

This task was developed by high school and postsecondary mathematics and design/pre-construction educators, and validated by content experts in the Common Core State Standards in mathematics and the National Career Clusters Knowledge & Skills Statements. It was developed with the purpose of demonstrating how the Common Core and CTE Knowledge & Skills Statements can be integrated into classroom learning – and to provide classroom teachers with a truly authentic task for either mathematics or CTE courses.

TASK: STORAGE SHEDS

TARGET COMMON CORE STATE STANDARD(S) IN MATHEMATICS:

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

G.MG.3 Apply geometric methods to solve design problems.*

7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.

7.SP.1 Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

7.SP.2 Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.

TARGET STANDARDS FOR MATHEMATICAL PRACTICES

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.6 Attend to precision.

TARGET COMMON CORE STATE STANDARD(S) IN ELA/LITERACY:

RST.9-10.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

RST.0-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.5 Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

WHST.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

TARGET CAREER AND TECHNICAL EDUCATION (CTE) KNOWLEDGE & SKILLS STATEMENTS:

ACC01.01.01 Use basic math functions to complete jobsite/workplace tasks.

ACC01.01.02 Use geometric formulas to determine areas and volumes of various structures.

ACC03.01.01 Plan, organize, schedule and manage a project/job to optimize workflow and outcome.

ACC03.01.02 Manage the schedule of a project/lab.

ACC03.01.03 Estimate resources/material required for a specific project or problem.

ACC03.01.04 Use available resources/material effectively while completing a project or resolving a problem with a project plan.

ACC03.01.05 Determine alternative solutions for a specific project/problem.

ACC05.03.02 Evaluate workplace/jobsite activities for compliance with governmental and other applicable safety regulations such as EPA and OSHA.

ACC07.01.01 Establish project goals that assist in meeting project specifications and deadlines.

ACC10.01.04 Use architect's plan manufacturer's illustrations and other materials to communicate specific data and visualize proposed work.

ACC10.02.01 Select tools, machinery, equipment, and resources that match requirements of the job.

RECOMMENDED COURSE:

Algebra 1; Integrated Math I; Applications in Design & Pre-Construction

ADDITIONAL INSTRUCTIONS:

This task should be completed over several days and should include time for design and pricing research, as well as the marketing survey.

* Modeling standards appear throughout the CCSS high school standards and are indicated by a star symbol (*).

About the Common Core State Standards in Mathematics

The Common Core State Standards (CCSS) for Mathematics are organized by grade level in grades K–8. At the high school level, the standards are organized by conceptual category (number and quantity, algebra, functions, geometry, and probability and statistics), showing the body of knowledge students should learn in each category to be college and career ready, and to be prepared to study more advanced mathematics. The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. www.corestandards.org

About the Common Core State Standards in English Language Arts/Literacy

The Common Core State Standards (CCSS) for ELA/Literacy are organized by grade level in grades K–8. At the high school level, the standards are organized by 9-10 and 11-12 grade bands. Across K-12 there are four major strands: Reading, Writing, Speaking and Listening, and Language. The CCSS also include Standards for Literacy in History/Social Studies, Science, and Technical Subjects, with content-specific (Reading and Writing) literacy standards provided for grades 6-8, 9-10, and 11-12, to demonstrate that literacy needs to be taught and nurtured across all subjects. www.corestandards.org

About the Career Cluster Knowledge and Skill Statements

As an organizing tool for curriculum design and instruction, Career Clusters™ provide the essential knowledge and skills for the 16 Career Clusters™ and their Career Pathways. It also functions as a useful guide in developing programs of study bridging secondary and postsecondary curriculum and for creating individual student plans of study for a complete range of career options. As such, it helps students discover their interests and their passions, and empowers them to choose the educational pathway that can lead to success in high school, college and career. www.careertech.org/career-clusters/resources/clusters/architecture.html. Although not included in this template, all Clusters and Pathways have Foundational Academic Expectations and Essential Knowledge & Skills Statements, which, in some cases, overlap with the Common Core State Standards.

KEY TERMS

- Profit margin
- Marketing plan
- Incentive sales plan

STORAGE SHEDS – *The Task*

Students at Carbondale High School want to send five classmates to a national conference in Kansas City for five days. They have decided to build and sell yard storage sheds to raise the money to cover the cost of the trip. In order to raise the most money they need to learn what types of sheds community members would purchase. The target profit is at least 10%, without regard to delivery and set up. The students know they will be building the sheds inside their classroom, which has a door opening of 14' high and 15' wide.

