

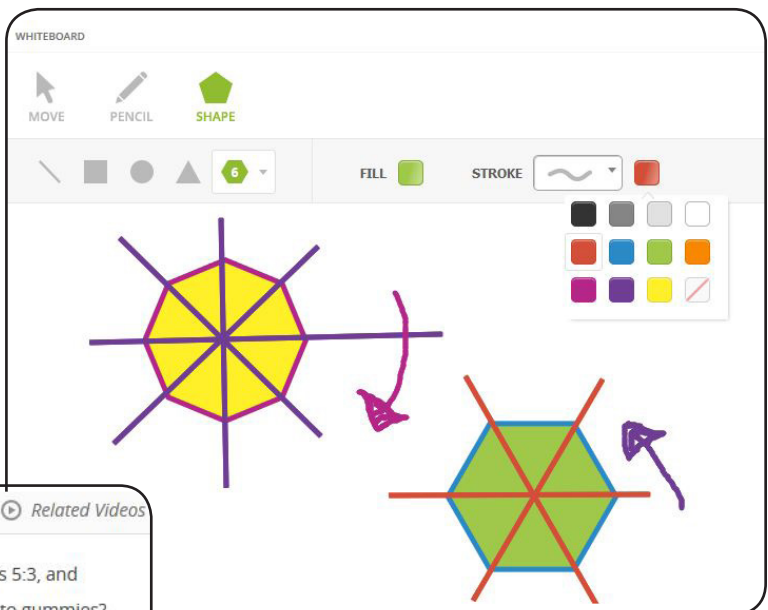
# Helpful Resources for the Math Video Challenge

## Interactive MATHCOUNTS Platform

The **Interactive MATHCOUNTS Platform** provides a unique forum where members of the MATHCOUNTS community can collaborate, chat and utilize innovative online features as they work on problems from MATHCOUNTS handbooks and competitions.

Powered by **NextThought**, the Interactive MATHCOUNTS Platform continues to grow, with more problems and features being added every year.

This resource includes problems and step-by-step solutions for all 250 math problems in the *2018-2019 MATHCOUNTS School Handbook*, as well as



### 7. INCORRECT

Related Videos

Mrs. Stephens has a bag of candy. The ratio of peppermints to chocolates is 5:3, and the ratio of peppermints to gummies is 3:4. What is the ratio of chocolates to gummies? Express your answer as a common fraction.

Answer:  $\frac{9}{20}$

We should use the least common multiple of 5 and 3 to make equivalent ratios with the same number of peppermints. We rewrite the ratio of peppermints to chocolates (5:3) as  $\frac{15}{9}$  and the ratio of peppermints to gummies (3:4) as  $\frac{15}{20}$ . This means that for every 15 peppermints there are 9 chocolates and 20 gummies. The desired ratio is  $\frac{9}{20}$ .

$\sqrt{\quad}$   $x^2$   $()$   $\approx$   $\pi$

Hide Solution

Try again

past handbooks and School, Chapter and State Competitions from multiple years.

Users can take advantage of numerous features that make this platform engaging; here are just a few:

- *Digital white-boards* enable students to highlight problems, add notes and questions and show their work.
- *Interactive problems* can be used to assess student or team performance.
- *Advanced search tools* make it easy to find MATHCOUNTS content and notes.
- *Collaborative forums* allow users to chat and share with the global MATHCOUNTS community.

The Interactive MATHCOUNTS Platform is a great resource for your Math Video Challenge team! Create your free account at [mathcounts.nextthought.com](https://mathcounts.nextthought.com) today!

# MATH TOOLKIT

This is a collection of lists, formulas and terms that Mathletes frequently use to solve problems like those found in this playbook. There are many others we could have included, but we hope you find this collection useful.

Fraction	Decimal	Percent
$\frac{1}{2}$	0.5	50
$\frac{1}{3}$	$0.\bar{3}$	$33.\bar{3}$
$\frac{1}{4}$	0.25	25
$\frac{1}{5}$	0.2	20
$\frac{1}{6}$	$0.1\bar{6}$	$16.\bar{6}$
$\frac{1}{8}$	0.125	12.5
$\frac{1}{9}$	$0.\bar{1}$	$11.\bar{1}$
$\frac{1}{10}$	0.1	10
$\frac{1}{11}$	0.09	9.09
$\frac{1}{12}$	0.083	8.3

## Common Arithmetic Series

$$1 + 2 + 3 + 4 + \dots + n = \frac{n(n+1)}{2}$$

$$1 + 3 + 5 + 7 + \dots + (2n-1) = n^2$$

$$2 + 4 + 6 + 8 + \dots + 2n = n^2 + n$$

## Prime Numbers

2	43
3	47
5	53
7	59
11	61
13	67
17	71
19	73
23	79
29	83
31	89
37	97
41	

## Combinations & Permutations

$${}_nC_r = \frac{n!}{r!(n-r)!} \quad {}_nP_r = \frac{n!}{(n-r)!}$$

$n$	$n^2$	$n^3$
1	1	1
2	4	8
3	9	27
4	16	64
5	25	125
6	36	216
7	49	343
8	64	512
9	81	729
10	100	1000
11	121	1331
12	144	1728
13	169	2197
14	196	2744
15	225	3375

## Geometric Mean

$$\frac{a}{x} = \frac{x}{b} \quad \text{and} \quad x = \sqrt{ab}$$

## Divisibility Rules

2: units digit is 0, 2, 4, 6 or 8

3: sum of digits is divisible by 3

4: two-digit number formed by tens and units digits is divisible by 4

5: units digit is 0 or 5

6: number is divisible by both 2 and 3

8: three-digit number formed by hundreds, tens and units digits is divisible by 8

