NATIONAL MUSEUM
OF THE UNITED STATES AIR FORCE™

Statute and Nautical Mile Conversions

Students will have a basic understanding of statute and nautical miles while solving a series of historical and real world problems.

LESSON PLAN

Lesson Objectives
The students will:
- Be introduced to formulas used in flight related to navigation and aircraft performance.
- Learn the difference between statue and nautical miles.
- Practice statute and nautical miles examples to understand the difference between the two

Purpose

In this lesson, students will gain an understanding of common calculations performed by flight personnel. Students will learn about statute and nautical miles and how they apply to both aviation and naval navigation. Students will then solve mathematical equations from historical and real life examples.

Introduction

On land we measure long distances in miles. These are referred to as statute miles **(sm)**. In navigation, distance is measured in nautical miles **(nm)**, which allows for the curvature of the earth. Nautical miles is a mathematical calculation based on degrees of latitude around the equator. In navigation, one minute is called a nautical mile. So each degree of latitude is sixty minutes or sixty nautical miles. So this means a minute of arc on the planet Earth is 1 nautical mile. This unit of measurement is also used by all nations for air and sea travel. A mile on the ground **(sm)** is 5,280 feet. While a mile in the air **(nm)** is 6076.1 feet. To convert be- tween the units, we use the formula:

nm = sm x 1.15

Therefore, 6076.1 feet = 5280 x 1.15

This would mean statute miles are shorter than nautical miles. Though these measurements are often used for naval navigation, it is also used for aviation and the movement of airplanes within different sections of the world. See pages 3-4 for worksheet. A PowerPoint presentation is also attached that shows how to solve three of these equations.

Grade Level: 5 – 6

Ohio Learning Standards/Mathematics (2017)

Standards for Mathematical Practice
MP.1: Make sense of problems
MP.3: Construct viable arguments
MP.5: Use appropriate tools strategically
MP.6: Attend to precision

Measurement & Data
5.MD.1: Know relative sizes and conversions of U.S. measurements

Expressions & Equations
6.EE.5: Understand solving an equation
6.EE.6: Use variables to represent expressions
6.EE.9: Use two variables in a real-world problem

Materials Required:

- Paper
- Pencil or Pen
- Attached worksheet

Resources:

National Museum of the United States Air Force:
https://www.nationalmuseum.af.mil/
https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104465/b-52-stratofortress/
https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/197379/round-the-rim-flight/
https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/197382/doolittles-atlantic-to-pacific-flight/
https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/197393/martin-b-10/platform/AFmuseum/

Statute vs Nautical:
https://www.thebalanceeveryday.com/nautical-miles-vs-statute-miles-282937
https://indianapublicmedia.org/amomentofscience/difference-mile-nautical-mile.php
https://www.boatsafe.com/conversiona-nautical-statute-miles/

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STUDENT WORKSHEET   *NAME:* _____

nm = sm x 1.15

Exercise 1:

Find the distance in nautical miles given a distance of 1000 statute miles, the approximate distance from Miami FL to Washington, D.C.

Exercise 2:

Find the distance in nautical miles given the distance 10,000 statute miles, the approximate distance traveled during the Round-the-Rim flight in 1919.

Exercise 3:

Find the distance in nautical miles given the distance 2,163 statute miles, the distance of the first trans-continental flight across the United States by Lt. Jimmy Doolittle in 1922.

Exercise 4:

Find the distance in nautical miles given the distance 4,153 statute miles, the approximate distance a flight of B-10 bombers flew from Washington, DC to Fairbanks, AK in 1934. Find the distance in nautical miles for the round trip.

Exercise 5:

Find the distance in nautical miles given the distance 16,000 statute miles, the approximate distance flight of a B-52 bomber that flew from Barksdale Air Force Base, Louisiana on a 34-hour round-trip combat mission.

Answer Sheet

1.) Find the distance in nautical miles given a distance of 1000 statute miles, the approximate distance from Miami FL to Washington, D.C.

