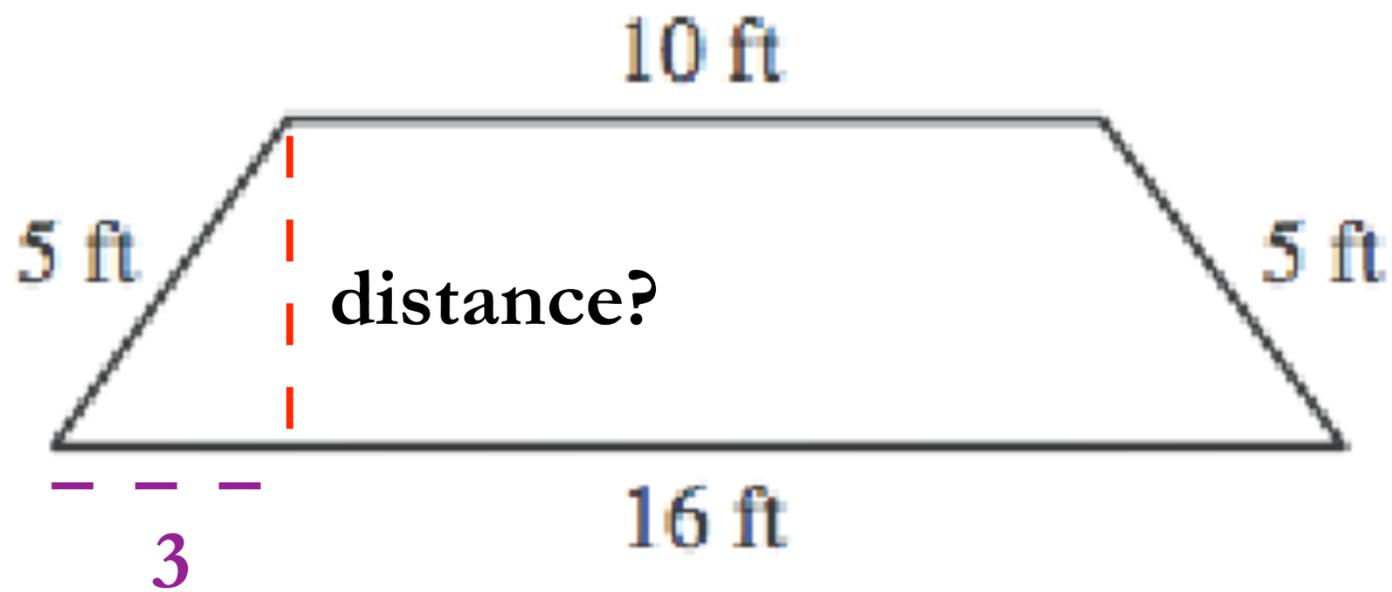


$$- - - + - - - = 6$$

$$\text{Therefore, } - - - = 3$$

(Think, pair, share) Second we need to determine the base of this triangle, the base of the trapezoid is six longer than the top. So, the base of the triangle is three.

What is the distance between the 10 ft and 16 ft sides of this trapezoid?



(Think, pair, share) Second we need to determine the base of this triangle, the base of the trapezoid is six longer than the top. So, the base of the triangle is three.

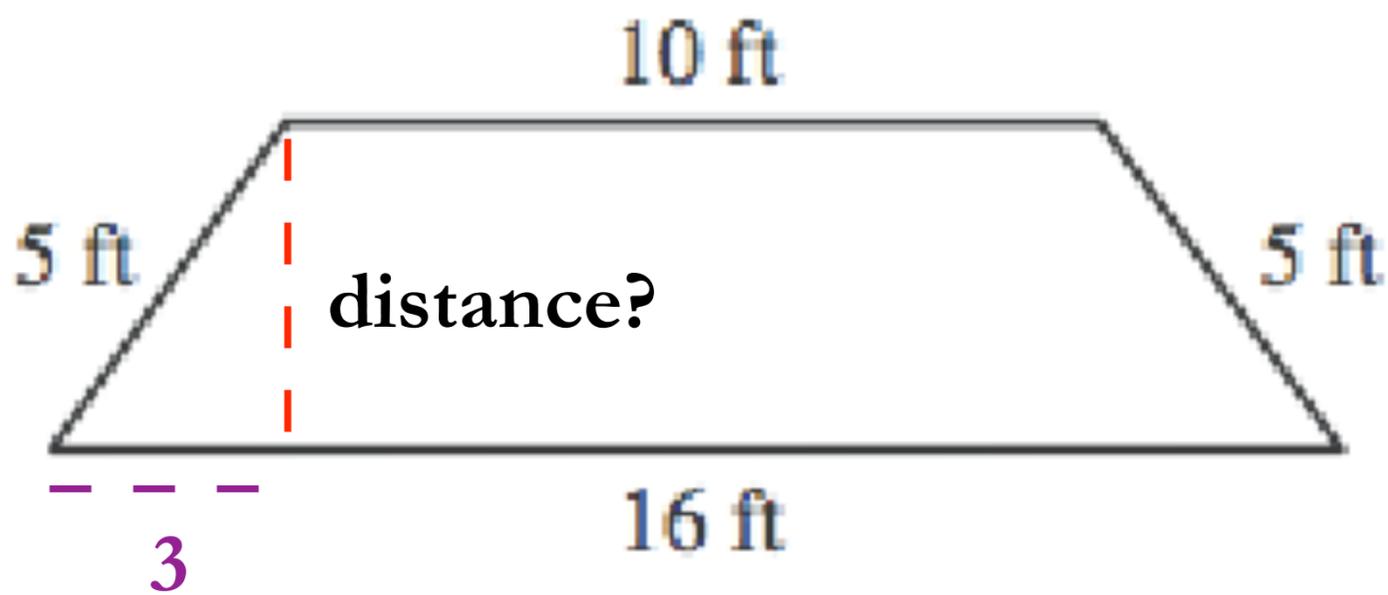
What is the distance between the 10 ft and 16 ft sides of this trapezoid?

$$3^2 + d^2 = 5^2$$

$$9 + d^2 = 25$$

$$d^2 = 16$$

$$d = 4$$



(Think, pair, share) Third, we can now use the Pythagorean theorem (or realize that this is a 3-4-5 triangle).

