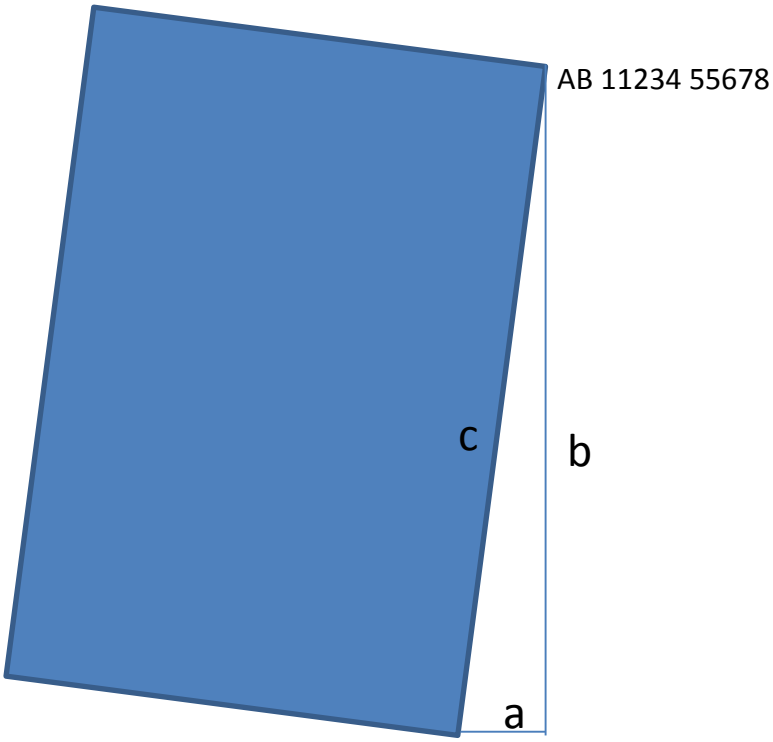
# Math commonly used in the US Army Pathfinder School

**Pythagorean Theorem** is used for solving triangles when two sides are known. In the Pathfinder Course it is used to determine the radius of circular drop zones and is used to determine lengths and widths on a drop zone survey. Use the following link to familiarize yourself with the Pythagorean Theorem and complete the practice quiz.

http://www.mathsisfun.com/pythagoras.html




In order to solve for the length of the side of this drop zone you must use the Pythagorean Theorem as the drop zone does not sit on the vertical axis of the map.

