

Aviation Integration: Topics, Tech, & Career Connections for Enhancing Math Concepts

<https://tinyurl.com/Aviation-Integration>

Created & Presented By:

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Objective: 5th -12th grade teachers will 1) discover how to incorporate aviation concepts, tech, & tools into math curriculum & 2) gain ideas, corresponding activities, & LOTS of resources to enhance the teaching & learning of math concepts. Aviation Topics: Forces of Flight, Time Zones, Drones, Satellite Imagery, GPS, CNC Programming... Math Concepts: Angles, Area, Coordinate Geometry, Decimals, Fractions, Intersecting Circles, Linear Functions, Shapes, ...

1) Forces of Flight

A. Weight

- i. Engage Students with Activities/Experiments (Scientist)
 - a. Ball Drop Activity
 - Math Concepts = Sphere, Diameter, Volume, Surface Area, Weight
 - b. Bouncing Balls Activity
 - Math Concepts= Linear Functions
 - https://digitalcommons.imsa.edu/pfs_tr/6/
- ii. Point out that Cargo Impacts Weight & Center of Gravity (Load Master)
 - a. Find the Center of Gravity for Cargo for an Aircraft
 - Math Concepts = Measuring & Formulas
 - Video Resource= https://youtu.be/vfPcjPj_ZyI
 - ✓ Corresponding Questions: http://wpafbstem.com/soar/assets/img/Weights_worksheet.pdf
 - ✓ Corresponding Answers: http://wpafbstem.com/soar/assets/img/Weights_answers.pdf
 - b. Connect to Finding the Center of a Circle or the Centroid of a Triangle
- iii. Stress the impact of Fuel on Weight (Fuel Distribution Specialist or In-Flight Refueler)
 - a. Fuel Distribution Specialist Video Resource= <https://youtu.be/Gv-1Eg64XBo>
 - b. Boom Operator Video Resource
 - i. <https://youtu.be/QX9xe8yOShI>
 - ii. <https://www.dvidshub.net/video/815030/women-aviation>
 - iii. <https://youtu.be/AuDlaCaUzUA>
 - c. Math Concepts = Proportions

B. Drag

- i. Consider having students engage in an activity involving “Parachutes”
 - a. Math Concepts= Area, Measurement (Distance/Time) & Statistics
 - b. Activities include:
 - <https://digitalcommons.imsa.edu/proflearningday/2016/STEM/5/>
 - <https://digitalcommons.imsa.edu/proflearningday/2012/STEM/9/>
 - https://www.hq.nasa.gov/office/aero/pdf/four_forces_5_8.pdf
- ii. Highlight the concept of a DROGUE CHUTE also known as a drag parachute
 - a. Used with planes (Aircrew Flight Equipment Technician)
 - Video = <https://youtu.be/4zFzJJ2WcE0>
 - b. Used with spacecraft
 - Math Concepts = Volume of a 3D object, Area of a Circle, Pythagorean theorem
 - NASA Activity = <https://tinyurl.com/fyn3wbtt>
 - Talk about the SpaceX Dragon returning to Earth using 4 DROG CHUTES
 - Video = <https://youtu.be/fZrSnM2xZzc?t=23956>
 - ✓ CAREERS at SPACEX - <https://www.spacex.com/careers/?department=>

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1) Forces of Flight (CONTINUED)

C. Lift

- i. Explain the Concept of Bernoulli's Principle (Engineer)
 - a. Math Concepts= Sphere/Cylinder/Circle, Area, Volume, Surface Area,
 - b. Activity= https://digitalcommons.imsa.edu/pfs_tr/26/
- ii. Calculate the area of different types of wings (Aviation Mechanic)
 - a. <https://www.grc.nasa.gov/www/k-12/VirtualAero/BottleRocket/airplane/area.html>
 - b. https://www.airfieldmodels.com/information_source/math_and_science_of_model_aircraft/formulas/straight_tapered_and_delta_wing_area.htm
- iii. Fuselage will generate lift if it is angled/inclined to airflow
 - * <https://www.grc.nasa.gov/www/k-12/airplane/factors.html>
 - * <https://tinyurl.com/22mffkyd>
- iv. Highlight Importance of Sheetmetal Work Repairing/Maintaining Wings (Aviation Mechanic)
 - a. Math Concepts= Fractions, Scale, Angles
 - b. Sheet Metal Problems
 - Remijan, K.W. (Under Development). Connecting Middle School Math to Aviation Mechanics
- iv. Experience lift using Google Earth Flight Simulator (Pilot)
 - a. Google Earth
 - Install Google Earth to your computer - <https://support.google.com/earth/answer/21955?hl=en#zippy=>
 - Basic Steps for using Google Earth Flight Simulator - <https://youtu.be/B48hQA01LD0>
 - b. Civil Air Patrol Flight Simulator Kit
 - <https://www.gocivilairpatrol.com/programs/aerospace-education/programs/stem-kits/available-stem-kits/flight-simulator>
 - Become an Education Member of Civil Air Patrol (\$45 one-time fee)
 - <https://www.gocivilairpatrol.com/programs/aerospace-education/join-as-an-aem>