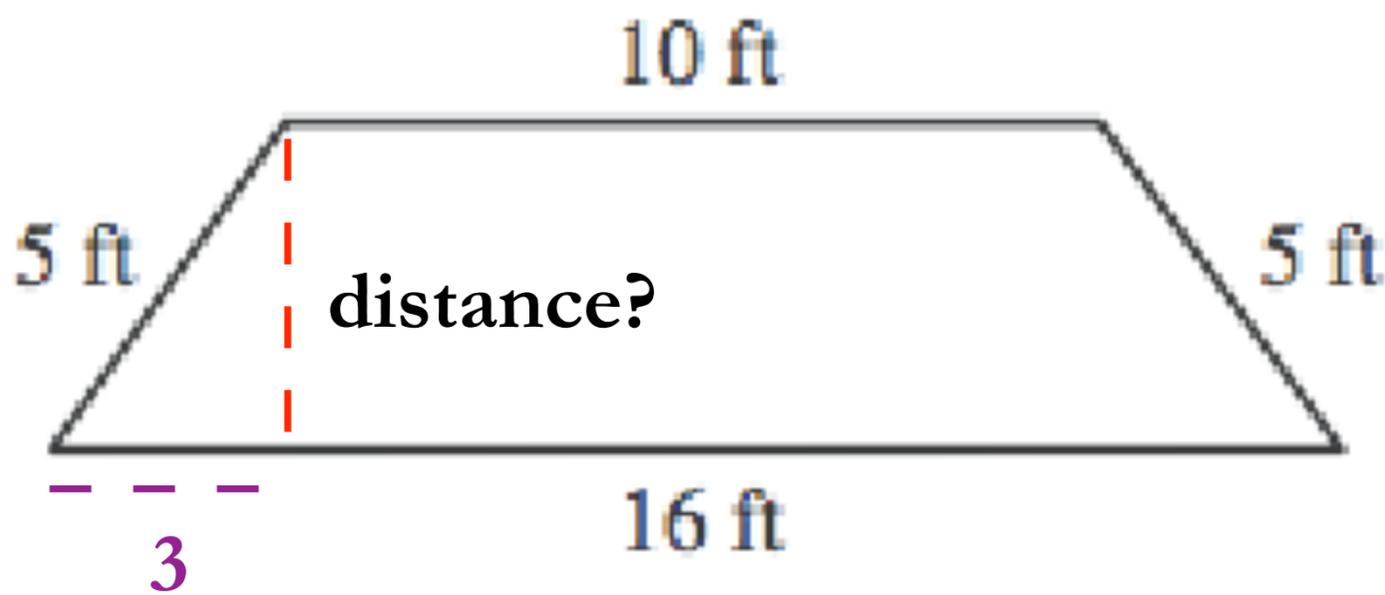
What is the distance between the 10 ft and 16 ft sides of this trapezoid?

$$3^2 + d^2 = 5^2$$

$$9 + d^2 = 25$$

$$d^2 = 16$$

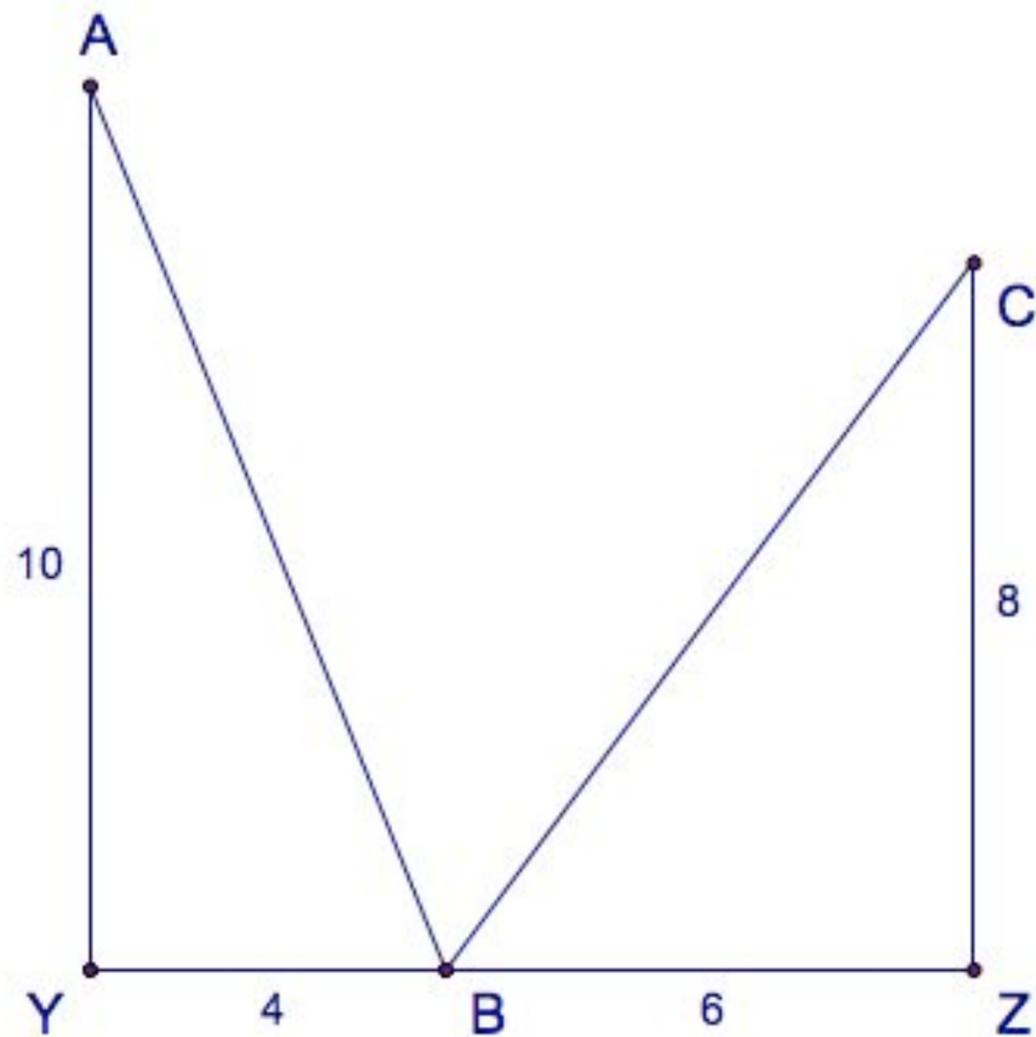
$$d = 4$$



The height of the trapezoid is 4 feet and that is the distance between the 10 and 16 ft sides.

(Think, pair, share) Solution stated.

