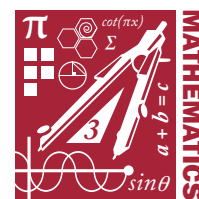


FIGURE IT OUT!



MATHEMATICS

8

GRADE 8

This guide links the *Figure It Out!* unit to the Texas Essential Knowledge and Skills (TEKS) for eighth graders. *Figure It Out!* is a mathematics unit that allows students to explore the uses of statistics in everyday life. Though a mathematics unit, *Figure It Out!* also teaches students skills in the other subject areas of English language arts, science, and social studies. For example, students use problem solving and critical thinking, which the Science TEKS include, and writing and research skills, which the English Language Arts and Reading and Social Studies TEKS address. The following document includes the applicable TEKS and the details of the *Figure It Out!* unit. The asterisks indicate that those TEKS are testable on the State of Texas Assessments of Academic Readiness (STAAR). The final section of this document presents the applicable Texas College and Career Readiness Standards adopted by the Texas Higher Education Coordinating Board (THECB) on January 24, 2008.

Description of Unit

Students will choose a topic to investigate about which they can gather statistical data. They will survey an identified population and analyze the results. From their research, they will write a letter or article that uses the data to support solutions to the problem.

Phase I. Learning Experiences

This unit gives students an opportunity to develop survey research skills. Students identify an issue to investigate using survey research. They identify the issue, design a survey tool for collecting the data, analyze the data, and draw conclusions in an article that is written for an actual publication (e.g., school newspaper, community newspaper through a letter to the editor, teen magazine, online journal).

1. Introduction. Students review one of the following Internet resources (or other similar resources) to become familiar with survey research and design:

<http://www.surveysystem.com/sdesign.htm>
<http://www.statpac.com/surveys/>
http://www.dobney.com/Research/MR_basics.htm

2. Students read an article that includes survey results. What are the questions that might have been asked in the survey? Each group generates a set of questions and shares the questions. Students review all of the questions that were generated, identify questions that may produce biased results, and select the most effective questions. As a class, they develop and administer a survey, analyze data, and report their findings. Students should compare how the class's results were similar to or different from the published study.
3. Sample problems. Students complete the sample statistics problems; Attachment #1.

Phase II. Independent Research

A. Research process

1. Selecting a topic. Each student identifies a real-world problem which he/she wishes to investigate through a survey process (e.g., what solution do various groups of citizens favor for a current issue in the city or town, what solution do students, parents, and teachers favor for a pressing school issue, etc.).
2. Asking guiding questions. Once the student has selected a topic, he/she should think of three to five guiding questions to explore, such as:
 - What has been done in the past to address the problem?
 - What are potential solutions?
 - What do various groups see as solutions to the problems?
 - How can each group be adequately surveyed?

While these examples are general, the student's questions should be specific to the chosen topic. The questions should lead him/her to form individual research-based opinions. The student should also develop a hypothesis or some possible answers to the questions.

3. Designing and submitting a research proposal. The student should include numerous components in the research proposal:
 - The real-world problem to be investigated
 - Three to five guiding questions he/she will investigate
 - Resources he/she will need to find answers to questions, such as previous studies on the topic and/or correspondence with experts on the subject
 - A survey design, including who will be surveyed, numbers of various groups to be surveyed, how the survey questions will be tested, how the survey will be disseminated, what is an acceptable return rate, what the student will do to ensure that surveys are returned, and how data will be analyzed

In the process of writing the research proposal, students may refine their guiding questions.

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4. Conducting the research. After the teacher has approved the student proposal, each student begins using the identified resources and other sources he/she may encounter. Research may encompass survey design or other survey research that has been done on the topic. During this stage, the student will need to keep a log, note cards, or resource process sheets of all the sources they use and what they learn from each one.
5. Conducting the survey and analyzing the results. Each student should write and distribute the surveys, as identified in the research plan. When surveys are returned, the student should analyze them in terms of response rate, item response, and trend analysis. Then, the student should generate conclusions and offer recommendations.
6. **For students taking algebra:** Students might want to design their survey so that they can easily relate two of the parameters (variables) in a graph form.

