



THE 2008 HAWAII EDUCATION ASSOCIATION PROBLEM-SOLVING COMPETITION
For Students in Grades 6, 7 and 8

Application and Information at 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 grade level in a single class to send to HEA. (This means that if a teacher has two classes of seventh or eighth grade students, six entries may be submitted, three from each class.)**

2. **FORMAT**
 - a. The student may submit **only one** entry whether as an individual or as 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**MUST BE "CAMERA READY" and BLACK AND WHITE.** Colored examples and videos will be considered for judging but will not be published.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 2008 follows:

MELE KALIKIMAKA CHALLENGE

Kahale, a Christmas menehune, has challenged his friend Melia in a game. He has placed four red and four green ribbon strips in a bag.

Kahale said, "We each pick two ribbons. If the ribbons are the same color, I get a point. If the ribbons are different colors, you get a point. Whoever has the most points wins."

Answer all of the questions below. Make sure any graphics used are camera ready.

- **If the ribbons are replaced after each drawing, who will win this game? Justify your answers (e.g. by tables, reasoning).**

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HEA PROBLEM-SOLVING COMPETITION (continued)

- **Is this game fair? Justify your answer.**
- **Carry out and describe an experiment that supports your answer. Justify how many times the experiment should be repeated.**

Then design your own game.

Determine who will win and if the game is fair. Justify both answers.

Carry out and describe an experiment that supports your answer. Justify how many times the experiment should be repeated.

HCPS 3 benchmarks that may be covered:

- MA. 6.14.1 Compute probabilities of simple compound events (e.g., rolling two dice, using two different spinners at the same time)
 - MA. 7.1.1 Solve problems using fractions, decimals and percents
 - MA.7.13.1 Formulate new questions that arise from previous conclusions or conjectures and plan a new study to answer them
 - MA.7.14.1 Relate theoretical probability to experimental results
 - MA.8.14.1 Judge the validity of conjectures that are based on experiments or simulations.
4. What should we expect from students who enter the problem-solving contest? We should see some evidence of open-ended thinking. We should see students applying these steps:
- a. First, thoroughly study the problem situation.
 - (1) If that element were obvious there would be no problem, only a routine operation.
 - (2) A problem arises when the key element is hidden; it may seem to be part of the background.
 - (3) The key element has to be mentally highlighted to solve the problem.
 - b. Second, find the element that can be moved or changed.
 - (1) If that pattern were obvious there would be no problem, only a routine operation.
 - (2) Look for a pattern that may not have been applied to the sort of problem at hand.
 - c. Third, look for a pattern that would fit the situation.
 - (1) If that pattern were obvious there would be no problem, only a routine operation.
 - (2) Look for a pattern that may not have been applied to the sort of problem at hand.
 - d. Fourth, expand the problem: look for consequences, benefits, or applications that may serve in solving other problems.
 - e. Fifth, write it all up in clear, unambiguous English, using the forms of writing that seem appropriate. Fictional techniques, for example, are no longer objectionable in nonfictional writing, if applied intelligently.

HEA PROBLEM-SOLVING COMPETITION (continued)

5. "HEA Guidelines for Judging The Problem-Solving Contest--7/7/94" will be used in scoring the 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 equally on problem-solving ability (50%) and on language skills (50%). In general, judges will evaluate entries by the following criteria:
- Is there a clear, coherent, unambiguous explanation of what has been done to solve the problem?
 - If diagrams, graphs, or charts are included, are they clear, simple, and camera ready?
NOTE: Students are invited to submit diagrams, graphs, or charts, but these items will NOT be considered in the evaluation of the entry.
 - Is communication in the paper effective?
 - Does the presentation indicate an understanding of the open-ended problem's ideas and processes?
 - Are all of the important elements of the problem identified?
 - Have examples and counter-examples been covered?
 - Are strong supporting arguments for the solution included?
 - Is there evidence of innovative thinking in the written presentation?
 - Has anything been included in the narrative that extends the problem and considers consequences of the solution?
6. **DEADLINE: ENTRIES MUST BE RECEIVED BY 4:30 P.M. ON FRIDAY, FEBRUARY 29, 2008.**
7. **PRIZES:**
- | | |
|------------------------------------|------------------|
| First Place | \$100 |
| Second Place | \$50 |
| Third Place | \$40 |
| 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! 2008*. Every winner, however, and his/her teacher, will be presented with two complimentary copies of the HEA publication.
9. **Send entries to HEA's new address:**
- Problem-Solving Contest Chairman, Grades 6-8
Hawaii Education Association
1953 South Beretania Street, Suite 3C
Honolulu, HI 96826**



THE 2008 HAWAII EDUCATION ASSOCIATION PROBLEM-SOLVING COMPETITION
For Students in Grades 9, 10, 11, and 12

Application and Information at www.heaed.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 grade level in a single class to send to HEA. (This means that if a teacher has two classes of ninth or tenth grade students, six entries may be submitted, three from each class.)**
2. **FORMAT**
 - a. The student may submit **only one** entry whether as an individual or as 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 2008 follows:

SLICING A CUBE

Write a paper answering questions A-E. Be sure to explain each answer. A drawing may be part of an explanation. Be sure that any tables or drawings are camera ready.