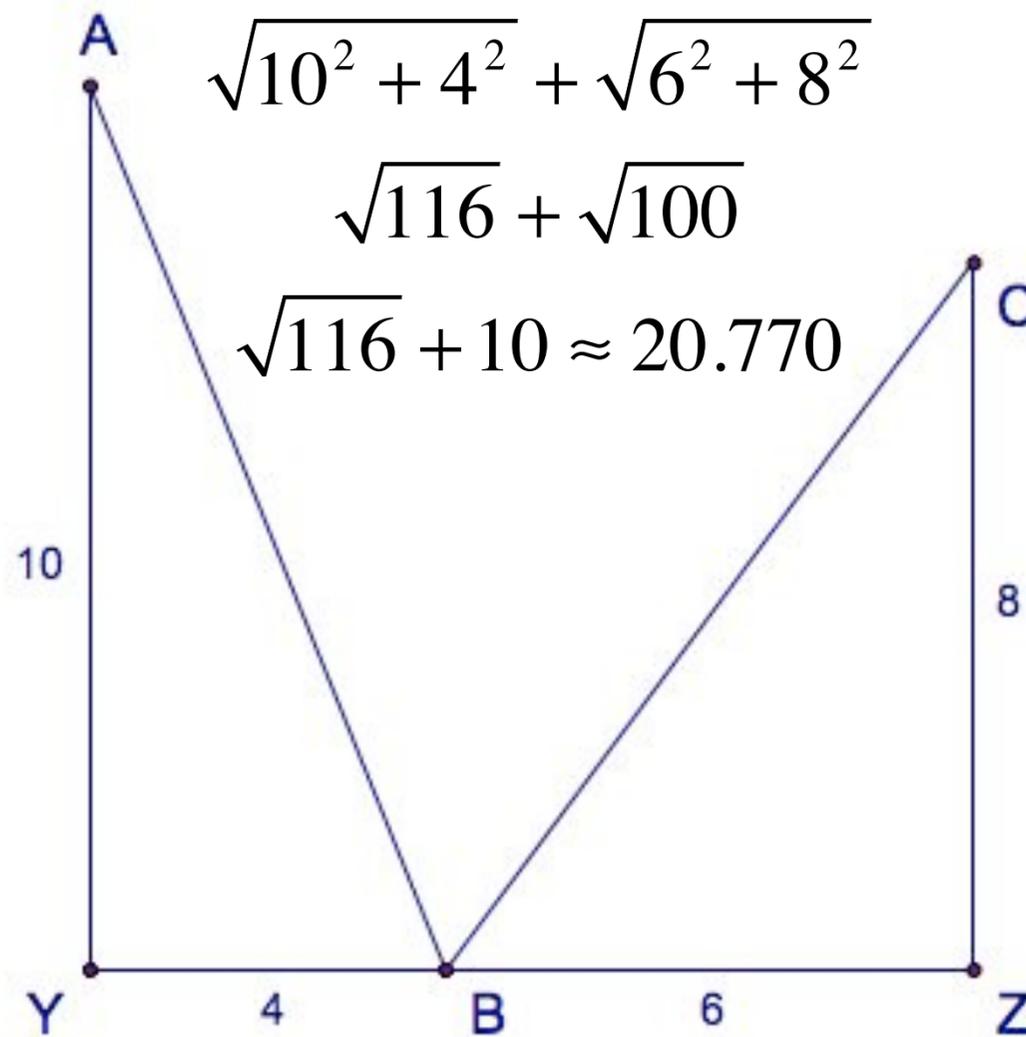
What is the distance from A to B to C?



(Think, pair, share) Students need to apply the pythagorean theorem twice, then sub the terms. Answer on the next slide.

OPTIONAL EXTENSION: In this lesson (on Curriki) there is also included an extension that moves the location of B along the line segment YZ, and asks “What is the shortest distance from A to B to C?”

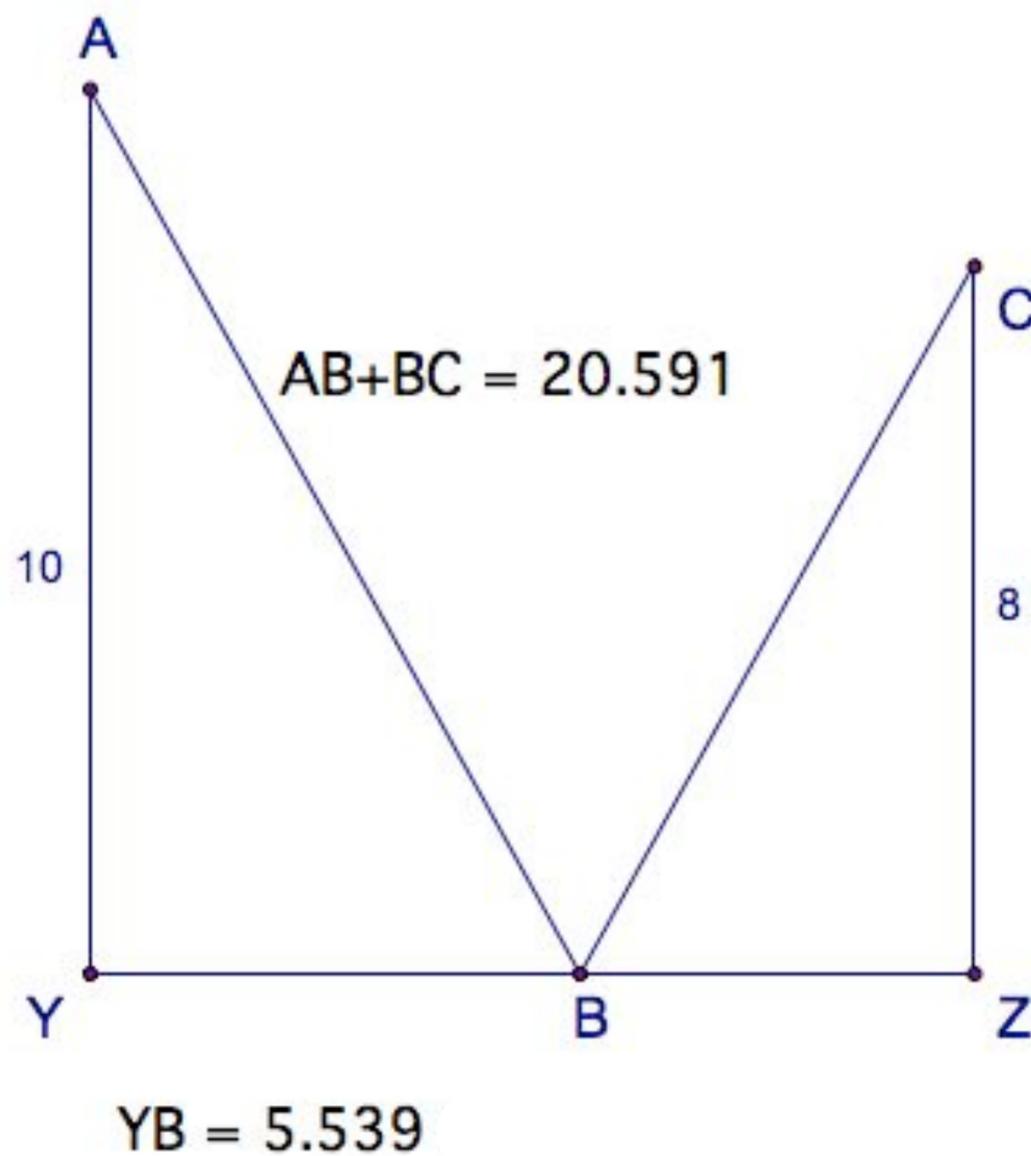
What is the distance from A to B to C?



