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| **PROBLEM SOLVING TASK (PST)**  **NORTH SALEM CENTRAL SCHOOL DISTRICT**  **HIGH SCHOOL**  6/24/2013 |
| **Course(s):**  **Math Modeling or Other appropriate course** |
| **Teacher(s):**  **Mrs. Falk** |
| **Title Of This Problem solving task (PST):**  **What’s Your Focus?** |
| **Unit Questions relevant to this task:**  ***How do we use mathematical models to examine or observe real world phenomena?***  ***How can I communicate my ideas mathematically and otherwise?***  ***How can we use technology to demonstrate real world phenomena?***  **Unit objectives (with their thinking skill verbs) relevant to this task are incorporated into the specific tasks listed in the following steps.** |
| English Language Arts Standards » Science & Technical Subjects » Grade 11-12  * [**CCSS.ELA-Literacy.RST.11-12.2**](http://www.corestandards.org/ELA-Literacy/RST/11-12/2/) Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. * [**CCSS.ELA-Literacy.RST.11-12.3**](http://www.corestandards.org/ELA-Literacy/RST/11-12/3/) Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. * [**CCSS.ELA-Literacy.RST.11-12.4**](http://www.corestandards.org/ELA-Literacy/RST/11-12/4/) Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. * [**CCSS.ELA-Literacy.RST.11-12.7**](http://www.corestandards.org/ELA-Literacy/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. * [**CCSS.ELA-Literacy.RST.11-12.9**](http://www.corestandards.org/ELA-Literacy/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.  English Language Arts Standards » Anchor Standards » College and Career Readiness Anchor Standards for Speaking and Listening  * [**CCSS.ELA-Literacy.CCRA.SL.4**](http://www.corestandards.org/ELA-Literacy/CCRA/SL/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.  English Language Arts Standards » Writing » Grade 11-12  * [**CCSS.ELA-Literacy.WHST.11-12.2**](http://www.corestandards.org/ELA-Literacy/WHST/11-12/2/) Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. * [**CCSS.ELA-Literacy.WHST.11-12.2a**](http://www.corestandards.org/ELA-Literacy/WHST/11-12/2/a/) Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension   CCSS.Mathematics»Functions  **- Interpret expressions for functions in terms of the situation they**  **model**  **Building Functions F-BF.1a**  ***Build a function that models a relationship between two quantities***  1. Write a function that describes a relationship between two quantities.★  a. Determine an explicit expression, a recursive process, or steps for  calculation from a context.  **Linear, Quadratic, and Exponential Models F–LE.5**  ***Construct and compare linear, quadratic, and exponential models***  ***and solve problems***  5. Interpret the parameters in a linear or exponential function in terms of  a context.  **CCSS.Mathematics**» **Geometry**  **- Apply geometric concepts in modeling situations**  **Expressing Geometric Properties with Equations G-GPE.2**  ***Translate between the geometric description and the equation for a***  ***conic section***  2. Derive the equation of a parabola given a focus and direction.  **Modeling with Geometry G-MG.3**  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). |
| **Step 1 Of The Cycle Of Learning: Task, Audience and Purpose**  **Your Role:**  Designer and Builder of Solar Cooker  **The Task:**  Build a Solar Cooker and cook a hot dog  **Your Audience:**  Anyone in the community who wants to lower their carbon footprint and the use of alternative forms of energy for cooking.  **Purpose Of Your Work, e.g., How You Intend To Impact Your Audience:**    Solar cookers will be designed (mathematically) and assembled with low cost materials. Solar cooker demonstration will illustrate how the cooker works and if it is feasible for their location.  **Background Narrative For This Project:**  Community members are interested in harnessing the power of the sun and using it as an alternative form of energy for cooking. With your help they will be able to design and construct a low cost parabolic trough cooker that can be easily used for cooking and can be stored away for later use in a space no larger than a copy paper box.  **Assessment Of Your Work:** Review the rubric that will be used by you and your teacher to assess your work. Be able to determine: what makes a successful solar cooker? Pay attention to any goals you have set for yourself to improve your work.  **Use your journal to record ideas, sketches, data, and other information as you work through the following steps of this problem.** |
| **Step 2 Of The Cycle Of Learning: Accessing and Acquiring Information**  **GROUP WORK**  **Brainstorm** ideas for gathering necessary data. (creative thinking)  **INDIVIDUAL WORK**  **Draw** appropriate diagrams to illustrate the problem. (critical and creative thinking)  **Demonstrate** outcome theoretically, algebraically and geometrically through computer simulated and physical modeling. (critical /creative thinking)  **Determine** the measurements you will need to complete the task. (critical thinking)  **Construct** the mathematical model for the parabolic trough(critical thinking)  **Organize** the information that you know. (critical thinking) |
| **Step 3 Of The Cycle Of Learning: Processing Information**  **INDIVIDUAL WORK**  **Explain** through detailed calculations and supportive explanation the location of the focus, placement of the skewer and the parabolic trough. (critical thinking)\*  **GROUP WORK**  **Brainstorm** ideas for construction of the frame for the trough; for example type of material and placement in the box. (creative thinking)  **INDIVIDUAL WORK**  **Determine** the **exact** placement of frame for the parabolic trough of reflective material through the calculations determined by your mathematical model. (creative and critical thinking) |
| **Step 4 Of The Cycle Of Learning: Producing Product**  **GROUP WORK**  **Construct** a physical model based on calculations (critical /creative thinking)  **Analyze and Resolve** issues and problems that arise in the design or material elements. (critical and creative thinking)    **INDIVIDUAL WORK**  **Reflect** on and **modify** the product as needed after testing to determine what adjustments if any are required. (critical and creative thinking) |
| **Step 5 Of The Cycle Of Learning: Disseminating Product**  **INDIVIDUAL WORK**  **Prove** through demonstration the location of the focus.(creative thinking)  **Explain** through a written technical report exactly how the cooker works (mathematically and physically) (critical thinking)  **Critique** and **Evaluate** the practicality of the product for the particular area, time of day and location of the cooker. (critical thinking) |
| **Steps 6, 7, and 8 Of The Cycle Of Learning: Self-Assessment, Self-Evaluation and Self-Regulation (goal setting)**  **At the conclusion of your work on this task, write a reflection of your work according to the following:**  **INDIVIDUAL WORK**  **Assess** your work using the rubric (critical thinking)  **Identify** your specific strengths and weaknesses on this task. (critical thinking)  **Think** about your work on these kinds of task over time – your last several tasks like this one. **Identify** what specific parts of your performance are getting better and what specific parts of your performance are not improving. (critical thinking)  **Take an overall view** of your work and list three goals that you should consider setting for yourself so that you will improve. (creative thinking)  Now, **select** one “doable” goal for yourself and **create** a simple action plan that you will pay attention to so that your work improves. (critical and creative thinking)  **Due\_\_\_\_\_\_\_\_\_\_\_:** |