D. Thrust

- i. Demonstrate Propellers (Aviation Mechanic)
 - a. Math Concepts= Distance vs Time, Diameter, Collecting & Graphing Data
 - I purchased a kit and made a propeller car for \$19 from <https://tinyurl.com/tqlpgyo>
 - Utilize FREE Tracker Software - <https://physlets.org/tracker/>
 - b. Career Connections:
 - Inform students of pathways, programs, and opportunities for an Aviation Mechanic
 - 1-2 year programs = <https://www.swic.edu/academics/career-degrees/aviation/aviation-maintenance-technology/>
 - 4 year programs = <https://aviation.siu.edu/technologies/bachelor-of-science/course-information.php>
 - Additional Resources
 - Video about being an Aviation Mechanic - <https://youtu.be/ELUC5C74Mpc>
 - Math at Work - <https://www.achieve.org/files/MathAtWork-Aerospace.pdf>
- ii. Demonstrate the Concept of Airplane Engines and Rocket Propulsion (Engineer)
 - a. Balloon Rocket Activity
 - Math Concepts= Ratio, Slope of Ascent
 - Video - <https://youtu.be/KqZdHZvwDbA>
 - b. Extension – Send a rocket to the moon carrying a satellite
 - <https://youtu.be/c0wh4GxoL28?t=103>

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- 2) Other Aviation Topics, Career Connections, and Math Concepts
 - A. Time Zones (Flight Dispatcher, Air Traffic Controller, or Pilot)
 - Math Concepts: Adding/Subtracting Integers, Time, Angles
 - B. Wind (Meteorologist, Flight Dispatcher, Pilot)
 - Math Concepts: Adding/Subtracting Integers & Using Vectors
 - Resource: [http://ww2010.atmos.uiuc.edu/\(Gh\)/guides/mtr/cyc/upa/wndvct.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cyc/upa/wndvct.rxml)
 - C. Aviation Alphabet (Flight Dispatcher, Air Traffic Controller, or Pilot)
 - Math Concepts: Naming of Points, Angles, or Groups
 - Resource: <https://tinyurl.com/we8a8t83>
 - D. Flight Profile (Air Traffic Controller & Pilot)
 - Math Concepts = Increasing, Constant, and Decreasing Functions
 - Vocabulary = Take-Off, Altitude in Feet vs Distance in Miles, Landing
 - Resource: <https://science.howstuffworks.com/transport/flight/modern/air-traffic-control.htm#pt2>
 - E. Navigation and Air Space (FAA Safety Inspector & Air Traffic Controller)
 - Math Concepts: Concentric Circles & Cylinders
 - Resources:
 - <https://science.howstuffworks.com/transport/flight/modern/air-traffic-control.html>
 - www.youtube.com/watch?v=rl6jmmM98Ig&list=PLBJ4Geff0T5iYy5Q8u2WVaX50Zo3qbgYe
 - F. Runways (Air Traffic Controllers & Pilots)
 - Math Concepts: Angles/Circles, Compass Rose, & Parallel Lines)
 - Resources:
 - Google Earth (Video on how to use - <https://youtu.be/KjxuSlgumFI>)
 - <https://skyvector.com/> or <https://www.airnav.com/airport/>
 - G. GPS – Global Positioning System (Flight Dispatchers, Pilots, Drone Pilots, Accident Reconstructionists)
 - Math Concepts: Intersecting circles
 - Activities:
 - Activity (w/out tech): Where am I? <http://www.gps-stem.com/earth/>
 - Activity (w/ tech): Geocaching Software
 - <https://www.geocachingtoolbox.com/index.php?lang=en&page=circleIntersection&status=result>
 - https://digitalcommons.imsa.edu/pfs_tr/25/
 - H. Cybersecurity (Cybersecurity Analyst)
 - Math Concepts: Binary Code, Base 10 vs Base 2, Exponents, Dividing
 - Resource: https://digitalcommons.imsa.edu/pfs_tr/30/