(Think, pair, share) Students need to apply the pythagorean theorem twice, then sub the terms. Answer on the next slide, but there may be some variation in the mode of the answer (decimals, radicals)

OPTIONAL EXTENSION: In this lesson (on Curriki) there is also included an extension that moves the location of B along the line segment YZ, and asks “What is the shortest distance from A to B to C?”

What is the SHORTEST distance from A to B to C?
... if B can move back and forth along YZ



Answer to the OPTIONAL EXTENSION. The answer of $YB \approx 5.539$ can be derived in an Algebra 2 or PreCalculus class, so any answer of "between 5 and 6" is excellent at this stage.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered.

By going diagonally across the court, 40 meters are saved.

What are the dimensions of the court?



(Small group discussion) THIS IS NOT A LINEAR-EQUATION PROBLEM. An analytic solution to this problem is saved for a higher class, but we can search for a solution using a table.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered.

By going diagonally across the court, 40 meters are saved.

What are the dimensions of the court?



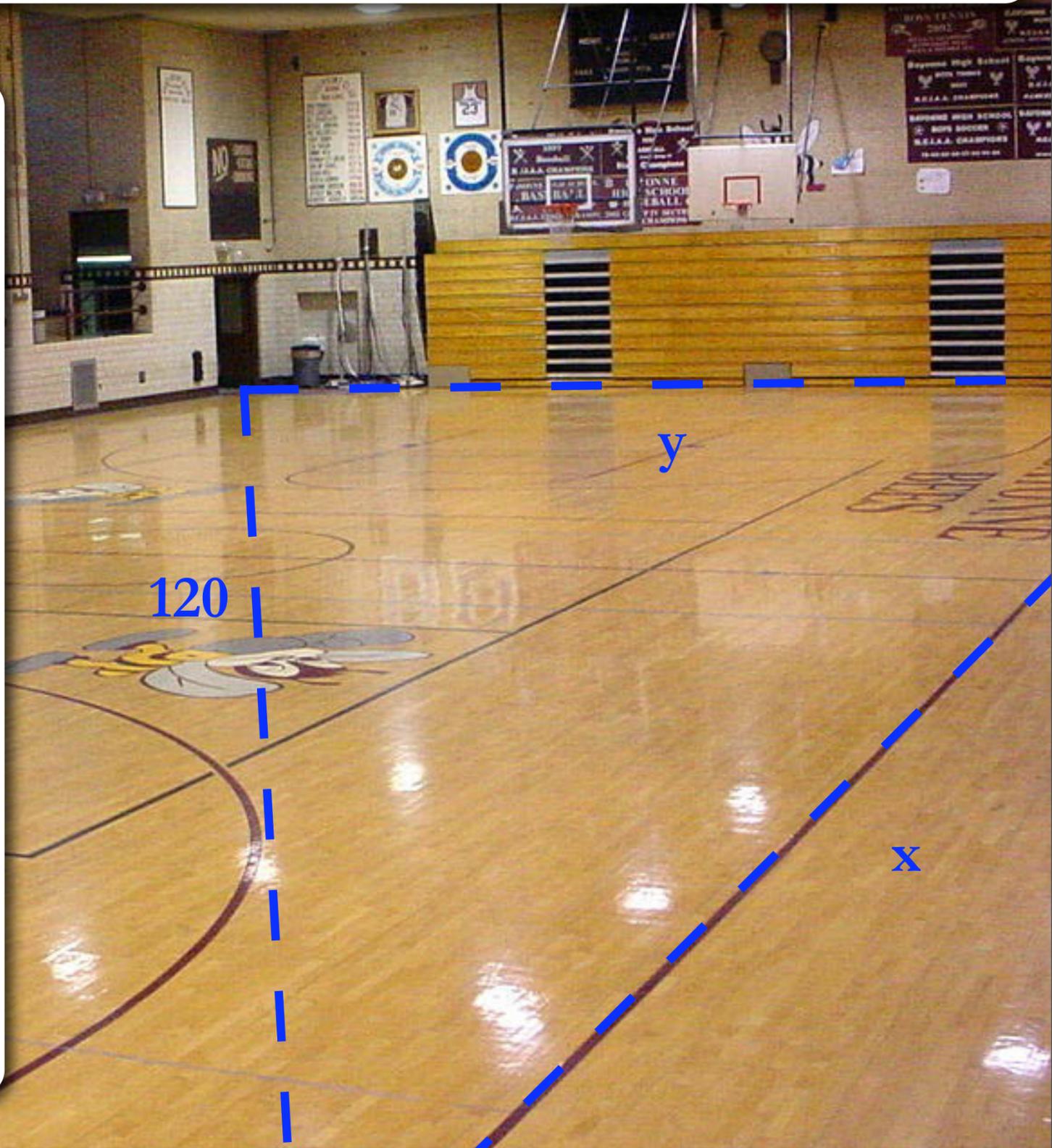
(hint for discussion) Set-up triangle

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered.

By going diagonally across the court, 40 meters are saved.

What are the dimensions of the court?



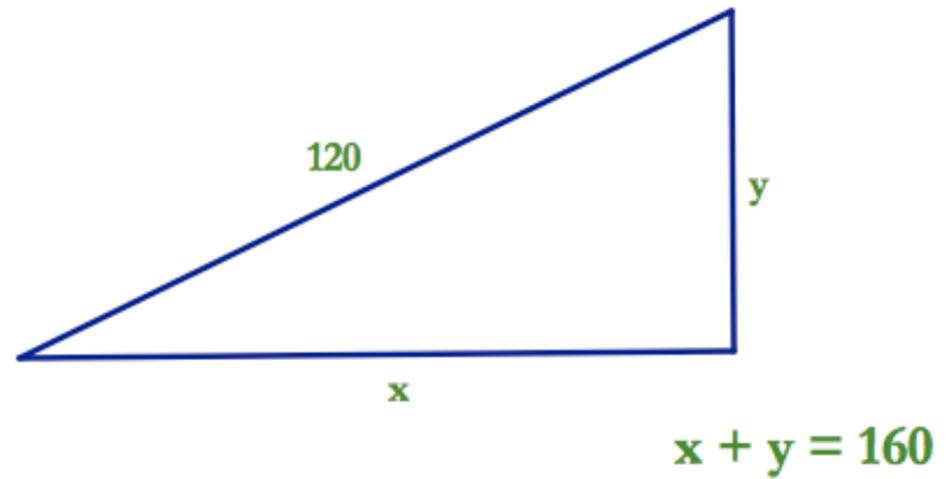
(hint for discussion) Define triangle.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered.