In preparation to solve $a^2 + b^2 = c^2$

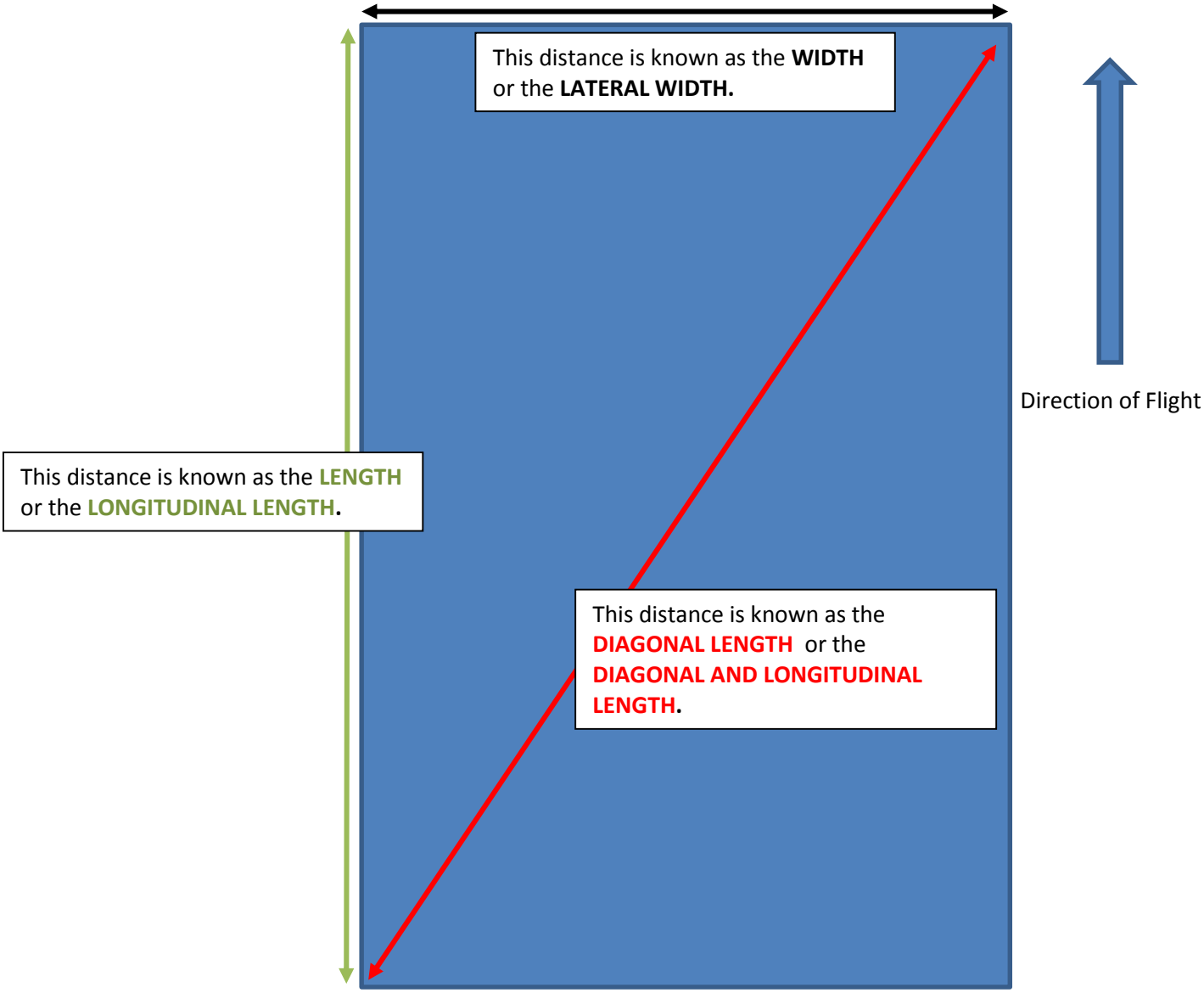
1. You must first solve for "a" and "b"
2. To solve "a" find the difference of the eastings*[1]. $11234 - 11100 = 134$
3. To solve for "b" find the difference of the northings*[1]. $55678 - 54234 = 1444$
4. Now plug those values into the Pythagorean Theorem $134^2 + 1444^2 = c^2$ and simplify $\sqrt{134^2 + 1444^2} = 1450$
5. Therefore, "c"= 1450

*** Easting is the first set of numbers in a grid. In this case it is 11234 and 11100.**
**Northing is the second set of numbers in a grid. In this case it is 55678 and 54237.**
**[1] Either of these numbers may be negative; this is ok, because you will end up squaring them, resulting in a positive number and the equation will work. Remember that you're dealing with distances and there is no such thing as a negative distance.**

## BASICS OF A DROP ZONE

The left corner as you depart the drop zone on drop heading is known as the **Left Trailing Edge (LTE)**

The right corner as you approach the drop zone on drop heading is known as the **Right Trailing Edge (RTE)**




The left corner as you approach the drop zone on drop heading is known as the **Left Leading Edge (LLE)**

The right corner as you approach the drop zone on drop heading is known as the **Right Leading Edge (RLE)**

**Dimensions of a drop zone (always round your final answers down):**

**Length** - Compare both lengths (left side [LLE to LTE] and right side[RLE to RTE]) and take the **SMALLEST** value.

**Width** – Compare both widths (lead edge [LLE to RLE] and trail edge [LTE to RTE]) and take the **SMALLEST** value.

**Diagonal Length** – Compare both diagonals (RLE to LTE and LLE to RTE) and take the **SMALLEST** value.

[2]To convert meters to yards divide by .9144 (100 meters ÷ .9144 = 109.36 yards)

[2]To convert yards to meters multiply by .9144 (100 yards x .9144 = 91.44 meters)

When converting, do not round until **AFTER** you have completed the conversion.

