

# $\sqrt{CCML}$ Video Contest – Meet 5 2017-2018

## Guidelines

- Students from each half of your team (freshman/sophomore or junior/senior) from your school may submit up to two videos on the given problem. Each video submitted must be produced by different students, but must all be from the appropriate grade band. If your school decides to submit two f/s videos, there should be different students in each video.
- Each video should be no more than SIX minutes in length. Note that this does not mean that you have to fill the entire six minutes.
- The problems are to be solved and the videos produced by student groups. The bulk of the work should be done by students. A parent or teacher holding a camera is fine, but solving a problem for the students is not.
- Videos must be produced by a group of at least two students, and at most five students. Each participating student's contribution should be made evident either from an appearance in the video or a credit at the beginning or end of the video. Indicate names of all students involved (maximum of 5) in credits or introductions at the beginning or end of the video.
- The top f/s video and j/s video from your school will earn points for your overall team score according to the attached rubric.
- Creative solutions and presentations are encouraged, but correct math is paramount. Please make the focus of your video the mathematics. If you have a creative context, great, but it should not be the focus of your video. Soundtracks should not distract or interfere with the explanation of the solution.

## Submission

- Coaches should ensure that no more than two videos per grade band are submitted.
- Coaches should upload videos to Google drive and share access with Michael Caines (macaines@cps.edu). Please use the following naming conventions for the videos: **school\_level\_teamnumber\_contestnumber\_year**. For example, a submission for CCML 3 for an f/s team from Kelly in the 2015–2016 school year should be named as follows, **kelly\_fs\_team1\_contest3\_1516**. A submission from a j/s team from Lakeview should be named **lakeview\_js\_team1\_contest3\_1516**
- **All submissions must be shared by 5pm on Monday, April 9, 2018.**

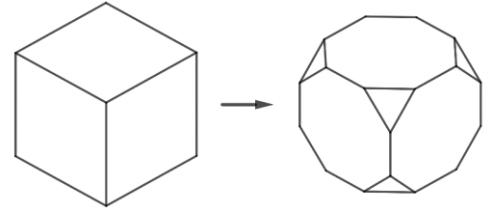
Please direct any questions about the contest to Michael Caines (macaines@cps.edu). Coaches who are interested in helping judge the submissions should email Michael Caines by the submission deadline.

**Problems:**

• **Freshman/Sophomore Problem:**

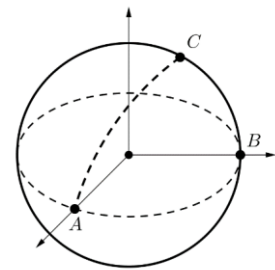
(a) Determine the perimeter of an equilateral triangle with area of  $1 \text{ cm}^2$ .

(b) A  $1 \times 1 \times 1$  cube is *truncated* by cutting off each vertex. The cutting planes make contact with the cube such that they intersect the trisection points of each edge that are nearest to a given vertex. (See image.) Determine the surface area of the resultant polyhedron.



(c) A *great circle* of a sphere is formed by the intersection of the sphere and a plane passing through the center of the sphere. A *spherical triangle* is the union of three arcs of great circles.

$\triangle ABC$  shown below has angle measures of  $60^\circ$ ,  $90^\circ$ , and  $90^\circ$ , respectively. Given that the sphere has radius 1, determine the area of the triangle.



• **Junior/Senior Problem:**

(a) Determine all solutions to the equation  $\cos \theta = \cos 2\theta$  on the interval  $[0^\circ, 360^\circ)$ .

(b) Let  $S(n) = \sum_{k=1}^n \sin(20k^\circ)$ . Determine the smallest natural  $n$  such that  $S(n)$  has an absolute maximum.

(c) Let  $a$ ,  $b$ , and  $c$  be chosen, with replacement, from the set  $\{0^\circ, 30^\circ, 60^\circ, 90^\circ, 120^\circ, 150^\circ, 180^\circ, 210^\circ, 240^\circ, 270^\circ, 300^\circ, 330^\circ, 360^\circ\}$

How many ordered triples  $(a, b, c)$  exist such that both  $a, b, c$  are in an arithmetic progression and  $\cos a, \cos b, \cos c$  are in an arithmetic progression?

## CCML Video Contest Rubric

Team Name: \_\_\_\_\_ Contest: \_\_\_\_\_ Year: \_\_\_\_\_

<b>Part (a)</b>	<b>0</b>	<b>1</b>		<b>2</b>
	<ul style="list-style-type: none"> <li>No attempt is made, or the work contains profound errors.</li> </ul>	<ul style="list-style-type: none"> <li>Problem contains some good work, but also nontrivial errors.</li> <li>Explanation of work is unclear.</li> </ul>	<ul style="list-style-type: none"> <li>Problem contains only trivial errors or no errors.</li> <li>Explanation of work is clear.</li> </ul>	
<b>Part (b)</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
	<ul style="list-style-type: none"> <li>No attempt is made, or the work contains profound errors.</li> </ul>	<ul style="list-style-type: none"> <li>Problem contains some good work, but also multiple nontrivial errors.</li> <li>Explanation of work is unclear.</li> </ul>	<ul style="list-style-type: none"> <li>Problem contains no more than one nontrivial error.</li> <li>Explanation of work is generally clear.</li> </ul>	<ul style="list-style-type: none"> <li>Problem contains only trivial errors or no errors.</li> <li>Explanation of work is clear.</li> </ul>
<b>Part (c)</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
	<ul style="list-style-type: none"> <li>No attempt is made, or the work contains profound errors.</li> </ul>	<ul style="list-style-type: none"> <li>Problem contains some good work, but also multiple nontrivial errors.</li> <li>Explanation of work is unclear.</li> </ul>	<ul style="list-style-type: none"> <li>Problem contains no more than one nontrivial error.</li> <li>Explanation of work is generally clear.</li> </ul>	<ul style="list-style-type: none"> <li>Problem contains only trivial errors or no errors.</li> <li>Explanation of work is clear.</li> </ul>
<b>Presentation</b>	<b>0</b>		<b>1</b>	<b>2</b>
	<ul style="list-style-type: none"> <li>Images are sloppy or out of focus.</li> <li>Audio is difficult to hear.</li> </ul>		<ul style="list-style-type: none"> <li>Audio/video are clear.</li> <li>Presentation is organized well</li> </ul>	<ul style="list-style-type: none"> <li>Presentation is truly creative and engaging.</li> </ul>

Score: \_\_\_\_\_ / 10

Notes: