

Auxiliary Concept: Engineering Geometry & Trigonometry

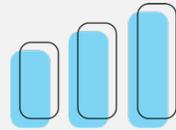
Engineering Literacy Dimension: Engineering Knowledge

Domain: Engineering Mathematics

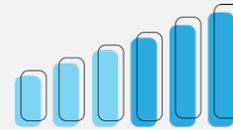
Overview: *Geometry* is a branch of mathematics that focuses on the measurement, properties, and relationships of points, lines, angles, surfaces, and solids. Historically emerging from applications of geometry, is *Trigonometry*, which specifically studies angles and angular relationships of planar and three-dimensional figures. These areas of mathematics are important to Engineering Literacy as engineering professionals frequently select and use geometric/trigonometric content and practices in the analysis, design, and making of solutions to engineering problems. For example, the related mathematical applications can help one to calculate distances and angles of velocity, enable efficiency when processing materials to make a physical product, support the development of engineering graphics through computer aided design software, and accurately create models and simulations to predict the functionality of a design idea.

Performance Goal for High School Learners

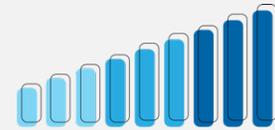
I can, when appropriate, draw upon the knowledge of geometric/trigonometric content and practices, such as (1) *geometric measurement and dimensions*, (2) *expressing geometric properties with equations*, (3) *right triangles*, (4) *trigonometric functions*, and (5) *vector analysis*, to solve problems in a manner that is analytical, predictive, repeatable, and practical.



Basic



Proficient



Advanced

GEOMETRIC MEASUREMENT AND DIMENSIONS

I can identify the formula for several geometric shapes such as the circumference of a circle, volume of a cylinder, pyramid and cone.

I can use the formulas for several geometric shapes to find needed information such as the circumference of a circle, volume of a cylinder, pyramid and cone.

I can properly assess, derive and utilize geometric shape formulas to find needed information that helps inform design concepts for specific applications.

EXPRESSING GEOMETRIC PROPERTIES WITH EQUATIONS

I can manipulate and solve an equation for the desired unknown variable in a geometric concept (e.g. $v=l(w)h$ - solve for h).

I can identify the importance of a variable of a geometric equation upon a calculation for a quantity (e.g. mass moment of inertia).

I can predict the impact of a variable of a geometric equation upon a calculation for a quantity (e.g. mass moment of inertia).

RIGHT TRIANGLES

I can identify and explain that a right triangle is a property of a triangle with one right angle which inform other equations needed (such as ratios).

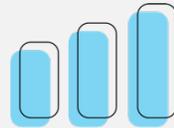
I can solve and evaluate problems that involve right triangles using trigonometric ratios for acute angles.

I can assess, evaluate, execute solving right triangles using the Pythagorean theorem and ratios that are in a specific system.

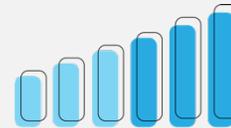
Auxiliary Concept: Engineering Geometry & Trigonometry Cont.

Performance Goal for High School Learners

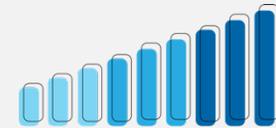
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TRIGONOMETRIC FUNCTIONS

I can explain basic trigonometric functions and make computations using their formulas (e.g. sine, cosine, tangent).

I can solve for components in an engineering problem by selecting and utilizing appropriate trigonometric functions (e.g. laws of sines and cosines for force values in a truss).

I can predict outcomes when a certain variable is altered (e.g. determining tension vs. compression, etc.) with the solution involving trigonometric operations.

VECTOR ANALYSIS

I can manipulate vectors using basic operations (resolving vectors into their components and calculating resultants of multiple vectors, calculating scalar magnitudes).

I can solve a problem with identified vectors through utilizing basic vector operations.

I can compose vectors from descriptive diagrams/sketches and use basic vector operations in order to determine design solutions to an engineering problem (e.g. truss analysis).