   Solution:
   nm = sm x 1.15
   nm = 1,000 miles x 1.1.5 nm = 1,150 miles

2.) Find the distance in nautical miles given the distance 10,000 statute miles, the approximate distance traveled during the Round-the-Rim flight in 1919.

   Solution:
   nm = sm x 1.15
   nm = 10,000 miles x 1.15 nm = 11,500 miles

3.) Find the distance in nautical miles given the distance 2,163 statute miles, the distance of the first trans-continental flight across the United States by Lt. Jimmy Doolittle in 1922.

   Solution:
   nm = sm x 1.15
   nm = 2163 miles x 1.15
   nm = 2,487.5 miles (rounded to the nearest tenth)

4.) Find the distance in nautical miles given the distance 4,153 statute miles, the approximate distance a flight of B-10 bombers flew from Washington, DC to Fairbanks, AK in 1934. Find the distance in nautical miles for the round trip.

   Solution:
   nm = sm x 1.15
   nm = 4,153 miles x 1.15
   nm = 4,775.95 miles rounded up to 4,776 miles

   Round trip: 4,776 nm x 2 = 9,552 nm

5.) Find the distance in nautical miles given the distance 16,000 statute miles, the approximate distance flight of a B-52 bomber that flew from Barksdale Air Force Base, Louisiana on a 34-hour round-trip combat mission.

   Solution:
   nm = sm x 1.15
   nm = 16,000 x 1.15
   nm = 18,400 miles

Diagram

Statute and Nautical Mile Conversions

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STATUTE VS NAUTICAL MILES

- On land we measure long distances in miles

- Referred to as statute miles **(sm)**

- In navigation, distance is measured in nautical miles **(nm)** and one minute is a nautical mile

- Nautical miles is a mathematical calculation based on degrees of latitude around the equator

STATUTE AND NAUTICAL MILES

A mile on the ground **(sm)** is 5,280 feet

A mile in the air **(nm)** is 6076.1 feet

To convert between the units, we use the formula:

nm = sm x 1.15

Therefore, 6076.1 feet = 5280 feet x 1.15

STATUTE AND NAUTICAL MILES

nm = sm x 1.15

EXERCISE #1:

Find the distance in nautical miles given a distance of 1000 statute miles, the approximate distance from Miami FL to Washington, D.C.

Solution:
nm = sm x 1.15
nm = 1,000 miles x 1.15
nm = 1,150 miles

EXERCISE #2: ROUND-THE-RIM FLIGHT

In its desire to test the long-range capabilities of the airplane, the Air Service decided to fly a Glenn Martin bomber completely around the periphery of the U.S. The flight, which began at Bolling Field, Washington, D.C., on July 24, 1919, was made in a counterclockwise direction. Since time and speed were not factors, the flight proceeded leisurely westward across the northern states, down the Pacific Coast, and eastward along the Mexican border and across the southern states, arriving back at Bolling on Nov. 9, 1919. **The total distance of approximately 10,000 miles was flown in 114 hours, 45 minutes.** This was a tremendous achievement for such an early period in the development of the multi-engine bomber.

STATUTE AND NAUTICAL MILES

nm = sm x 1.15

Find the distance in nautical miles given the distance 10,000 statute miles, the distance of the round-the-rim flight in 1919.

STATUTE AND NAUTICAL MILES

nm = sm x 1.15

Find the distance in nautical miles given the distance 10,000 statute miles, the distance of the round-the-rim flight in 1919.

Solution:
nm = sm x 1.15
nm = 10,000 miles x 1.15
nm = 11,500 miles (rounded to the nearest tenth)

EXERCISE #3: DOOLITTLE'S ATLANTIC TO PACIFIC FLIGHT

The first transcontinental flight across the United States within a single day (24-hour period) was made by Lt. Jimmy Doolittle on Sept. 4, 1922. Flying a DH-4B, Lt. Doolittle took off from Pablo Beach, Fla., and landed at Rockwell Field near San Diego, Calif., **covering a distance of 2,163 miles in 21 hours, 20 minutes flying time.** He made one refueling stop at Kelly Field near San Antonio, Texas.