B. The product

The student shows what he/she has learned through **one** of the following written products:

1. A letter to a person or organization with responsibility for the problem. In the letter, the student should summarize the results of his/her survey, as well as including the survey methodology. Students should also include supplementary materials (such as graphs, tables, and/or visual depictions of the system) with the letter.
2. An article that summarizes the results of the research. The student should use graphs, tables, or visual depictions of the system to illustrate the results of the survey, the survey process, and conclusions. The article should be submitted to a publication (e.g., school newspaper, community newspaper through a letter to the editor, teen magazine, online journal).
3. **For students taking algebra:** Students should graph two of the parameters (variables) of their survey, create and find an equation of best fit, write a description of the relationship between the two parameters, and make some analyses and predictions.
4. Whatever product is chosen, the student must complete a Reference List/Works Cited Page that includes at least ten references.

C. Communication

The student demonstrates what he/she has learned through **one** of the following types of presentations, to last no more than fifteen minutes:

1. A formal presentation to a panel of experts. In the class, form panels of “experts”—groups of students or adults—who will read the student’s letter or article, listen to his/her presentation, and ask questions. The student may provide some questions to the panel, but others should be generated by the panel members.

2. An informal class presentation in which the student presents his/her expertise to the class. A question-and-answer session should follow the presentation.

D. Submission

- a. A cover sheet
- b. The research proposal
- c. A log, note cards, or resource process sheets
- d. Data summary
- e. The letter or article
- f. A Works Cited Page with at least ten references
- g. An audiotape or videotape of presentation, including the Q&A session
- h. A response to the student letter or article, if received

Texas Essential Knowledge and Skills

The unit may address the following TEKS:

English Language Arts and Reading:

8.1	Reads grade-level text with fluency and comprehension
8.2	Understands new vocabulary and use it when reading and writing* (Testable on the Grade 8 Reading STAAR, Reporting Category 1)
8.3	Analyzes, makes inferences, and draws conclusions about theme and genre in different cultural, historical, and contemporary contexts and provides evidence from the text to support their understanding* (Testable on the Grade 8 Reading STAAR, Reporting Category 1, Reporting Category 2)
8.9	Analyzes, makes inferences, and draws conclusions about the author's purpose in cultural, historical, and contemporary contexts and provides evidence from the text to support their understanding* (Testable on the Grade 8 Reading STAAR, Reporting Category 1)
8.10	Analyzes, makes inferences, and draws conclusions about expository text and provides evidence from text to support their understanding* (Testable on the Grade 8 Reading STAAR, Reporting Category 3)
8.13	Uses comprehension skills to analyze how words, images, graphics, and sounds work together in various forms to impact meaning* (Testable on the Grade 8 Reading STAAR, Reporting Category 2, Reporting Category 3)
8.14	Uses elements of the writing process (planning, drafting, revising, editing, and publishing) to compose text
8.19	Understands the function of and use the conventions of academic language when speaking and writing
8.20	Writes legibly and uses appropriate capitalization and punctuation conventions in their compositions
8.21	Spells correctly
8.22	Asks open-ended research questions and develops a plan for answering them

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- 8.23 Determines, locates, and explores the full range of relevant sources addressing a research question and systematically record the information they gather
- 8.26 Uses comprehension skills to listen attentively to others in formal and informal settings
- 8.27 Speaks clearly and to the point, using the conventions of language

Mathematics:

- 8.1 Uses mathematical processes to acquire and demonstrate mathematical understanding
- 8.2 Applies mathematical process standards to represent and use real numbers in a variety of forms
- 8.8 Applies mathematical process standards to use one-variable equations or inequalities in problem situations
- 8.11 Applies mathematical process standards to use statistical procedures to describe data
- A.1 Uses mathematical processes to acquire and demonstrate mathematical understanding
- A.2 Applies the mathematical process standards when using properties of linear functions to write and represent in multiple ways, with and without technology, linear equations, inequalities, and systems of equations
- A.4 Applies the mathematical process standards to formulate statistical relationships and evaluate their reasonableness based on real- world data
- A.12 Applies the mathematical process standards and algebraic methods to write, solve, analyze, and evaluate equations, relations, and functions

