NATIONAL MUSEUM
OF THE UNITED STATES AIR FORCE®

MATHEMATICS OF FLIGHT: DISTANCE, RATE AND TIME

Students will have a basic understanding of math applications used in flight. This includes calculating distance, rate and time. Students will solve a series of problems. (One in a series.)

Grade Level: 6-8

National Mathematics Content Standards:
Algebra: Represent and analyze mathematical situations and structures using algebraic symbols; Use mathematical models to represent and understand quantitative relationships.

Technology Content Standards (from STL):
Technology and Society

Materials Required:

- Paper
- Pencil or pen
- Formula:
  distance = rate x time (d = rt)

LESSON PLAN

Lesson Objectives

The students will:

- Be introduced to formulas used in flight related to navigation and aircraft performance.
- Learn to calculate distances using rate and time.

Goal

In this lesson, students will gain an understanding of common calculations performed by flight personnel.

Distance, Rate and Time

In flight applications, distance is usually measured in miles. Rate or speed is usually measured in knots (nautical miles per hour.) Time is usually measured in hours. The distance formula is:

Distance = rate x time
or
d = rt

It can also be used to calculate speed of an aircraft when distance and time are given, or to find the time when the distance and speed are given.

Example:
A jet travels at 690 knots (nautical miles per hour) for 6 hours. How many nautical miles will the plane cover ?

Solution:

distance = rate x time

d = 690 knots/hour x 6 hours

d = 4,140 nautical miles

Exercise 1
The P-51 aircraft travels at a cruising speed of 275 knots and has a range (maximum distance) of 1,000 miles. Can it fly for three hours before running out of fuel? Can it fly for 4 hours before running out of fuel?

Solution:

d = r t
d = 275 knots x 3 hours
d = 825 nautical miles—yes, it is within the range of 1,000 nautical miles

d = r t
d = 275 knots x 4 hours
d = 1,100 nautical miles - no, it can not fly for four hours if its range is 1,000 nautical miles

Exercise 2
The F-80C has a cruising speed of 437 knots and a range of 1,090 nautical miles. How many hours can it fly before running out of fuel?

Solution:

d = r t

$\frac{d}{r} = \frac{r}{r} t \qquad \frac{1{,}090}{437} = \frac{437}{437} \times \text{time}$

$\frac{d}{r} = t \qquad \frac{1{,}090}{437} = \text{time}$

2.49 hours = time

Exercise 3
The A-10 has a range of 800 miles and a maximum speed of 450 knots. If it flew at its maximum speed throughout the flight, how many hours can it fly before running out of fuel? What is the answer in minutes?

Solution:

d = rt

$\frac{d}{r} = \frac{r}{r} t \qquad \frac{800}{450} = \frac{450}{450} \times \text{time}$

$\frac{d}{r} = t \qquad \frac{800}{450} = \text{time}$

1.7 hours = time

To convert hours to minutes, multiply by 60

1.7 hours x 60 minutes/hour = 106.6 minutes

Exercise 4
The F-117A has a maximum cruising speed of 684 knots. Its range is unlimited due to air-to-air refueling. If it flew for three hours, how far did it fly?

Solution:

d = r t
d = 684 knots x 3 hours
d = 2,052 nautical miles

See student worksheet and presentation
Examples are from the collection of the National Museum of the U.S. Air Force

Resources:

National Museum of the United States Air Force

- http://www.nationalmuseum.af.mil/factsheets/factsheet.asp?id=513
- http://www.nationalmuseum.af.mil/factsheets/factsheet.asp?id=290
- http://www.nationalmuseum.af.mil/factsheets/factsheet.asp?id=413
- http://www.nationalmuseum.af.mil/factsheets/factsheet.asp?id=410

Belcher, Diana. *Education in Flight: A Teacher's Guide to the Mathematics of Flight.* Department of the Air Force, 2007.

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STUDENT WORKSHEET *NAME:*__________________________________

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