**Ex.** Convert 789.8 m to yds

789.8 m ÷ .9144 = 863.736 yds. Round both answers down – 789m / 863 yds

If you **INCORRECTLY** round meters down before converting

789 m ÷ .9144 = 862.861 yds. Round down and it is 789 m / **862** yds – This answer is 1yd off and therefore wrong.

**PRACTICE QUESTIONS (ANSWER IN METERS AND YARDS)**

**1.** You have a drop zone with the following corner coordinates:

Left Leading Edge (LLE) - 18S TH 92110 26839

Right Leading Edge (RLE) - 18S TH 91337 26350

Left Trailing Edge (LTE) – 18S TH 92941 25525

Right Trailing Edge (RTE) – 18S TH 92168 25036

a) What is the length of the drop zone?

b) What is the width of the of the drop zone?

c) What is the diagonal length of the drop zone?

**2.** You have a drop zone with the following corner coordinates:

Left Leading Edge (LLE) - 16R EU 70649 96816

Right Leading Edge (RLE) – 16R EU 70471 97430

Left Trailing Edge (LTE) – 16R EU 68893 96306

Right Trailing Edge (RTE) – 18S EU 68715 96920

a) What is the length of the drop zone?

b) What is the width of the of the drop zone?

c) What is the diagonal length of the drop zone?

**3.** You have a drop zone with the following corner coordinates:

Left Leading Edge (LLE) - 06V UP 58937 05981

Right Leading Edge (RLE) – 06V UP 57307 06202

Left Trailing Edge (LTE) – 06V UP 58593 03444

Right Trailing Edge (RTE) – 06V UP 56963 03665

a) What is the length of the drop zone?

b) What is the width of the of the drop zone?

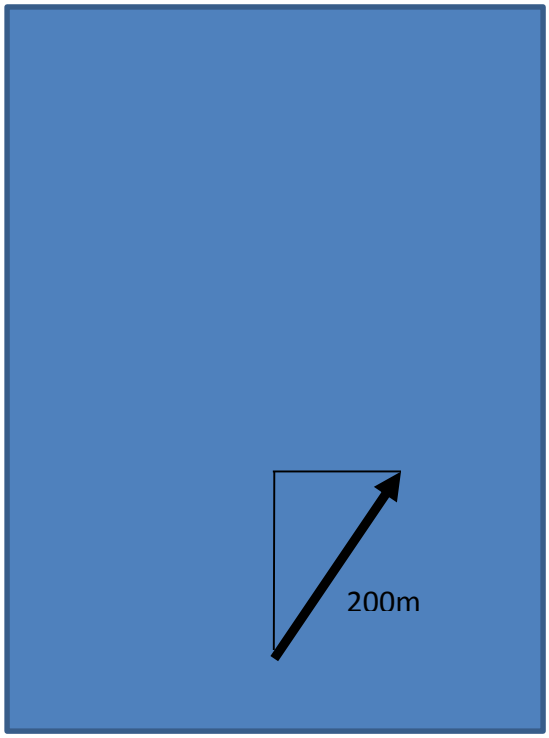
c) What is the diagonal length of the drop zone?

**ANSWERS**

1. a) 1554m / 1,700yds b) 914m / 1,000yds c) 1803m / 1972yds
2. a) 1828m / 1999yds b) 639m / 699yds c) 1937m / 2118yds
3. a) 2560m / 2799yds b) 1644m / 1798yds c) 3043m / 3327yds

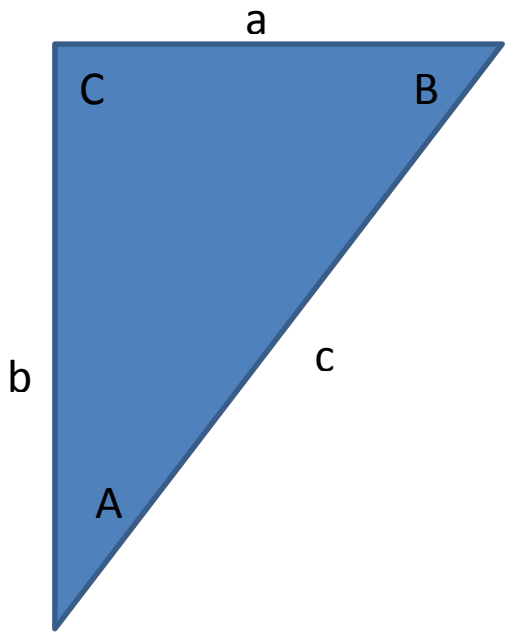
**The Law of Sines** (or **Sine Rule**) is used to determine the unknown lengths of a triangle when you have one known side and known angles. In the Pathfinder Course it is used to determine width and length requirements of helicopter landing zones and angular drift calculations on drop zones. Use the following link to familiarize yourself with the Law of Sines and complete the practice quiz.

