

Showing Results for:

Course: Principles Of Engineering

Units: 1, 2, 3 & 4

Lessons: L1.1, L1.2, L1.3, L1.4, L2.1, L2.2, L2.3, L2.4, L3.1, L3.2, L3.3, L4.1 & L4.2

Common Core State Standards for Mathematical Practice (HS) & Common Core State Standards for English Language Arts

Common Core State Standards for Mathematical Practice (HS)

Lesson 1.1 - Mechanisms

Number and Quantity

Quantities

-Reason Quantitatively And Use Units To Solve Problems.

1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (N.Q .1)
2. Define appropriate quantities for the purpose of descriptive modeling. (N.Q .2)
3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (N.Q .3)

Algebra

Seeing Structure In Expressions

-Interpret The Structure Of Expressions

1. Interpret expressions that represent a quantity in terms of its context. (A.SSE.1)
 - 1.a. Interpret parts of an expression, such as terms, factors, and coefficients. (A.SSE.1.a)
 - 1.b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P .* (A.SSE.1.b)

Creating Equations

-Create Equations That Describe Numbers Or Relationships

1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* (A.CED.1)
4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance R .* (A.CED.4)

Reasoning With Equations And Inequalities

-Solve Equations And Inequalities In One Variable

3. Solve linear equations and inequalities in one variable, including equations with coefficients

represented by letters. (A.REI.3)

Functions

Linear, Quadratic, And Exponential Models

-Construct And Compare Linear, Quadratic, And Exponential Models And Solve Problems

1.b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. (F.LE.1.b)

Geometry

Modeling With Geometry

-Apply Geometric Concepts In Modeling Situations

1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* (G.MG.1)

3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).* (G.MG.3)

Lesson 1.2 - Energy Sources, Selections do not meet Alignment Criteria

Lesson 1.3 - Energy Applications, Selections do not meet Alignment Criteria

Lesson 1.4 - Design Problem - Energy and Power

Number and Quantity

Quantities

-Reason Quantitatively And Use Units To Solve Problems.

1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (N.Q .1)

2. Define appropriate quantities for the purpose of descriptive modeling. (N.Q .2)

3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (N.Q .3)

Lesson 2.1 - Statics, Selections do not meet Alignment Criteria

Lesson 2.2 - Material Properties

Number and Quantity

Quantities

-Reason Quantitatively And Use Units To Solve Problems.

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Geometry

Geometric Measurement And Dimension

-Explain Volume Formulas And Use Them To Solve Problems

3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.* (G.GMD.3)

-Visualize Relationships Between Two-Dimensional And Three- Dimensional Objects

4. Identify the shapes of two-dimensional cross-sections of three- dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. (G.GMD.4)

Modeling With Geometry

-Apply Geometric Concepts In Modeling Situations

1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* (G.MG.1)

2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* (G.MG.2)

Lesson 2.3 - Material Testing

Number and Quantity

Quantities

-Reason Quantitatively And Use Units To Solve Problems.

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Algebra

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-Interpret The Structure Of Expressions

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1.a. Interpret parts of an expression, such as terms, factors, and coefficients. (A.SSE.1.a)

1.b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P .* (A.SSE.1.b)

Lesson 2.4 - Design Problem - Materials and Structures

Number and Quantity

Quantities

-Reason Quantitatively And Use Units To Solve Problems.

1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (N.Q .1)
2. Define appropriate quantities for the purpose of descriptive modeling. (N.Q .2)

Lesson 3.1 - Machine Control, Selections do not meet Alignment Criteria

Lesson 3.2 - Fluid Power, Selections do not meet Alignment Criteria

Lesson 3.3 - Design Problem - Control Systems

Number and Quantity

Quantities

-Reason Quantitatively And Use Units To Solve Problems.