Science:

- 8.2 Uses scientific inquiry methods during laboratory and field investigations* (Testable on the Grade 8 Science STAAR)
- 8.3 Uses critical thinking, scientific reasoning, and problem solving to make informed decisions and knows the contributions of relevant scientists* (Testable on the Grade 8 Science STAAR)

Social Studies:

- 8.10 Understands the location and characteristics of places and regions of the United States, past and present* (Testable on the Grade 8 Social Studies STAAR, Reporting Category 2)
- 8.23 Understands the relationships between and among people from various groups, including racial, ethnic, and religious groups, during the 17th, 18th, and 19th centuries* (Testable on the Grade 8 Social Studies STAAR, Reporting Category 2)
- 8.24 Understands the major reform movements of the 19th century* (Testable on the Grade 8 Social Studies STAAR, Reporting Category 2)
- 8.27 Understands the impact of science and technology on the economic development of the United States* (Testable on the Grade 8 Social Studies STAAR, Reporting Category 4)
- 8.29 Applies critical-thinking skills to organize and use information acquired through established research methodologies from a variety of valid sources, including electronic technology* (Testable on the Grade 8 Social Studies STAAR)
- 8.30 Communicates in written, oral, and visual forms* (Testable on the Grade 8 Social Studies STAAR)

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- 8.31 Uses problem-solving and decision-making skills, working independently and with others, in a variety of settings

Texas College and Career Readiness Standards

This unit may address the following Texas College and Career Readiness Standards:

English Language Arts:

- | | |
|---------|---|
| I.A.2 | Generates ideas and gathers information relevant to the topic and purpose, keeping careful records of outside sources |
| I.A.3 | Evaluates relevance, quality, sufficiency, and depth of preliminary ideas and information, organize material generated, and formulate thesis |
| I.A.4 | Recognizes the importance of revision as the key to effective writing |
| I.A.5 | Edits writing for proper voice, tense, and syntax, assuring that it conforms to standard English, when appropriate |
| II.A.2 | Uses text features and graphics to form an overview of informational texts and to determine where to locate information |
| II.A.4 | Draws and supports complex inferences from text to summarize, draw conclusions, and distinguish facts from simple assertions and opinions |
| II.A.5 | Analyzes the presentation of information and the strength and quality of evidence used by the author and judge the coherence and logic of the presentation and the credibility of an argument |
| II.A.8 | Compares and analyzes how generic features are used across texts |
| II.A.11 | Identifies, analyzes, and evaluates similarities and differences in how multiple texts present information, argue a position, or relate a theme |
| II.B.1 | Identifies new words and concepts acquired through study of their relationships to other words and concepts |
| II.B.2 | Applies knowledge of roots and affixes to infer the meanings of new words |
| II.B.3 | Uses reference guides to confirm the meanings of new words or concepts |
| III.A.1 | Understands how style and content of spoken language varies in different contexts and influences the listener's understanding |
| III.A.2 | Adjusts presentation (delivery, vocabulary, length) to particular audiences and purposes |
| III.B.1 | Participates actively and effectively in one-on-one oral communication situations |
| III.B.2 | Participates actively and effectively in group discussions |
| III.B.3 | Plans and delivers focused and coherent presentations that convey clear and distinct perspectives and demonstrate solid reasoning |
| IV.A.1 | Analyzes and evaluate the effectiveness of a public presentation |
| IV.A.2 | Interprets a speaker's message; identifies the position taken and the evidence in support of that position |
| IV.A.3 | Uses a variety of strategies to enhance listening comprehension |

