



**THE 2010 HAWAII EDUCATION ASSOCIATION PROBLEM-SOLVING COMPETITION**  
For Students in Grades 4 and 5

**Application and Information at [www.heaed.com](http://www.heaed.com).**

1. This contest is open to **ALL** students in grades 4 and 5 enrolled in public schools. Each student is invited to submit an entry to his/her teacher in accordance with the rules given in the following paragraphs. The teacher will select **no more than three entries per class to send to HEA.**
2. **FORMAT**
  - a. The student may submit only one entry whether as an individual or as a member of a pair.
  - b. The entry should be no fewer than 200 words and no more than 600 words, computer-generated or typewritten on one side only, and double-spaced. Any graphs, charts, or diagrams used in the student's solution **MUST BE "CAMERA READY" and BLACK AND WHITE.** Colored examples and video will be considered for judging but will not be published.
  - c. The entrant's name(s) should **NOT** appear on any of the manuscript pages.
  - d. The **FULL TITLE** should be stated at the top of the **FIRST PAGE**.
  - e. A **COVER FORM**, giving HEA the right to publish the entry if it is a winner, shall be attached to the manuscript. The form accompanies these rules. Both the form and the rules may be duplicated.
3. The problem used in this contest is "open-ended." There may actually be several ways to solve the problem, and the contest is designed to assess both problem-solving ability and the language skills used to write about the procedures used in addressing the problem. The problem to be considered in 2010 follows:

**THE AHUNA'S SWIMMING POOL**

**Show your solution to each part of the following problem. Be sure to explain your thinking clearly. Be sure to label your answers appropriately.**

**Make a scaled drawing or use small-gridded paper to make a drawing (that includes a scaling factor) that supports what you have written. The scaled drawing must be camera-ready, drawn in black ink. The scaled drawing must illustrate each part of the problem.**

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**HEA PROBLEM-SOLVING COMPETITION - GRADES 4-5 (continued)**

- A. The Ahunas plan to build a new swimming pool in their backyard. Its dimensions are 30 feet by 60 feet. Please determine the area of the pool.
- B. The pool will be surrounded by a walkway that is 10 feet wide. Please determine the area of this walkway.
- C. Hibiscus bushes are to be planted one foot apart and one foot away from the sidewalk surrounding three sides of this walkway, a length and two widths. Make drawings to check out different scenarios. Determine how to lay out these bushes and how many will be needed. (Is there more than one way of laying out the bushes?)
- D. A quarter of the pool is to be used for small keiki to wade in. It will have water only 1.5 feet deep. Use your imagination to choose what shape this wading pool will have and where it will be located in the pool. Find the perimeter of the wading pool including the length of the floaters which will separate the wading pool from the rest of the pool. Explain why you chose this shape for the wading pool.

The following Hawaii Content Performance Standards 3 may be covered:

- MA.4.4.2 Select and apply appropriate customary and metric units and tools to measure length, perimeter, and area for the degree of accuracy needed
- MA.4.4.5 Use known measurements to calculate desired measurements of squares and rectangles (e.g., use the length of the square to calculate its area and perimeter)
- MA.4.5.4 Predict and confirm the results of putting together and taking apart two- and three-dimensional shapes
- MA.5.4.3 Use map scales to measure the distance between locations and make scale drawings
- MA.5.4.5 Use known measurements (e.g., base and height) to calculate desired measurements (e.g., area) of triangles, parallelograms, and trapezoids
- MA.5.9.1 Analyze patterns and functions and use generalizations to make reasonable predictions

**HEA PROBLEM-SOLVING COMPETITION - GRADES 4-5 (continued)**

4. The HEA Mathematics Problem-Solving Competition Scoring Rubric (8/12/08) will be used in scoring entries. Depending on the quality of the entries received, the judges reserve the right to award or not to award prizes. They will assign scores based on problem-solving ability and on language skills. In general, judges will use the following criteria:

**HEA Mathematics Problem-Solving Competition  
Scoring Rubric  
(8/12/08)**

<b>CRITERIA</b>	<b>DEFINITELY</b>	<b>SOMEWHAT</b>	<b>NONE N/A</b>	<b>COMMENTS</b>
Have all key elements of the problem been addressed?				
Is the solution correct?				
Are strong supporting arguments for the solution included?				
Does the presentation indicate an understanding of the open-ended problem's ideas and processes?				
Is there a clear understanding of the concepts?				
Is communication in the paper effective?				
Is there evidence of innovative thinking?				
If the problem requires an extension, is it innovative and effective?				