3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (N.Q .3)

Lesson 4.1 - Statistics

Statistics and Probability

Interpreting Categorical And Quantitative Data

-Summarize, Represent, And Interpret Data On A Single Count Or Measurement Variable

1. Represent data with plots on the real number line (dot plots, histograms, and box plots). (S.ID.1)
2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. (S.ID.2)
3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). (S.ID.3)
4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. (S.ID.4)

Making Inferences And Justifying Conclusions

-Understand And Evaluate Random Processes Underlying Statistical Experiments

1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (S.IC.1)
2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5.*

Would a result of 5 tails in a row cause you to question the model? (S.IC.2)

-Make Inferences And Justify Conclusions From Sample Surveys, Experiments, And Observational Studies

4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. (S.IC.4)

Conditional Probability And The Rules Of Probability

-Understand Independence And Conditional Probability And Use Them To Interpret Data

1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). (S.CP.1)

2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. (S.CP.2)

3. Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. (S.CP.3)

4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* (S.CP.4)

5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* (S.CP.5)

-Use The Rules Of Probability To Compute Probabilities Of Compound Events In A Uniform Probability Model

6. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. (S.CP.6)

7. Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model. (S.CP.7)

8. (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model. (S.CP.8)

9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems. (S.CP.9)

Using Probability To Make Decisions

-Use Probability To Evaluate Outcomes Of Decisions

7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). (S.MD.7)

Lesson 4.2 - Kinematics

Number and Quantity

The Real Number System

-Extend The Properties Of Exponents To Rational Exponents.

2. Rewrite expressions involving radicals and rational exponents using the properties of exponents. (N.RN.2)

Quantities

-Reason Quantitatively And Use Units To Solve Problems.

1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (N.Q .1)
2. Define appropriate quantities for the purpose of descriptive modeling. (N.Q .2)
3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (N.Q .3)

Vector And Matrix Quantities

-Represent And Model With Vector Quantities.

1. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v , $|v|$, $\|v\|$, v). (N.VM.1)
2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. (N.VM.2)
3. (+) Solve problems involving velocity and other quantities that can be represented by vectors. (N.VM.3)

Algebra

Seeing Structure In Expressions

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 - 1.b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P .* (A.SSE.1.b)

Creating Equations

-Create Equations That Describe Numbers Or Relationships

3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* (A.CED.3)
4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance R .* (A.CED.4)

Reasoning With Equations And Inequalities

-Solve Equations And Inequalities In One Variable

3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. (A.REI.3)
4. Solve quadratic equations in one variable. (A.REI.4)

Functions

Trigonometric Functions

-Model Periodic Phenomena With Trigonometric Functions

7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.* (F.TF.7)

Geometry

Similarity, Right Triangles, And Trigonometry

-Define Trigonometric Ratios And Solve Problems Involving Right Triangles

6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. (G.SRT.6)
8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.* (G.SRT.8)

Modeling With Geometry

-Apply Geometric Concepts In Modeling Situations

3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).* (G.MG.3)

Statistics and Probability

Interpreting Categorical And Quantitative Data

-Summarize, Represent, And Interpret Data On A Single Count Or Measurement Variable

2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. (S.ID.2)

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Common Core State Standards for English

Language Arts

Lesson 1.1 - Mechanisms

Lesson 1.2 - Energy Sources, Selections do not meet Alignment Criteria

Lesson 1.3 - Energy Applications, Selections do not meet Alignment Criteria

Lesson 1.4 - Design Problem - Energy and Power

Lesson 2.1 - Statics, Selections do not meet Alignment Criteria

Lesson 2.2 - Material Properties

Reading

Key Ideas and Details

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. (AS.R.1)
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas. (AS.R.2)
7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words. (AS.R.7)
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take. (AS.R.9)
10. Read and comprehend complex literary and informational texts independently and proficiently. (AS.R.10)

Text Types and Purposes

2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. (AS.W.2)
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. (AS.W.4)
7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation. (AS.W.7)
8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism. (AS.W.8)
9. Draw evidence from literary or informational texts to support analysis, reflection, and research. (AS.W.9)

10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences. (AS.W.10)

Comprehension and Collaboration

2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally. (AS.SL.2)
4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience. (AS.SL.4)
5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations. (AS.SL.5)

Conventions of Standard English

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. (AS.L.1)
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. (AS.L.2)
6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. (AS.L.6)

Lesson 2.3 - Material Testing

Lesson 2.4 - Design Problem - Materials and Structures

Lesson 3.1 - Machine Control, Selections do not meet Alignment Criteria

Lesson 3.2 - Fluid Power, Selections do not meet Alignment Criteria

Lesson 3.3 - Design Problem - Control Systems

Lesson 4.1 - Statistics

Lesson 4.2 - Kinematics

Reading

Text Types and Purposes

5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. (AS.W.5)
6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. (AS.W.6)
7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation. (AS.W.7)
8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism. (AS.W.8)
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