Name _____ Date _____

CHAPTER 2

Project: Ice Rescue

For use after Solving Linear Equations

Objective **Determine the safest and best ways to rescue a child stranded on thin ice.**

Materials Paper, pencil, calculator, quarter-inch grid paper, sheet of ice at least one-inch thick formed in a serving dish or baking pan, empty soup can, heavy objects like books, scale

Investigation A 100-pound child is stranded in the middle of a pond on thin ice. You have three options to use to rescue the child. In all three, assume you carry the child back.

- You can slide on your feet.
- You can use your ice skates which each weigh 1 pound more than a shoe. The area of a blade that touches the ice is 2 square inches.
- You can lay down on a nine-by-two-foot board and slide. The board weighs 10 pounds.

Stress (σ) can be found using the formula $\sigma = \frac{F}{A}$ where F is force and A is the area on which the force acts. In this situation, force is equal to the weight being put on the ice and the area is the area of contact with the ice.

1. Determine how many pounds per square inch (psi) of stress your sheet of ice can handle. You will use this number to represent the stress of the ice in the pond. Prop the ice so the center of the sheet is not supported. Put the can in the center and then stack books on the can, one at a time, until the ice breaks. Weigh the can together with all but the last book. Substitute this value for F in the stress formula. Find the area of the can that touched the ice and then find the stress. (*Hint:* The area of a circle is πr^2 where r is the radius of the circle.)
2. Use the quarter-inch grid paper to estimate the area of your foot. Write an equation for the maximum you can weigh to safely rescue the child by sliding on your feet. Solve the equation.
3. Write an equation for the maximum you can weigh to safely rescue the child using ice skates. Assume you keep both skates on the ice at all times. Solve the equation.
4. Write an equation for the maximum you can weigh to safely rescue the child by sliding on the board. Solve the equation.

Present Your Results Make a poster to present your results. Include your equations. Make diagrams illustrating the stress involved in each option. Decide which option is the safest and explain. Decide if the safest option is the best option for rescuing the child and explain.

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Name _____ Date _____

CHAPTER 2

Teacher's Notes for Ice Rescue Project *continued*

Project Goals

- Use multi-step equations to model and solve real-life problems.
- Use rates and ratios to model and solve real-life problems.
- Collect and analyze data.

Managing the Project

The sheet of ice can be formed by freezing water in a shallow serving dish or baking pan. The sheet of ice needs to be long enough to reach between whatever supports are used and wider than the can.

To estimate the area of the bottom of their feet, have students trace one of their feet onto the quarter-inch grid paper, count the whole squares, and combine partial squares. You may want to remind them to divide the total number of squares by 16 to find the area in square inches.

Be sure students include the total weight in each equation. They may omit the weight of the child, the ice skates, or the board.

Discuss reasons for variations, if any. Have a class discussion at the completion of the project.

Rubric for Project

The following rubric can be used to assess student work.

4 The student collects the data carefully and analyzes it correctly, uses equations to determine the maximum weight for each rescue option, and decides the safest and the best options. The poster presents the best options, makes a convincing case for decisions, and shows supporting evidence.

3 The student collects and analyzes data, uses equations to determine the maximum weight for each rescue option, and decides the safest and the best options. However, the student may make errors in collecting data, may not perform all calculations correctly, or may not fully address all issues when choosing the safest and the best options. The poster gives and supports opinions about the best options, but the presentation may not be as convincing as possible.

2 The student collects data, solves equations, and presents an opinion about the safest and the best options. However, work may be incomplete or reflect misunderstanding. For example, the student may use inappropriate procedures to collect the data or may make errors in setting up and solving the equations. The poster may indicate a limited grasp of certain ideas or may lack key supporting evidence.

1 Data analysis, equations, and decisions on the best options are missing or do not show an understanding of key ideas. The poster does not give a reasonable decision or fails to support the decision.

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