5. Suggestions for Producing Quality Mathematics Problem-Solving Documents

- a. If necessary, research your question: Internet, library, interviews.
- b. Brainstorm ideas and process with teacher and peers. Take time to think about creative ideas and ways of combining ideas.
- c. Have your teachers check your drafts for correctness of mathematics and grammar.

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**HEA PROBLEM-SOLVING COMPETITION - GRADES 4-5 (continued)**

d. These are what the judges will be looking for in choosing the top papers:

1. creativity, quality and correctness of ideas
2. clarity and correctness in both mathematics and writing
3. quality coverage of all of the objectives listed in the problem
4. appeal and appropriateness of drawings and tables.

**6. DEADLINE: ENTRIES MUST BE RECEIVED BY 12:00 NOON ON FRIDAY, FEBRUARY 26, 2010.**

**7. PRIZES:**

<b>First Place</b>	<b>\$50</b>
<b>Second Place</b>	<b>\$40</b>
<b>Third Place</b>	<b>\$30</b>
<b>Four (4) Honorable Mentions</b>	<b>\$10/each</b>

8. In this contest, only the first place winner is assured of having his/her entry printed in *Write On, HEA! 2010*. Every winner, however, and his/her teacher, will be presented with two complimentary copies of the HEA publication.

**9. Send entries to: Problem-Solving Contest Chairman, Grades 4 and 5  
Hawaii Education Association  
1953 South Beretania Street, Suite 3C  
Honolulu, HI 96826**



THE 2010 HAWAII EDUCATION ASSOCIATION PROBLEM-SOLVING COMPETITION  
For Students in Grades 6, 7 and 8

Application and Information at [www.heaed.com](http://www.heaed.com).

1. This contest is open to **ALL** students in grades 6, 7 and 8 enrolled in public schools. Each student is invited to submit an entry to his/her teacher in accordance with the rules given in the following paragraphs. The teacher will select **no more than three entries per class to send to HEA.**
2. **FORMAT**
  - a. The student may submit **only one** entry whether as an individual or as a member of a pair.
  - b. The entry should be no fewer than 400 words and no more than 1,000 words, computer-generated or typewritten on one side only, and double-spaced. Any graphs, charts, or diagrams used in the student's solution **MUST BE "CAMERA READY" and BLACK AND WHITE.** Colored examples and videos will be considered for judging but will not be published.
  - c. The entrant's name(s) should **NOT** appear on any of the manuscript pages.
  - d. The **FULL TITLE** should be stated at the top of the **FIRST PAGE**.
  - e. A **COVER FORM**, giving HEA the right to publish the entry if it is a winner, shall be attached to the manuscript. The form accompanies these rules. Both the form and the rules may be duplicated.
3. The problem used in this contest is "open-ended." There may actually be several ways to solve the problem, and the contest is designed to assess both problem-solving ability and the language skills used to write about the procedures used in addressing the problem. The problem to be considered in 2010 follows:

**MY DREAM BEDROOM**

**When your great-uncle Masa died in 2005, his attorney notified your parents that Masa had opened a savings account in your name to start a college fund for you. In January 2000, he deposited \$5,000 at 3.5% interest compounded annually. Your parents have agreed to let you use half of the money in your account at the end of 2009 to redecorate the interior of your bedroom into a teen room where you can study and relax.**

- A) Determine the amount of money in your account at the end of 2009. Explain and show all of your formulas and calculations to get your final answer.

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**HEA PROBLEM-SOLVING COMPETITION - GRADES 6-8 (continued)**

- B) Make a scale drawing of your bedroom on grid paper and include the scale factor. Label and explain all parts and include all measurements.
- C) Make a chart of all items to be purchased for your room. Include the item, including brand name, where it will be purchased, cost, tax and the total cost for the whole project.
- D) Write a persuasive letter to your parents explaining how you are going to spend your money, justifying how this dream bedroom will increase your ability to study. Remember you must "sell" this idea and each item you are purchasing to your parents or they can reject certain items or even the entire project. What will it be?

The following Hawaii Content Performance Standards 3 may be covered.

MA 6.2.2; 6.3.1; 6.4.3; 6.7.1; 6.7.2; 6.9.1; 6.10.1;

MA 7.1.1; 7.1.4; 7.2.2; 7.4.2; 7.10.2;

MA 8.3.1; 8.4.1; 8.10.1

- 4. The HEA Mathematics Problem-Solving Competition Scoring Rubric (8/12/08) will be used in scoring entries. Depending on the quality of the entries received, the judges reserve the right to award or not to award prizes. They will assign scores based on problem-solving ability and on language skills. In general, judges will use the following criteria:

**HEA PROBLEM-SOLVING COMPETITION - GRADES 6-8 (continued)**

**HEA Mathematics Problem-Solving Competition  
Scoring Rubric  
(8/12/08)**

<b>CRITERIA</b>	<b>DEFINITELY</b>	<b>SOMEWHAT</b>	<b>NONE N/A</b>	<b>COMMENTS</b>
Have all key elements of the problem been addressed?				
Is the solution correct?				
Are strong supporting arguments for the solution included?				
Does the presentation indicate an understanding of the open-ended problem's ideas and processes?				
Is there a clear understanding of the concepts?				
Is communication in the paper effective?				
Is there evidence of innovative thinking?				
If the problem requires an extension, is it innovative and effective?				

5. Suggestions for Producing Quality Mathematics Problem-Solving Documents

- a. If necessary, research your question: Internet, library, interviews.
- b. Brainstorm ideas and process with teacher and peers. Take time to think about creative ideas and ways of combining ideas.
- c. Have your teachers check your drafts for correctness of mathematics and grammar.

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**HEA PROBLEM-SOLVING COMPETITION - GRADES 6-8 (continued)**

d. These are what the judges will be looking for in choosing the top papers:

1. creativity, quality and correctness of ideas
2. clarity and correctness in both mathematics and writing
3. quality coverage of all of the objectives listed in the problem
4. appeal and appropriateness of drawings and tables.

**6. DEADLINE: ENTRIES MUST BE RECEIVED BY 12:00 NOON ON FRIDAY, FEBRUARY 26, 2010.**

<b>7. PRIZES:</b>	<b>First Place</b>	<b>\$75</b>
	<b>Second Place</b>	<b>\$50</b>
	<b>Third Place</b>	<b>\$40</b>
	<b>Four (4) Honorable Mentions</b>	<b>\$10/each</b>

8. In this contest, only the first place winner is assured of having his/her entry printed in *Write On, HEA! 2010*. Every winner, however, and his/her teacher, will be presented with two complimentary copies of the HEA publication.

**9. Send entries to: Problem-Solving Contest Chairman, Grades 6-8  
Hawaii Education Association  
1953 South Beretania Street, Suite 3C  
Honolulu, HI 96826**



**THE 2010 HAWAII EDUCATION ASSOCIATION PROBLEM-SOLVING COMPETITION**  
For Students in Grades 9, 10, 11, and 12

**Application and Information at [www.head.com](http://www.head.com).**

1. This contest is open to **ALL** students in grades 9, 10, 11, and 12 enrolled in public schools. Each student is invited to submit an entry to his/her teacher in accordance with the rules given in the following paragraphs. The teacher will select **no more than three entries per class to send to HEA.**
  
2. **FORMAT**
  - a. The student may submit **only one** entry whether as an individual or as a member of a pair.
  
  - b. The entry should be no fewer than 600 words and no more than 1,200 words, computer-generated or typewritten on one side only, and double-spaced. Any graphs, charts, or diagrams used in the student's solution **MUST BE "CAMERA READY" and BLACK AND WHITE.** Colored examples and videos will be considered for judging but will not be published.
  
  - c. The entrant's name(s) should **NOT** appear on any of the manuscript pages.
  
  - d. The **FULL TITLE** should be stated at the top of the **FIRST PAGE**.
  
  - e. A **COVER FORM**, giving HEA the right to publish the entry if it is a winner, shall be attached to the manuscript. The form accompanies these rules. Both the form and the rules may be duplicated.
  