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- IV.B.1 Listens critically and responds appropriately to presentations
- IV.B.2 Listens actively and effectively in one-on-one communication situations
- IV.B.3 Listens actively and effectively in group discussions
- V.A.1 Formulates research questions
- V.A.2 Explores a research topic
- V.A.3 Refines research topic and devise a timeline for completing work
- V.B.1 Gathers relevant sources
- V.B.2 Evaluates the validity and reliability of sources
- V.B.3 Synthesizes and organizes information effectively
- V.B.4 Uses source material ethically
- V.C.1 Designs and presents an effective product

Mathematics:

- I.A.1 Compares real numbers
- I.A.2 Defines and gives examples of complex numbers
- I.B.1 Performs computations with real and complex numbers
- I.C.1 Uses estimation to check for errors and reasonableness to solutions
- IV.A.1 Selects or uses the appropriate type of unit for the attribute being measured
- IV.B.1 Converts from one measurement system to another
- IV.D.1 Computes and uses measures of center and spread to describe data
- IV.D.2 Applies probabilistic measures to practical situations to make an informed decision
- VI.A.1 Plan a study
- VI.B.1 Determines types of data
- VI.B.2 Selects and applies appropriate visual representations of data
- VI.B.3 Computes and describes summary statistics of data
- VI.B.4 Describes patterns and departure from patterns in a set of data
- VI.C.1 Makes predictions and draw inferences, using summary statistics
- VI.C.2 Analyzes data sets, using graphs and summary statistics
- VI.C.3 Analyzes relationships between paired data, using spreadsheets, graphing calculators, or statistical software
- VI.C.4 Recognizes reliability of statistical results
- VIII.A.1 Analyzes given information
- VIII.A.2 Formulates a plan or strategy
- VIII.A.3 Determines a solution
- VIII.A.4 Justifies the solution
- VIII.A.5 Evaluates the problem-solving process
- VIII.B.1 Develops and evaluates convincing arguments
- VIII.B.2 Uses various types of reasoning
- VIII.C.1 Formulates a solution to a real-world situation based on the solution to a mathematic

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	problem
VIII.C.2	Uses a function to model a real-world situation
VIII.C.3	Evaluates the problem-solving process
IX.A.1	Uses mathematical symbols, terminology, and notation to represent given and unknown information in a problem
IX.A.2	Uses mathematical language to represent and communicate the mathematical concepts in a problem
IX.A.3	Uses mathematics as a language for reasoning, problem solving, making connections, and generalizing
IX.B.1	Models and interprets mathematical ideas and concepts, using multiple representations
IX.B.2	Summarizes and interprets mathematical information provided orally, visually, or in written form within the given context
IX.C.1	Communicates mathematical ideas, reasoning, and their implications using symbols, diagrams, graphs, and words
IX.C.2	Creates and uses representations to organize, record, and communicate mathematical ideas.
IX.C.3	Explains, displays, or justifies mathematical ideas and arguments using precise mathematical language in written or oral communications
X.A.1	Connects and uses multiple strands of mathematics in situations and problems
X.A.2	Connects mathematics to the study of other disciplines
X.B.1	Uses multiple representations to demonstrate links between mathematical and real-world situations
X.B.2	Understands and uses appropriate mathematical models in the natural, physical, and social sciences

Science:

I.A.1	Utilizes skepticism, logic, and professional ethics in science
I.A.2	Uses creativity and insight to recognize and describe patterns in natural phenomena
I.A.3	Formulates appropriate questions to test understanding of natural phenomena
I.A.4	Relies on reproducible observations of empirical evidence when constructing, analyzing, and evaluating explanations of natural events and processes
I.B.1	Designs and conducts scientific investigations in which hypotheses are formulated and tested.
I.C.1	Collaborates on joint projects
I.E.1	Uses several modes of expression to describe or characterize natural patterns and phenomena These modes of expression include narrative, numerical, graphical, pictorial, symbolic, and kinesthetic
I.E.2	Uses essential vocabulary of the discipline being studied
II.A.1	Understands the real number system and its properties
II.A.3	Understands ratios, proportions, percentages, and decimal fractions, and translate from any form to another
II.A.6	Estimates results to evaluate whether a calculated result is reasonable