1. Determine the cost per person to attend the conference in Kansas City. Registration for the conference is \$500 for a team of up to five students plus one chaperone for each school. Research (online or with a travel agent) costs for travel, food, lodging, and any additional costs.
2. Design, field test, and administer a survey to see what type of sheds people in the community would buy. Compile data, analyze, and determine which shed should be built and come to a consensus on the design of the shed.
3. Determine the maximum dimensions for the proposed shed and explain reasoning. Research pricing for ready-to-assemble sheds within the maximum dimension range.
4. Conduct market research to determine competitive product pricing for the assembled sheds and determine a price.
5. Develop a marketing plan, which includes advertising, sales goals, and an incentive sales plan.
6. Make drawings to scale and build scale models representing design options relative to materials and shed features with associated costs and profit margin.
7. Determine the number of storage sheds the students must sell in order to cover the required expenses. Is the project viable? Explain why or why not?

STORAGE SHEDS – Possible Solution(s)

1. *Answers will vary depending on location and date.*

In this sample solution the team is traveling from Denver, Colorado, is purchasing the ticket at least 6 weeks ahead, and will not be flying in the high season (e.g. holidays). The students will travel to Kansas City from Denver on a Sunday and return in the evening on the following Friday. In this example the cost of flights is \$186 per person for six people (5 students + 1 chaperone), including taxes and fees. (*Expedia.com* prices)

The example team is made up of two boys and three girls so three hotel rooms will be needed, two with two queen/king beds and one single (for the chaperone). The students will be staying in the Hyatt Regency Crown Center, connected to the Crown Center, and the rooms average \$194 per night.

The students and chaperone will be allotted \$61 per day for food.

Expenses:

Flights - $\$186 \times 6 =$ \$1,116.00 (6 people: 5 students and 1 chaperone)

Lodging - $\$194$ per night \times 3 rooms \times 5 nights =

\$2,910.00 (3 rooms required: 1 with 3 boys, 1 with 2 girls, 1 with chaperone)

Meals - $\$61 \times 6 \times 6 =$ \$2,196.00 (6 people for 6 days – includes first travel day)

(Using the IRS per diem table:

www.irs.gov/publications/p1542/ar02.html#en_US_2010_publink100098051)

TOTAL **\$6222.00** Or **\$6,500.00** to allow for small emergencies.

2. *Answers will vary depending on the survey questions and community responses. Some example of survey questions:*

- a. *What size shed would you be able to use?*
- b. *What would the purpose of the shed be? What will you store in it?*
- c. *What restrictions do you have for installation? (e.g., gate size, lot lines, landscaping issues, etc.)*
- d. *What style would you prefer?*
- e. *How much headroom do you need?*

3. With a 14' x 15' opening the sheds must be less than 14' tall and less than 15' for one dimension.

4. *Marketing research will vary.* A few examples of pricing for ready-to-assemble sheds can be found on the table below:

Home Depot

Lowe's

W	L	H	Base Price		H	Base Price
8	6	7'10"	\$999			
8	8	7'10"	\$1,269			\$749
8	10	7'10"	\$1,449		6'	\$1,605
8	12	7'10"	\$1,649		7'	\$2,265
10	10	8'2"	\$1,739			\$998
10	12	8'2"	\$1,999		6'	\$2,554

5. *Marketing plans will vary.*

6. *Scale drawings and models will vary.*

7. Using the average of the prices for completed sheds found in the chart above, \$1570 for each shed, and the assumption that a 50% mark-up would be included to pay for assembly and delivery, the total estimated profit would be \$785 per shed. Using those figures the students would need to sell at least 8 sheds.

$$\$6222 / \$785 = 7.926 \text{ or } \quad \mathbf{8 \text{ sheds}}$$

$$\$6500 / \$785 = 8.280 \text{ or } \quad \mathbf{9 \text{ sheds}}$$

The students will need to get orders for 8 or 9 sheds in order to have \$6222 - \$6500 profit (using the averages in this example). This project might be viable depending on the market research for the community and the estimated number of storage shed orders.

STORAGE SHEDS – *Possible Extensions*

The extensions below represent potential ways in which mathematics and/or CTE teachers can build on the task above. All of the extensions are optional and can be used in the classroom, as homework assignments, and/or as long-term interdisciplinary projects.

1. This example uses ready-to-assemble sheds. The task could be based on sheds designed by the students.
2. Determine how much paint would be needed and the cost if the shed were to be painted.
3. Research and calculate the cost of roofing materials for the sheds. Determine the dimensions of the roof based on the rise and run of the shed's roof.
4. Calculate the cost and materials needed to put in a concrete pad for the shed.
5. Determine if a specific brand of riding lawnmower will fit in the shed.
6. Vary the details (e.g., windows, gingerbread, porch, loft, etc.) by proposing options for the shed. Determine the cost and mark-up for each item.
7. Research the local codes regarding outbuildings, including wind, flood, and snow load codes. Show that you are sure your design will withstand the local elements.

STORAGE SHEDS – *Appendix: Alignment Ratings*

The rating system used in the following charts is as follows:

3 EXCELLENT ALIGNMENT:

The content/performance of the task is clearly consistent with the content/performance of the Common Core State Standard.