3. The problem used in this contest is "open-ended." There may actually be several ways to solve the problem, and the contest is designed to assess both problem-solving ability and the language skills used to write about the procedures used in addressing the problem. The problem to be considered in 2010 follows:

**HOLY ROTATIONS!**

You are to explore the results of rotating a plane figure about an axis of rotation that results in a solid of revolution. **For each problem, you are to draw the plane figure including the angle of rotation; explain and make a sketch of the resulting three dimensional solid of rotation. These drawings must be camera-ready and drawn in black ink.**

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## HEA PROBLEM-SOLVING COMPETITION - GRADES 9-12 (continued)

### Exploratory Problems

#### I. Two Dimensional

##### A. Rectangles

1. Compare the differences in rotating a 4" x 6" rectangle about its 4" side and about the 6" side. Show whether the resulting solids of revolution will have the same volume.
2. Compare the differences in rotating 4" x 6" rectangle about an axis bisecting the 4" sides and the 6" sides. Show whether the resulting solids of revolution will have the same volume.

##### B. Other Plane Figures

Sketch the following polygon figures, their axes of rotations and the resulting solids of revolution. For each type, explain what types can be rotated to make solids of revolution.

1. equilateral triangle
2. trapezoid
3. regular pentagon
4. regular hexagon

What conclusions can you make about the locations of axes of rotation in polygons (e.g., Any relationship to symmetry?)

#### II. Three Dimensional

##### A. Round Figures

Sketch the three-dimensional shapes. Explain and sketch the plane figures and show the axis of rotation that result in a:

1. sphere
2. cone
3. doughnut

#### III. On Your Own

Use a problem from above or create your own two-dimensional or three-dimensional problem. Draw and explain your solution. Discuss two relevant applications for your problem.

**HEA PROBLEM-SOLVING COMPETITION - GRADES 9-12 (continued)**

**The following Hawaii Content Performance Standards 3 may be covered:**

- MA.PA.4.4 Use formulas to determine the surface area and volume of selected prisms, cylinders, and pyramids
- MA.PA.5.2 Evaluate conjectures about classes of two- and three-dimensional shapes/objects
- MA.PA.6.3 Describe three-dimensional shapes that are formed by rotating two-dimensional figures about an axis
- MA. PA.7.1 Use two-dimensional representations of pyramids, prisms and cylinders to solve problems to solve problems about these figures
- MA. G. 4.2 Solve problems using the formulas for perimeter, circumference, and area, volume of two- and three-dimensional figures and solids
- MA.G.5.1 Use inductive and deductive reasoning to create and defend conjectures

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**HEA Mathematics Problem-Solving Competition  
Scoring Rubric  
(8/12/08)**

<b>CRITERIA</b>	<b>DEFINITELY</b>	<b>SOMEWHAT</b>	<b>NONE N/A</b>	<b>COMMENTS</b>
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Are strong supporting arguments for the solution included?				
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Is communication in the paper effective?				
Is there evidence of innovative thinking?				
If the problem requires an extension, is it innovative and effective?				

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**HEA PROBLEM-SOLVING COMPETITION - GRADES 9-12 (continued)**

5. Suggestions for Producing Quality Mathematics Problem-Solving Documents
- a. If necessary, research your question: Internet, library, interviews.
  - b. Brainstorm ideas and process with teacher and peers. Take time to think about creative ideas and ways of combining ideas.
  - c. Have your teachers check your drafts for correctness of mathematics and grammar.
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6. **DEADLINE:**                   **ENTRIES MUST BE RECEIVED BY 12:00 NOON ON FRIDAY, FEBRUARY 26, 2010.**
7. **PRIZES:**                   **First Place                   \$125**  
   **Second Place               \$100**  
   **Third Place                 \$ 75**  
   **Four (4) Honorable Mentions   \$10/each**
8. In this contest, only the first place winner is assured of having his/her entry printed in *Write On, HEA! 2010*. Every winner, however, and his/her teacher, will be presented with two complimentary copies of the HEA publication.
9. **Send entries to:**           **Problem-Solving Contest Chairman, Grades 9-12**  
   **Hawaii Education Association**  
   **1953 South Beretania Street, Suite 3C**  
   **Honolulu, HI 96826**