By going diagonally across the court, 40 meters are saved.

What are the dimensions of the court?



x

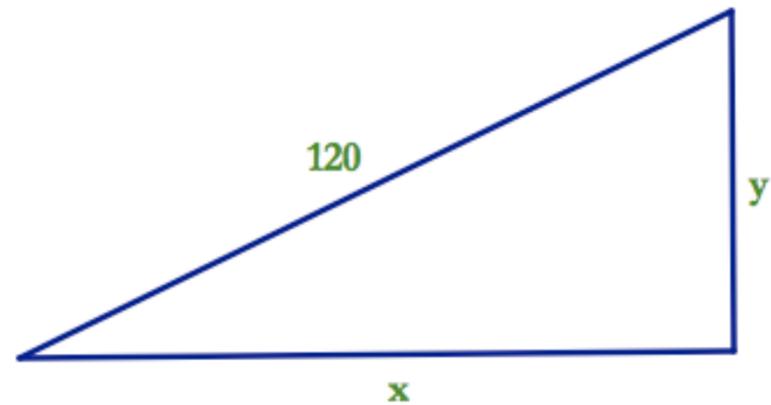
(hint for discussion) Set-up graphical representation.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered.

By going diagonally across the court, 40 meters are saved.

What are the dimensions of the court?



$$x + y = 160$$

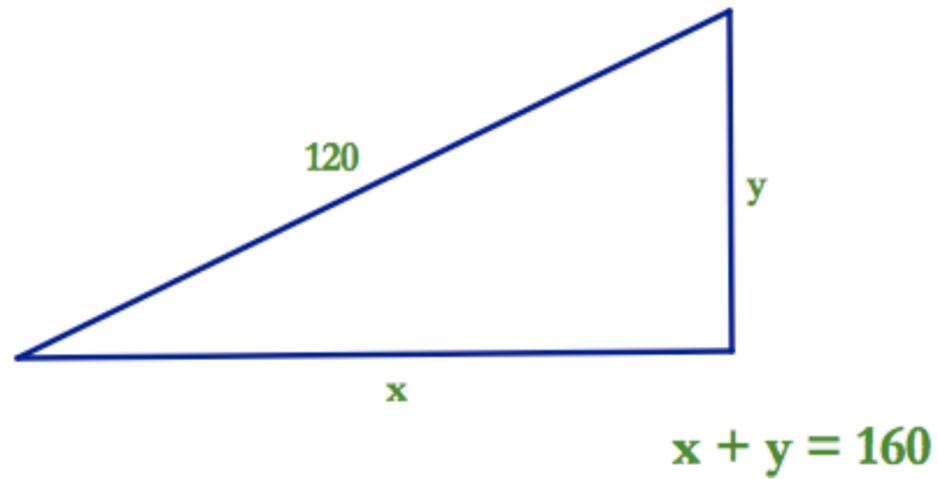
And we also realize that: $x^2 + y^2 = 120^2$

x

(last hint for discussion) Equations are set-up, but we really need a table (unless we can solve a system of with a non-linear equation and then a quadratic... later in Algebra).

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered

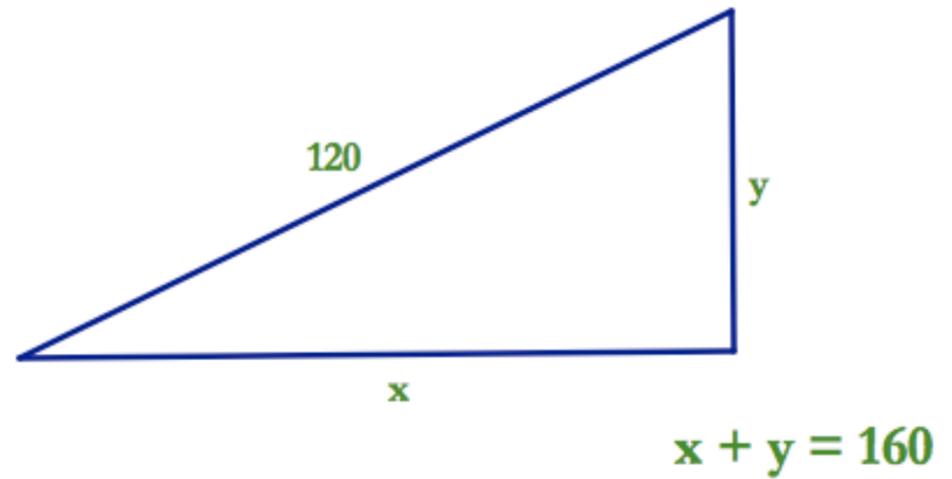


	x	y	$x^2 + y^2$	target	check
E				14,400	
a				14,400	
n				14,400	
V				14,400	
o				14,400	
				14,400	

Table set-up.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered

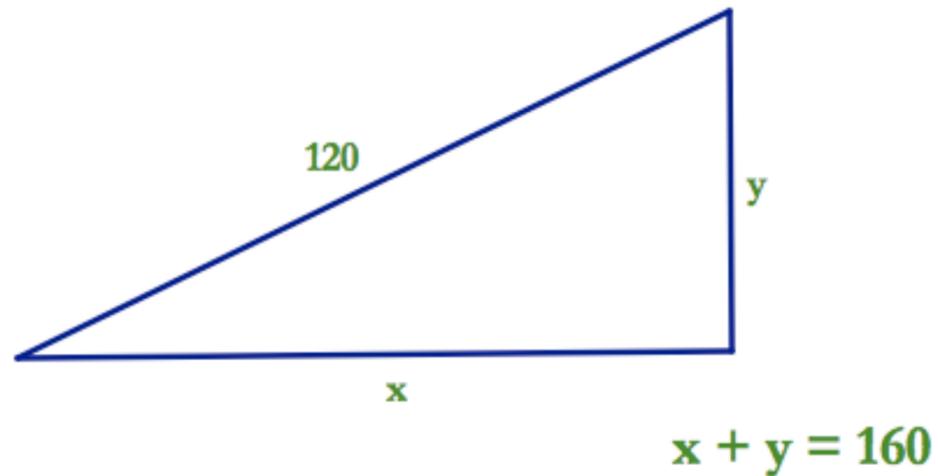


	x	y	$x^2 + y^2$	target	check
E	0	160	$0^2 + 160^2 = 25,600$	14,400	no
a	80	80	$80^2 + 80^2 = 12,800$	14,400	no
n	160	0	$160^2 + 0^2 = 25,600$	14,400	no
				14,400	
V				14,400	
o				14,400	
				14,400	