https://www.mathsisfun.com/algebra/trig-sine-law.html

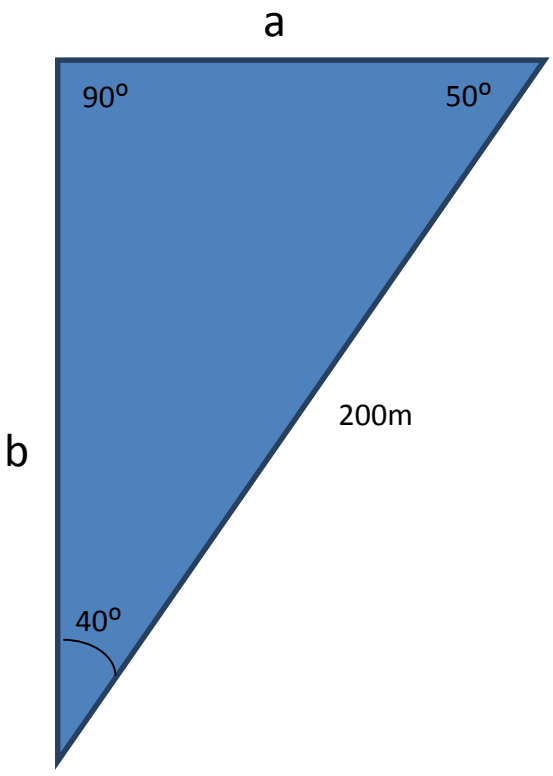



In order to determine the forward and/or lateral drift distances we must use the "Law of Sines"

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$



Where:




$$\frac{a}{Sin\ 40} = \frac{b}{Sin\ 50} = \frac{200}{Sin\ 90}$$

To solve for side “a”

: a = 200(Sin 40)

a = 129m

: b = 200(Sin50)

b = 153m

*Sin 90 = 1

**WHEN USING THE LAW OF SINES, ALWAYS USE “PROPER” MATH ROUNDING – BELOW 5, ROUND DOWN; 5 AND ABOVE, ROUND UP.**

**PRACTICE QUESTIONS**

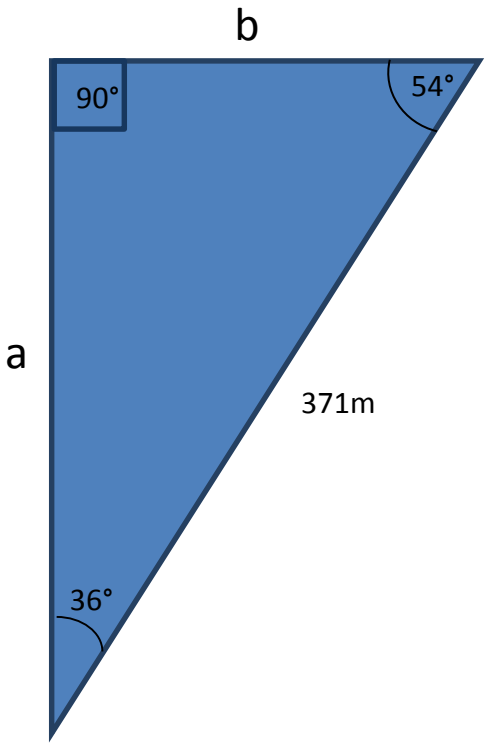
**Solve for "a" and "b", answers are in meters**

**1.**

a =

b =

$\frac{a}{Sin\ A} = \frac{b}{SinB} = \frac{c}{SinC}$



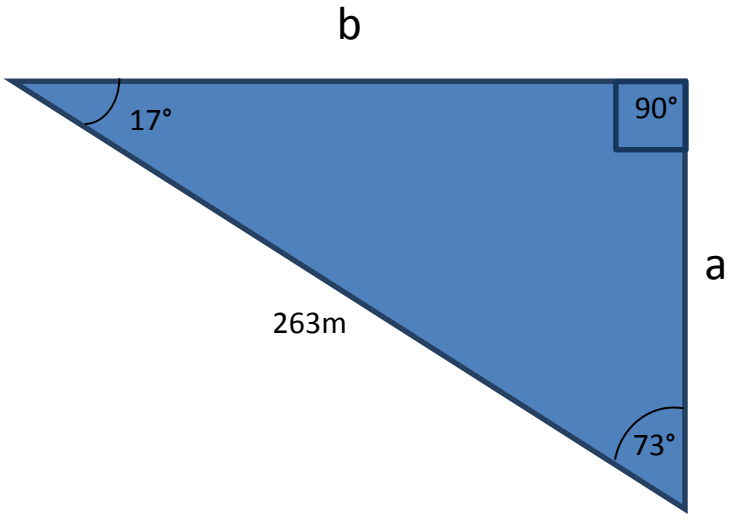

**Solve for "a" and "b", answers are in meters**

**2.**

a =

b =

$\frac{a}{Sin\ A} = \frac{b}{SinB} = \frac{c}{SinC}$



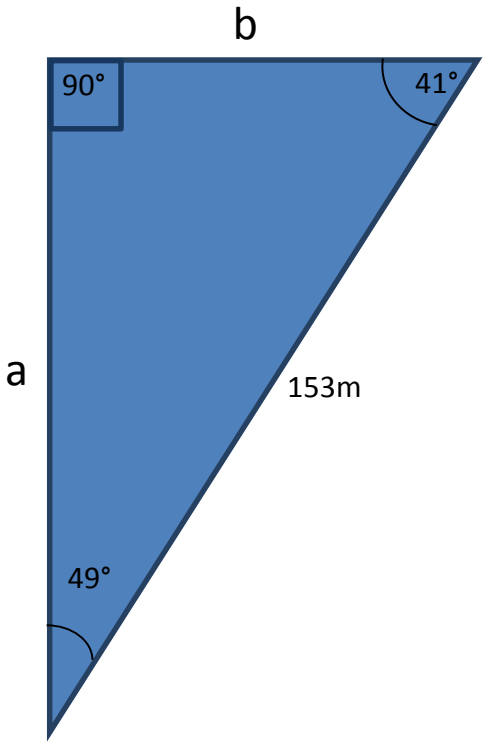
**Solve for “a” and “b”, answers are in meters**

**3.**

a =

b =

$$\frac{a}{Sin\ A} = \frac{b}{SinB} = \frac{c}{SinC}$$




**ANSWERS**

| | | | | |
|---|---|---|---|---|
| 1. a) | 218m | | b) | 300m |
| 2. a) | 77m | | b) | 252m |
| 3. a) | 100m | | b) | 115m |

**Incoming students also need to know:**

[2]To convert meters to yards divide by .9144 (100 meters / .9144 = 109.36 yards)

[2]To convert yards to meters multiply by .9144 (100 yards x .9144 = 91.44 meters)

To convert feet to meters divide by 3.28 (10 feet / 3.28 = 3.05 meters)

To convert meters to feet multiply by 3.28 (3 meters x 3.28 = 9.84 feet)

Aircraft Rate – to convert airspeed (KIAS – knots indicated airspeed) into meters/sec, multiply by .51 (70 KIAS x .51 = 35.7 meters per second) Depending on the problem, you may need to round this value up.

**[2] When doing conversions from meters to yards, remember that your "meters" value should ALWAYS BE SMALLER than your "yards" value.**

Radius – ½ the Diameter of a circle

Diameter – the width of a circle as it passes directly through the center

**Math Symbols**

$X > Y$ - X is greater than Y

$X < Y$ - X is less than Y

$X \geq Y$ - X is greater than or equal to Y

$X \leq Y$ - X is less than or equal to Y