STATUTE AND NAUTICAL MILES

nm = sm x 1.15

Find the distance in nautical miles given the distance 2,163 statute miles, the distance of the first transcontinental flight across the United States by Lt. Jimmy Doolittle in 1922.

STATUTE AND NAUTICAL MILES

nm = sm x 1.15

Find the distance in nautical miles given the distance 2,163 statute miles, the distance of the first transcontinental flight across the United States by Lt. Jimmy Doolittle in 1922.

Solution:
nm = sm x 1.15
nm = 2163 miles x 1.15
nm = 2,487.5 miles (rounded to the nearest tenth)

EXERCISE #4: B-10 ALASKAN FLIGHT - 1934

Ten B-10s, under the command of Lt. Col. H.H. Arnold, left Bolling Field near Washington, D.C., on July 19, 1934. Flying by way of Winnipeg and Edmonton, they arrived safely in Fairbanks, Alaska, on July 24. For the next month numerous exploratory flights were made over Alaska, including missions for aerial photography of 23,000 square miles of territory in only three days.

The planes took off from Fairbanks on Aug. 16 and returned to Washington, D.C., by way of Seattle, Wash., and Omaha, Neb. They landed at Bolling Field on Aug. 20, **completing a round trip of more than 7,000 miles**, much of it over uncharted wilderness. For commanding this flight, Arnold won the 1934 Mackay Trophy.
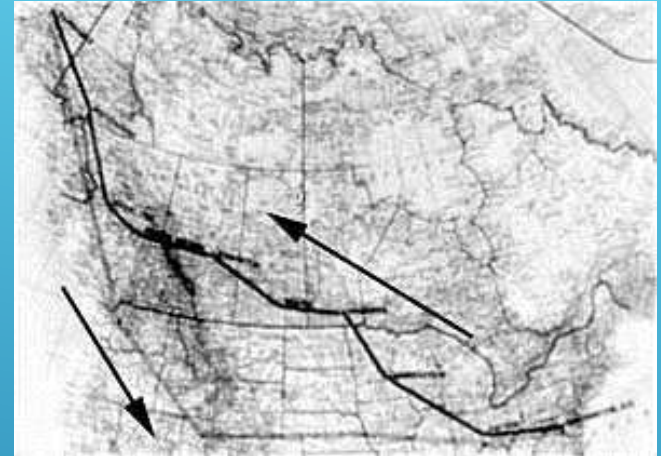
STATUTE AND NAUTICAL MILES

nm = sm x 1.15

Find the distance in nautical miles given the distance 4,153 statute miles, the approximate distance a flight of B-10 bombers flew from Washington, DC to Fairbanks, AK in 1934. Find the distance in nautical miles for the round trip.

STATUTE AND NAUTICAL MILES

Find the distance in nautical miles given the distance 4,153 statute miles, the approximate distance a flight of B-10 bombers flew from Washington, DC to Fairbanks, AK in 1934. Find the distance in nautical miles for the round trip.

Solution:

nm = sm   x 1.15

nm = 4,153 miles x 1.15

nm = 4,775.95 miles rounded up to 4,776 miles

Round trip: 4,776 nm x 2 = 9,552 nm

EXERCISE #5: B-52 MISSION

NM = SM X 1.15

Find the distance in nautical miles given the distance 16,000 statute miles, the approximate distance flight of a B-52 bomber that flew from Barksdale Air Force Base, Louisiana on a 34-hour round-trip combat mission.

STATUTE AND NAUTICAL MILES

Find the distance in nautical miles given the distance 16,000 statute miles, the approximate distance flight of a B-52 bomber that flew from Barksdale Air Force Base, Louisiana on a 34-hour round-trip combat mission.

Solution:

nm = sm   x 1.15

nm = 16,000 miles x 1.15

nm = 18,400 miles total

MORE RESOURCES

**Additional Resources
are available online at
www.nationalmuseum.af.mil/education/teacher/index.asp**