Table extremes. From this we can note that our width and length are interchangeable, that is to say, x and y could easily be y and x and every equation would be the same, so we have bounds starting on the next slide.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered

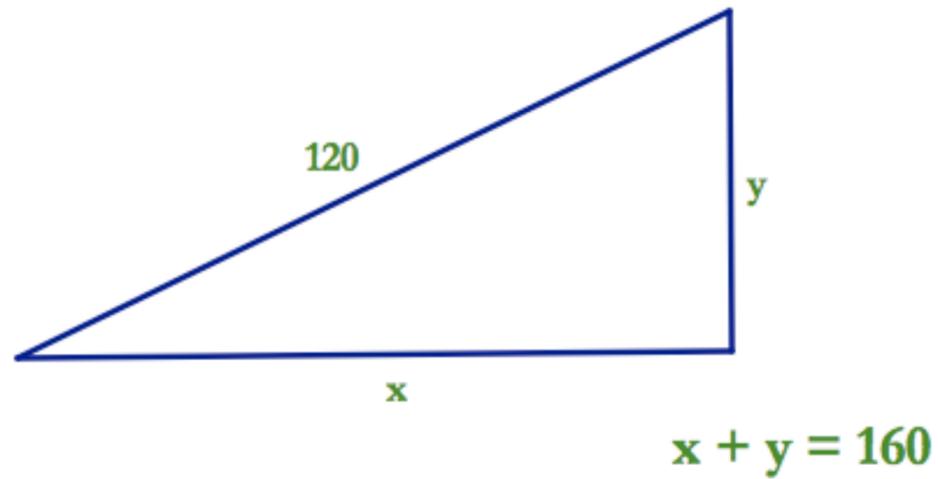


	x	y	$x^2 + y^2$	target	check
E	0	160	$0^2 + 160^2 = 25,600$	14,400	no
a				14,400	
n				14,400	
V				14,400	
o				14,400	
	80	80	$80^2 + 80^2 = 12,800$	14,400	no

Now, we are just going to check everything in between.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered

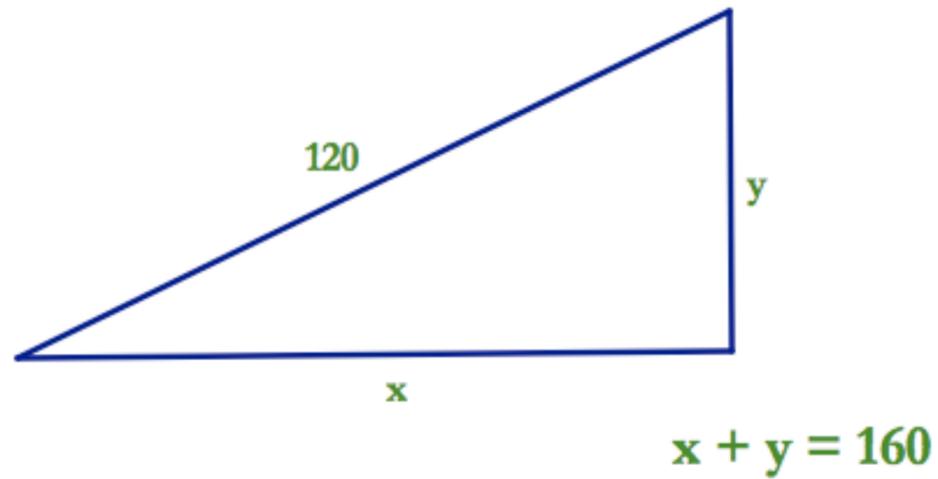


	x	y	$x^2 + y^2$	target	check
E	0	160	$0^2 + 160^2 = 25,600$	14,400	no
a				14,400	
n				14,400	
V				14,400	
o	70	90	$70^2 + 90^2 = 13,000$	14,400	no
	80	80	$80^2 + 80^2 = 12,800$	14,400	no

Now, we are just going to check everything in between. I start at the bottom, because 12800 is a lot closer to 14400 than 25600 is.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered

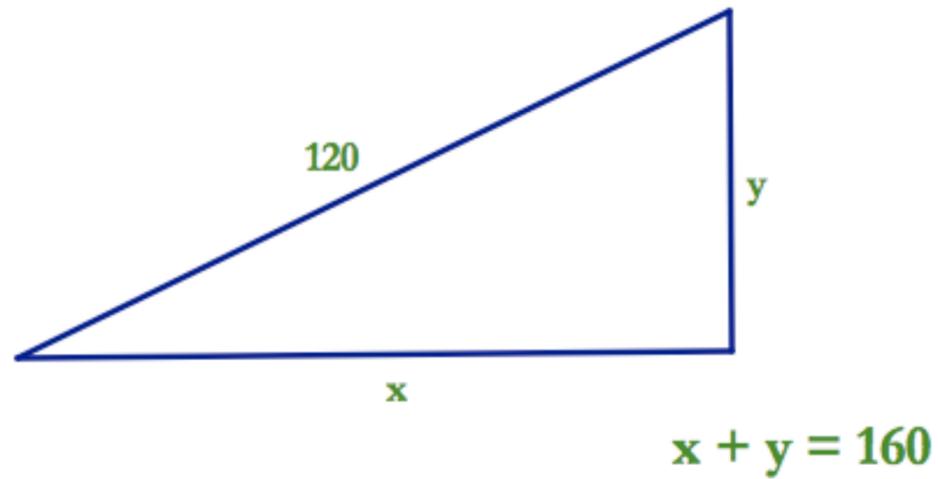


	x	y	$x^2 + y^2$	target	check
E	0	160	$0^2 + 160^2 = 25,600$	14,400	no
a				14,400	
n				14,400	
V				14,400	
o	60	100	$60^2 + 100^2 = 13,600$	14,400	no
	70	90	$70^2 + 90^2 = 13,000$	14,400	no
	80	80	$80^2 + 80^2 = 12,800$	14,400	no

Filling in table, looking for solution.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered