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- II.A.7 Uses calculators, spreadsheets, computers, etc. in data analysis
- II.B.1 Carries out formal operations using standard algebraic symbols and formulae
- II.B.2 Represents natural events, processes, and relationships with algebraic expressions and algorithms
- II.E.1 Understands descriptive statistics
- II.F.1 Selects appropriate Standard International (SI) units and prefixes to express measurements for real-world problems
- II.F.2 Uses appropriate significant digits
- III.A.1 Uses correct applications of writing practices in scientific communication
- III.B.1 Reads technical and scientific articles to gain understanding of interpretations, apparatuses, techniques or procedures, and data
- III.B.2 Sets up apparatuses, carry out procedures, and collect specified data from a given set of appropriate instructions
- III.B.3 Recognizes scientific and technical vocabulary in the field of study and use this vocabulary to enhance clarity of communication
- III.B.4 Lists, uses, and gives examples of specific strategies before, during, and after reading to improve comprehension
- III.C.1 Prepares and represents scientific/technical information in appropriate formats for various audiences
- III.D.1 Uses search engines, databases, and other digital electronic tools effectively to locate information
- III.D.2 Evaluates quality, accuracy, completeness, reliability, and currency of information from any source
- V.E.1 Uses models to make predictions
- V.E.2 Uses scale to relate models and structures

Social Studies:

- I.F.1 Uses a variety of research and analytical tools to explore questions or issues thoroughly and fairly
- IV.A.1 Identifies and analyzes the main idea(s) and point(s) of view in sources
- IV.A.2 Situates an informational source in its appropriate contexts
- IV.A.3 Evaluates sources from multiple perspectives
- IV.A.4 Understands the differences between a primary and secondary source and use each appropriately to conduct research and construct arguments
- IV.A.5 Reads narrative texts critically
- IV.A.6 Reads research data critically
- IV.B.1 Uses established research methodologies
- IV.B.3 Gathers, organizes, and displays the results of data and research
- IV.B.4 Identifies and collects sources
- IV.C.1 Understands/interprets presentations critically

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- IV.D.1 Constructs a thesis that is supported by evidence
- IV.D.2 Recognizes and evaluates counter-arguments
- V.A.1 Uses appropriate oral communication techniques depending on the context or nature of the interaction
- V.A.2 Uses conventions of standard written English
- V.B.1 Attributes ideas and information to source materials and authors

Cross-Disciplinary Standards:

- I.A.1 Engages in scholarly inquiry and dialogue
- I.A.2 Accepts constructive criticism and revises personal views when valid evidence warrants
- I.B.1 Considers arguments and conclusions of self and others
- I.B.2 Constructs well-reasoned arguments to explain phenomena, validate conjectures, or support positions
- I.B.3 Gathers evidence to support arguments, findings, or lines of reasoning
- I.B.4 Supports or modifies claims based on the results of an inquiry
- I.D.1 Self-monitors learning needs and seeks assistance when needed
- I.D.2 Uses study habits necessary to manage academic pursuits and requirements
- I.D.3 Strives for accuracy and precision
- I.D.4 Perseveres to complete and master tasks
- I.E.1 Works independently
- I.E.2 Works collaboratively
- I.F.1 Attributes ideas and information to source materials and people
- I.F.2 Evaluates sources for quality of content, validity, credibility, and relevance
- I.F.3 Includes the ideas of others and the complexities of the debate, issue, or problem
- I.F.4 Understands and adhere to ethical codes of conduct
- II.A.1 Uses effective prereading strategies
- II.A.2 Uses a variety of strategies to understand the meanings of new words
- II.A.3 Identifies the intended purpose and audience of the text
- II.A.4 Identifies the key information and supporting details
- II.A.5 Analyzes textual information critically
- II.A.6 Annotates, summarizes, paraphrases, and outlines texts when appropriate
- II.A.7 Adapts reading strategies according to structure of texts
- II.A.8 Connects reading to historical and current events and personal interest
- II.B.1 Writes clearly and coherently using standard writing conventions
- II.B.2 Writes in a variety of forms for various audiences and purposes
- II.B.3 Composes and revise drafts
- II.C.1 Understands which topics or questions are to be investigated
- II.C.2 Explores a research topic
- II.C.3 Refines research topic based on preliminary research and devise a timeline for completing