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- 3) More Aviation Topics, Career Connections, and Math Concepts
- A. Arc GIS – Geographic Information System (GIS Analyst, Pavement Engineer, Airport Wildlife Biologist)
- Math Concepts
 - a. Isosceles Triangles or Trigonometry
 - Activity = Find the height of a tree
 - Clinometer http://www.globe.ee/TeacherGuide/landcover/appendix/land_app.pdf
 - Smart Phone App (<https://bit.ly/3ocOLV0>)
 - b. Distance, Area, Proportions
 - Various Activities
 - <https://www.esri.com/en-us/industries/education/schools/geoinquiries-mathematics>
 - <https://www.oercommons.org/authoring/19783-using-gis-and-maps-to-teach-mathematics-measuremen/view>
 - Career Connections Resources
 - a. Analyze Runways and Pavement Quality- Determine what needs to be repaired/replaced
 - Video - https://youtu.be/i_SNi5AFeQ?t=173
 - b. Monitor Wildlife Concentration Sites
 - Video - https://youtu.be/i_SNi5AFeQ?t=210
 - c. Analyze Potential Obstacles – Determine heights of buildings, trees, etc. surrounding runways
 - Video - https://youtu.be/i_SNi5AFeQ?t=336
- B. Drones (Drone Pilots, Farmers, Firemen, Construction Managers, Accident Reconstructionists)
- Math Concepts:
 - Identify Location Coordinates of a drone/UAV (Unmanned Aerial Vehicle)
 - Calculate Viewing Area and Landing Pad Area for a Drone/UAV
 - Understand Inequalities
 - Rotor Blade Shapes & Area - https://digitalcommons.imsa.edu/pfs_tr/26/
 - Resources
 - <https://knowbeforeyoufly.org/>
 - www.purdue.edu/newsroom/releases/2019/Q1/drones-shown-to-make-traffic-crash-site-assessments-safer,-faster-and-more-accurate.html
 - Accident Reconstructionist Guest Speaker
 - ✓ Go to <https://actar.org/directory> & search w/in your state to find a local reconstructionist
 - ✓ Contact Kelly for an ILLINOIS STATE POLICE RECONSTRUCTIONIST
- C. Machining (Aerospace Machinist)
- Math Concepts: Coordinate Geometry
 - Activity & Article
 - Utilize a CNC Machine and Write a Computer Program Involving G-Code to Make a Design
 - Remijan, K.W. (September 2018). "Cultivating the Machining Field by Planting Seeds in the Math Classroom". **The Record**. 24-27. Retrieved from <https://ntma.org/wp-content/uploads/2019/02/Sept18-Record-web-compressed.pdf>
 - Online Simulator- <https://ncviewer.com/> (Video- https://youtu.be/Z4V_qKuoMMk)
 - Example of Aerospace Machining Course Units- <https://www.bethelsd.org/cms/lib/WA01918819/Centricity/Domain/4391/Aerospace%20Machining%202021.pdf>

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- 4) Teacher Resources for Aviation-Related Curriculum/Activities/Careers, Speakers, & *Free Student Flights
- A. NASA - www.nasa.gov/stem
 - B. AIAA - www.aiaa.org/membership/types-of-membership/educator-membership
 - C. *Civil Air Patrol - www.gocivilairpatrol.com/programs/aerospace-education/for-educators
 - D. Tuskegee Airmen - <https://tuskegeeairmenstl.com/contact-us/>
 - E. *Legacy Flight Academy - <https://www.legacyflightacademy.org/>
 - F. FAA - www.faa.gov/education
 - G. Association for Women in Aviation Maintenance (AWAM) - www.awam.org
 - H. Women in Aviation - <https://www.wai.org/chapters>
 - I. Organization of Black Aerospace Professionals - <https://obap.org/outreach-programs/apis/>
 - J. Latino Pilot Association - <https://www.latinopilot.org/>
 - K. National Weather Service - <https://www.weather.gov/education/>
 - Get in touch with your local office at <https://www.weather.gov/contact>
 - L. AOPA - <https://tinyurl.com/bj6mnmk>
 - M. Avion Institute (Chicago) - <https://avioninstitute.org/>
 - N. Minorities in Aviation (St. Louis) - <https://minoritiesinaviation.aero/>
 - O. *EAA- Young Eagles - <https://www.eaa.org/eaayouth/free-ye-flights>
 - P. Adopt a Pilot - <https://www.southwest.com/html/southwest-difference/community-involvement/adopt-a-pilot/index.html>
 - Q. United States Air Force - www.airforce.com/careers
 - R. Wings of Hope (St. Louis) - <https://wingsofhope.ngo/>
 - S. Pathways to Aviation - <https://pathwaystoaviation.org/job-seekers/learn-about-careers/>
 - T. Ninety-Nines - <https://www.ninety-nines.org> (STL = <https://www.greaterstl99s.org/>)
 - U. Scott AFB – Office of Public Affairs – Christine Spargur - christine.spargur@us.af.mil
- 5) SPECIAL THANKS TO:
- A. Scott AFB STEAM Advisory Council & Dr. Cindy Doil, Scott AFB School Liaison Officer in support of STEM Grants Awarded to Kelly Remijan and IMSA through the Griffins Institute
 - i. To learn about math concepts and technology involved in various careers
 - ii. To enhance mathematics curriculum, establish career to classroom connections, and improve workforce development
 - B. Southwestern Illinois College (SWIC)
 - a) Aviation Department - <https://www.swic.edu/academics/career-degrees/aviation/>
 - ✓ Keith Mueller - SWIC Coordinator of Aviation Pilot Training/Aviation Management
 - ✓ Matt Harter – SWIC Coordinator for Aviation Maintenance
 - b) Machining Precision Technology Department
 - ✓ Mark Bosworth – SWIC Industrial Technology Coordinator
 - ✓ Jerry Bonifield, Nick Weatherly, & David Berry – SWIC Precision Machining & Industrial Tech Instructors