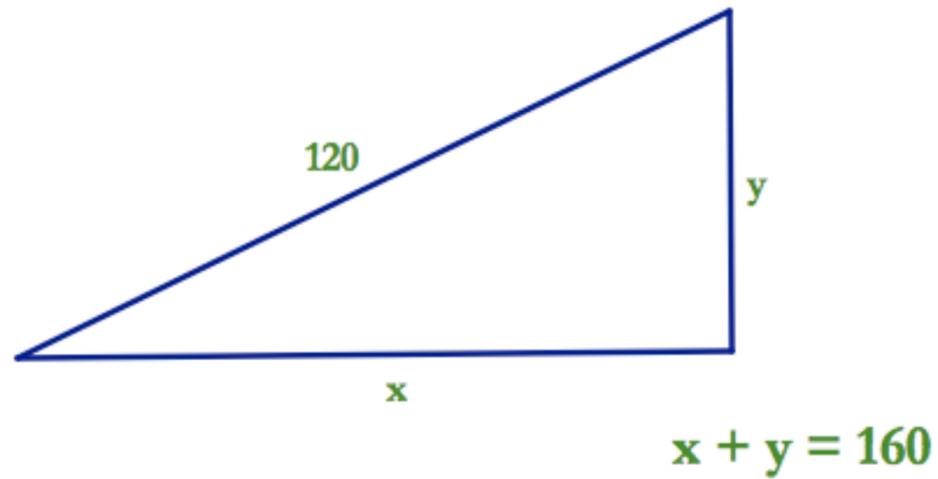


	x	y	$x^2 + y^2$	target	check
E	0	160	$0^2 + 160^2 = 25,600$	14,400	no
a				14,400	
n				14,400	
V	50	110	$50^2 + 110^2 = 14,600$	14,400	no, but close
o	60	100	$60^2 + 100^2 = 13,600$	14,400	no
	70	90	$70^2 + 90^2 = 13,000$	14,400	no
	80	80	$80^2 + 80^2 = 12,800$	14,400	no

Filling in table, looking for solution.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered

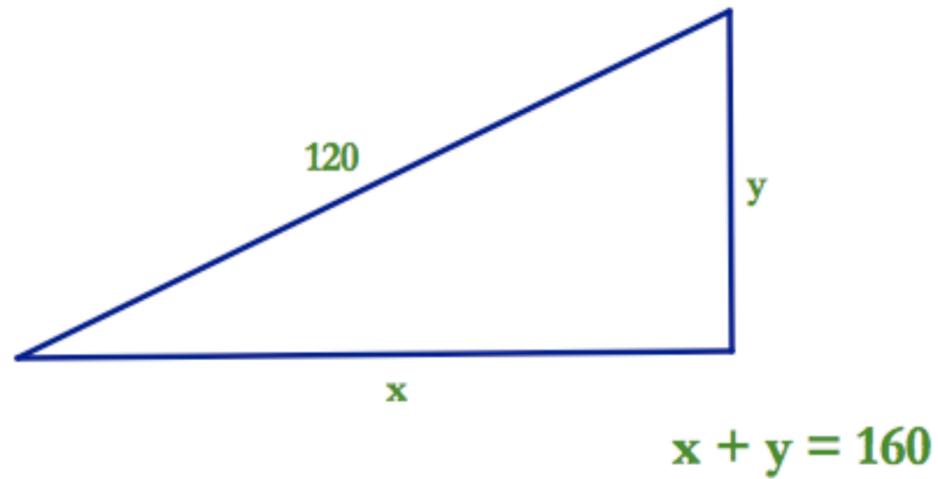


	x	y	$x^2 + y^2$	target	check
E	0	160	$0^2 + 160^2 = 25,600$	14,400	no
a	50	110	$50^2 + 110^2 = 14,600$	14,400	no, but close
n				14,400	
V	60	100	$60^2 + 100^2 = 13,600$	14,400	no
o	70	90	$70^2 + 90^2 = 13,000$	14,400	no
	80	80	$80^2 + 80^2 = 12,800$	14,400	no

Filling in table, looking for solution.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered

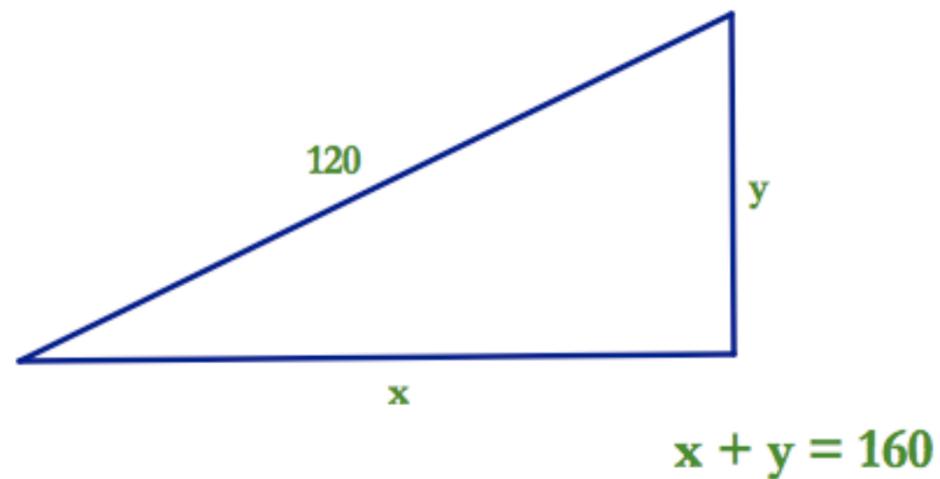


	x	y	$x^2 + y^2$	target	check
E	0	160	$0^2 + 160^2 = 25,600$	14,400	no
a	50	110	$50^2 + 110^2 = 14,600$	14,400	no, but close
n	51	109	$51^2 + 109^2 = 14,482$	14,400	closer
				14,400	
V	60	100	$60^2 + 100^2 = 13,600$	14,400	no
o	70	90	$70^2 + 90^2 = 13,000$	14,400	no
	80	80	$80^2 + 80^2 = 12,800$	14,400	no

Filling in table, looking for solution.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered