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	work
II.C.4	Evaluates the validity and reliability of sources
II.C.5	Synthesizes and organize information effectively
II.C.6	Designs and presents an effective product
II.C.7	Integrates source material
II.C.8	Presents final product
II.D.1	Identifies patterns or departures from patterns among data
II.D.2	Uses statistical and probabilistic skills necessary for planning an investigation, and collecting, analyzing, and interpreting data
II.D.3	Presents analyzed data and communicate findings in a variety of formats
II.E.1	Uses technology to gather information
II.E.2	Uses technology to organize, manage, and analyze information
II.E.3	Uses technology to communicate and display findings in a clear and coherent manner
II.E.4	Uses technology appropriately

**Attachment #1
Statistics Problems**

1. A student body survey asked students how they got to school. The data showed four main means of transportation: car, bus, bicycle, or walking. Of the 310 students who answered the question, 42% of them arrive by car, 35% by bus, 9% by bicycle, and 14% walk. Develop a chart or graph to represent the number of people who use each mode of transportation.
2. A flower shop owner is taking inventory of the kinds of flowers she received in a delivery today. The following table contains those data.

Flowers in the Delivery

Tulips	175
Roses	50
Carnations	200
Sunflowers	45
Daffodils	100
Violets	75

Organize these data into a pie chart.

3. Julia surveyed her classmates about the average number of hours they spent playing video games per week and the number of hours they spent studying per week. The data she collected are the following:

Person	Videogame Hours	Studying Hours
A	10	3
B	5	6
C	0	7
D	7	3
E	10	2
F	2	8
G	1	10
H	0	13
I	0	8
J	5	7

Develop a chart or graph to determine the correlation between the number of hours spent playing videogames and the number of hours spent studying.

Algebra Extension:

On a sheet of graph paper, draw a scatter plot of the data. Plot the hours spent playing videogames on the horizontal axis and the hours spent studying on the vertical axis.

A **line of best fit** is a straight line that fits a set of data as closely as possible. Add a line of best fit to your graph.

The line of best fit shows a relationship between the hours spent playing videogames and the hours spent studying. Describe this relationship.

Write an equation for your **line of best fit**, and make the following predictions:

- How many hours per week might a person study if he/she plays videogames for 12 hours per week?
 - How many hours per week might a person play videogames if she/he studies five hours per week?
- Survey a random sample of students to identify their eye colors and their grades in math. Plot the data in a scatter plot. What relationship did you find?
 - The school cafeteria decided to allow students to select from four options for lunch on Friday. One hundred (100) of the school's 1,387 students were surveyed on the options they would choose.

Survey Results

Lunch Option	Students
Pizza	24
Enchiladas	15
Chicken nuggets	39
Hamburgers	22

Based on these results, how many students are likely to choose chicken nuggets?

Represent the survey results in a graphic representation.

COVER SHEET

Name: _____

District: _____ School: _____

Project I.D. Number: _____ Topic: *Figure It Out!*Items submitted:

_____ Cover sheet

Research process:

_____ Research proposal

_____ Research evidence (log, note cards, or resource process sheets)

_____ Research survey and analysis

Product:_____ Product, including ten references (select **one** of the following)

_____ Letter

_____ Article

Communication:_____ Videotape or audiotape (select **one** of the following)

_____ Formal presentation, including the Q&A session

_____ Informal presentation, including the Q&A session

_____ A response to the student's letter or article submission, if received

For the Student:

I certify that all work submitted is totally my work and that I have credited others for their contributions.

Student Signature: _____ Date: _____

For the Teacher:

I certify that all the work submitted is totally that of this student.

Teacher Signature: _____ Date: _____