If you slice a cube in a direction parallel to one of the faces, the shape of the slice will be a square. If you slice a cube parallel to one of the bottom edges, but tilted from the horizontal, the shape of the slice will be a rectangle.

What shapes are possible for a slice?

Triangles: Equilateral, Acute isosceles, Right isosceles, Obtuse isosceles, Acute scalene, Right scalene, Half-equilateral, Obtuse scalene

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HEA PROBLEM-SOLVING COMPETITION (continued)

Quadrilaterals: Square, Rhombus, Rectangle, Parallelogram, Kite, Isosceles trapezoid, General trapezoid, General quadrilateral

Other polygons: Pentagon, Regular pentagon, Hexagon, Regular hexagon, Heptagon

Make models to determine which of the polygons can be sliced from a cube.

- A. Describe how you made your models and how you determined whether the shape could be sliced from the cube.**

Hints: clay, transparent cube, a “movie” of a cube moving through a wall, rotating the cube about an axis from one vertex to the opposite vertex on a diagonal of the cube.

- B. What polygon slices are possible? Impossible? Explain. Make generalizations about what classes of shapes can be sliced. Justify your generalizations.**
- C. What is the range of possible sides and angles for each polygon slice?**
- D. What is the most symmetric Triangle slice? Quadrilateral? Pentagon? Hexagon?**
- E. Is there a square slice that is not parallel to one of the faces?**

HCPS 3 benchmarks that may be covered:

- MA.PA.4.5 Use the right triangle relationships (e.g., trigonometric ratios: cosine, sine, and tangent) to solve problems
- MA.PA.5.1 Apply the Pythagorean theorem to solve problems involving right triangles
- MA.PA.5.2 Evaluate conjectures about classes of two- and three-dimensional shapes/objects
- MA.PA.7.1 Use two-dimensional representations of pyramids, prisms, and cylinders to solve problems involving these figures
- MA.PA.14.1 Judge the validity of conjectures that are based upon experiments or conjectures
- MA.G.7.1 Draw cross-sections, truncations, and compositions/decompositions of three-dimensional objects

Adapted from Picciotto. Geometry Labs.1999

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HEA PROBLEM-SOLVING COMPETITION (continued)

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 - f. Have examples and counter-examples been covered?
 - g. Are strong supporting arguments for the solution included?

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HEA PROBLEM-SOLVING COMPETITION (continued)

- h. Is there evidence of innovative thinking in the written presentation?
- i. Has anything been included in the narrative that extends the problem and considers consequences of the solution?

6. DEADLINE: ENTRIES MUST BE RECEIVED BY 4:30 P.M. ON FRIDAY, FEBRUARY 29, 2008.

7. PRIZES:	First Place	\$150
	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! 2008*. Every winner, however, and his/her teacher, will be presented with two complimentary copies of the HEA publication.

9. Send entries to HEA's new address:
Problem-Solving Contest Chairman, Grades 9-12
Hawaii Education Association
1953 South Beretania Street, Suite 3C
Honolulu, HI 96826



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SUGGESTIONS FOR PRODUCING QUALITY MATHEMATICS PROBLEM-SOLVING DOCUMENTS

1. Research your question: internet, library, interviews.
2. Brainstorm ideas and process with teacher and peers. Take time to think about creative ideas and ways of combining ideas.
3. Have your Mathematics and English teachers check your drafts for correctness of mathematics and grammar.
4. These are what the judges will be looking for in choosing the top papers:
 - creativity, quality and correctness of ideas
 - clarity and correctness in both mathematics and writing
 - quality coverage of all of the objectives listed in the problem
 - appeal and appropriateness of drawings and tables.

H.E.A. GUIDELINES FOR JUDGING THE PROBLEM-SOLVING CONTEST

KEEP IN MIND THAT THIS CONTEST REQUIRES EVALUATION OF PROBLEM-SOLVING ABILITY AND THE USE OF LANGUAGE SKILLS. A problem is any situation where we ask how something is to be done, or what is to be done next, or what is the answer to a perplexing question. The language skills to be evaluated are those required to write an essay, which is a written composition that expresses a point of view on a topic of interest to the writer.

	Low			High	
	1	2	3	4	5
<p><u>PROBLEM-SOLVING ABILITY</u></p> <ul style="list-style-type: none"> - Paraphrases the problem concisely - Provides preparation steps used to solve the problem - Shows understanding of the problem's ideas & processes - Identifies the important elements of the problem - Explains in detail what was done to solve the problem - Uses clear, thoughtful methods to reach a solution to the problem - Gives sensible solution to the problem - Extends problem and shows applications <p><u>LANGUAGE SKILLS</u></p> <ul style="list-style-type: none"> - Develops thematic coherence through title, introduction, details, and conclusion - Uses clear, vivid, and precise language - Uses sentences and paragraphs effectively - Uses correct grammar - Uses correct spelling - Uses appropriate punctuation - Uses logical organization 					