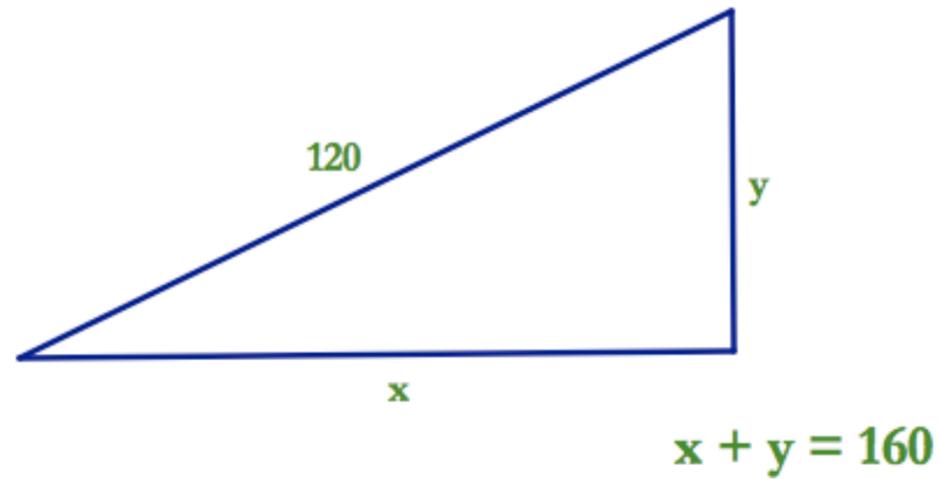


	x	y	$x^2 + y^2$	target	check
E	0	160	$0^2 + 160^2 = 25,600$	14,400	no
a	50	110	$50^2 + 110^2 = 14,600$	14,400	no, but close
n	51	109	$51^2 + 109^2 = 14,482$	14,400	just over
V	52	108	$52^2 + 108^2 = 14,368$	14,400	just under
o	60	100	$60^2 + 100^2 = 13,600$	14,400	no
	70	90	$70^2 + 90^2 = 13,000$	14,400	no
	80	80	$80^2 + 80^2 = 12,800$	14,400	no

Filling in table, looking for solution.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered



	x	y	$x^2 + y^2$	target	check
E	0	160	$0^2 + 160^2 = 25,600$	14,400	no
a	50	110	$50^2 + 110^2 = 14,600$	14,400	no, but close
n	51	109	$51^2 + 109^2 = 14,482$	14,400	just over
V	52	108	$52^2 + 108^2 = 14,368$	14,400	YES !
o	60	100	$60^2 + 100^2 = 13,600$	14,400	no
	70	90	$70^2 + 90^2 = 13,000$	14,400	no
	80	80	$80^2 + 80^2 = 12,800$	14,400	no

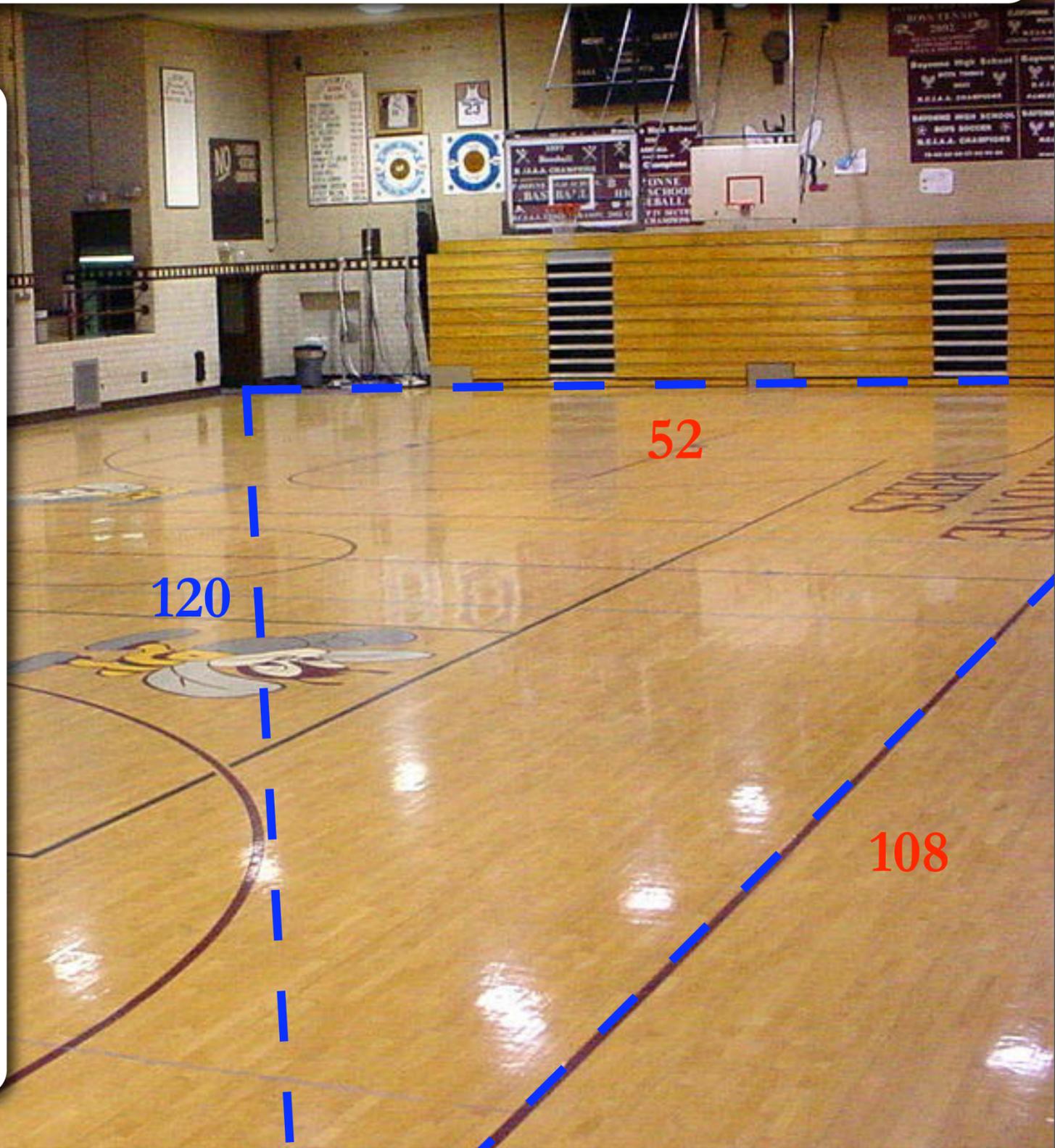
Filling in table, looking for solution.

What are the dimensions of the court?

To get from one corner of a rectangular court to the diagonally opposite corner by walking along two sides, a distance of 160 meters must be covered.

By going diagonally across the court, 40 meters are saved.

The court is 52m by 108m.



Solution stated.

Disclaimer

**All photos contained are used under
creative commons rights.**

BHS Gym by forever digital

<http://www.flickr.com/photos/foreverdigital/3151541570/>