2 GOOD ALIGNMENT:

The task is consistent with important elements of the content/performance of the CCSS statement, but part of the CCSS is not addressed.

1 WEAK ALIGNMENT:

There is a partial alignment between the task and the CCSS, however important elements of the CCSS are not addressed in the task.

N/A:

For Mathematical Practices a content rating does not apply.

In the charts **C = Content Rating** and **P = Performance Rating**

COLOR KEY

- **Black** = Part of CCSS/K&S Statement aligned to task
- **Gray** = Part of CCSS/K&S Statement *not* aligned to task

Task-to-Mathematical Practice Alignment Recording Sheet

Task Name	Aligned CCSS Mathematical Practice Standards	C	P	Alignment Comments (Standards selection, partial alignments, reasons for rating, etc)	Task Comments (Strengths, weaknesses, possible improvements, effectiveness, etc)
STORAGE SHEDS	MP.1 Make sense of problems and persevere in solving them.	N/A	3	For this task students analyze givens, constraints, relationships, and goals. They must make conjectures about the form and meaning of the solution and plan a solution pathway. They must check the reasonableness of their solution, continually asking themselves, "Does this make sense?"	This is a multi-stage problem with real life applications and considerations. Students must identify costs and possible profits for the project. They use both abstract reasoning and quantitative calculations.
	MP.2 Reason abstractly and quantitatively.	N/A	3	This task involves quantitative relationships. It requires that students make sense of quantities and their relationships in the problem situation. They must attend to the meaning of the quantities and pay attention to units as they represent the quantities and measures.	
	MP.3 Construct viable arguments and critique the reasoning of others.	N/A	2	Students are required to justify their conclusions. There is no requirement to critique the reasoning of others	
	MP.6 Attend to precision.	N/A	3	This task requires that students communicate precisely, organizing their information, as they show their mathematical thinking.	

Task-to-Common Core State Standards Alignment Recording Sheet

Task Name	Aligned CCSS Content Standards	C	P	Alignment Comments (Standards selection, partial alignments, reasons for rating, etc.)	Task Comments (Strengths, weaknesses, possible improvements, effectiveness, etc.)
STORAGE SHEDS	N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	3	3	Students must determine the total amount needed for the trip and the number of sheds. The first requires rounding up for an emergency fund and the second must be a whole number of sheds.	This task requires calculation of both the costs and profits and the measurements for the different shed choices.
	G.MG.3 Apply geometric methods to solve design problems.*	3	3	Students must draw their shed design to scale in part 5 of the task.	
	7.NS.3 Solve real-world and mathematical problems involving the four operations with rational numbers.	3	3	This task asks the student to calculate the total amount needed to send the students (and chaperone) to the event and then to calculate the number of sheds needed to do so.	
	7.SP.1 Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.	3	3	Sampling is done in the task to determine which type of sheds to build.	
	7.SP.2 Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.	3	2	The sampling and data collected is connected to marketing and may result in a list of potential clients. While students may generate multiple samples it likely that the samples will be used for marketing purposes rather than to gauge variation.	

* Modeling standards appear throughout the CCSS high school standards and are indicated by a star symbol (*).

Task-to-National Career Cluster Knowledge & Skills Statements Alignment Recording Sheet

Task Name	Aligned National Career Cluster Knowledge & Skills Statements	C	P	Alignment Comments
STORAGE SHEDS	ACC01.01.01 Use basic math functions to complete jobsite/workplace tasks.	3	3	This task requires basic math functions to calculate the trip expenditures as well as the shed expenses and revenue.
	ACC01.01.02 Use geometric formulas to determine areas and volumes of various structures.	3	3	
	ACC03.01.01 Plan, organize, schedule and manage a project/job to optimize workflow and outcome.	3	3	Market research will help drive the planning of the project, and will be part of the student's marketing plan.
	ACC03.01.02 Manage the schedule of a project/lab.	3	3	This may be part of the student's marketing plan.
	ACC03.01.03 Estimate resources/material required for a specific project or problem.	3	3	
	ACC03.01.04 Use available resources/material effectively while completing a project or resolving a problem with a project plan.	3	3	
	ACC03.01.05 Determine alternative solutions for a specific project/problem.	3	3	The use of survey data will help drive potential solutions to the student's challenge of raising money and building the most demanded sheds.
	ACC05.03.02 Evaluate workplace/jobsite activities for compliance with governmental and other applicable safety regulations such as EPA and OSHA.	3	2	Students must understand every component and purpose of project.
	ACC07.01.01 Establish project goals that assist in meeting project specifications and deadlines.	3	3	
	ACC10.01.04 Use architect's plan manufacturer's illustrations and other materials to communicate specific data and visualize proposed work.	3	3	
ACC10.02.01 Select tools, machinery, equipment, and resources that match requirements of the job.	3	3		