9: sum of digits is divisible by 9

10: units digit is 0

## Equation of a Line

Standard Form

$$Ax + By = C$$

Slope-Intercept Form

$$y = mx + b$$

$m$  = slope       $b$  =  $y$ -intercept

Point-Slope Form

$$y - y_1 = m(x - x_1)$$

$m$  = slope       $(x_1, y_1)$  = point on the line

## Distance Traveled

$$\text{Distance} = \text{Rate} \times \text{Time}$$

## Quadratic Formula

For  $ax^2 + bx + c = 0$ , where  $a \neq 0$ ,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

## Pythagorean Triples

(3, 4, 5)	(5, 12, 13)	(7, 24, 25)
(8, 15, 17)	(9, 40, 41)	(12, 35, 37)

## Difference of Squares

$$a^2 - b^2 = (a + b)(a - b)$$

## Sum and Difference of Cubes

$$a^3 + b^3 = (a + b)(a^2 + ab + b^2)$$

$$a^3 - b^3 = (a - b)(a^2 - ab + b^2)$$

**Circles**

Circumference  $2 \times \pi \times r = \pi \times d$       Area  $\pi \times r^2$

For radius  $r$

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Arc Length  $\frac{x}{360} \times 2 \times \pi \times r$       Sector Area  $\frac{x}{360} \times \pi \times r^2$

For central angle of  $x$  degrees

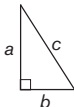
**Given A(x<sub>1</sub>, y<sub>1</sub>) and B(x<sub>2</sub>, y<sub>2</sub>)**

Distance from A to B =  $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Midpoint of  $\overline{AB} = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

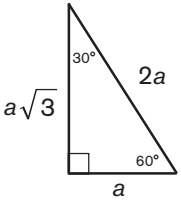
Slope of  $\overline{AB} = \frac{y_2 - y_1}{x_2 - x_1}$

**Pythagorean Theorem**

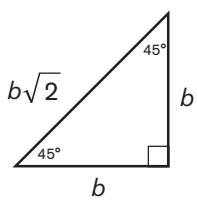


$a^2 + b^2 = c^2$

**Special Right Triangles**



30-60-90  
Right Triangle



45-45-90  
Right Triangle

**Area of Polygons**

Square	side length $s$	$s^2$
Rectangle	length $l$ , width $w$	$l \times w$
Parallelogram	base $b$ , height $h$	$b \times h$
Trapezoid	bases $b_1, b_2$ , height $h$	$\frac{1}{2}(b_1 + b_2) \times h$
Rhombus	diagonals $d_1, d_2$	$\frac{1}{2} \times d_1 \times d_2$
Triangle	base $b$ , height $h$	$\frac{1}{2} \times b \times h$
Triangle	semi-perimeter $s$ , side lengths $a, b, c$	$\sqrt{s(s-a)(s-b)(s-c)}$
Equilateral Triangle	side length $s$	$\frac{s^2\sqrt{3}}{4}$

**Polygon Angles (n sides)**

Sum of the interior angle measures:  
 $180 \times (n - 2)$

Central angle measure of a regular polygon:  
 $\frac{360}{n}$

Interior angle measure of a regular polygon:  
 $\frac{180 \times (n - 2)}{n}$  or  $180 - \frac{360}{n}$

Solid	Dimensions	Surface Area	Volume
Cube	side length $s$	$6 \times s^2$	$s^3$
Rectangular Prism	length $l$ , width $w$ , height $h$	$2 \times (l \times w + w \times h + l \times h)$	$l \times w \times h$
Circular Cylinder	base radius $r$ , height $h$	$2 \times \pi \times r \times h + 2 \times \pi \times r^2$	$\pi \times r^2 \times h$
Circular Cone	base radius $r$ , height $h$	$\pi \times r^2 + \pi \times r \times \sqrt{r^2 + h^2}$	$\frac{1}{3} \times \pi \times r^2 \times h$
Sphere	radius $r$	$4 \times \pi \times r^2$	$\frac{4}{3} \times \pi \times r^3$
Pyramid	base area $B$ , height $h$		$\frac{1}{3} \times B \times h$

## Vocabulary & Terms

The following list is representative of terminology used in the problems but **should not** be viewed as all-inclusive. Mathletes creating videos may find it useful to review these terms.

absolute difference	geometric sequence	rate
absolute value	hemisphere	ratio
acute angle	image(s) of a point(s)	rational number
additive inverse ( <i>opposite</i> )	( <i>under a transformation</i> )	ray
adjacent angles	improper fraction	real number
apex	infinite series	reciprocal ( <i>multiplicative inverse</i> )
arithmetic mean	inscribe	reflection
arithmetic sequence	integer	regular polygon
base 10	interior angle of a polygon	relatively prime
binary	intersection	revolution
bisect	inverse variation	right angle
box-and-whisker plot	irrational number	right polyhedron
center	isosceles	rotation
chord	lateral edge	scalene triangle
circumscribe	lateral surface area	scientific notation
coefficient	lattice point(s)	sector
collinear	LCM	segment of a circle
common divisor	median of a set of data	segment of a line
common factor	median of a triangle	semicircle
common fraction	mixed number	semiperimeter
complementary angles	mode(s) of a set of data	sequence
congruent	multiplicative inverse	set
convex	( <i>reciprocal</i> )	significant digits
coordinate plane/system	natural number	similar figures
coplanar	obtuse angle	slope
counting numbers	ordered pair	space diagonal
counting principle	origin	square root
diagonal of a polygon	palindrome	stem-and-leaf plot
diagonal of a polyhedron	parallel	supplementary angles
digit-sum	Pascal's Triangle	system of equations/inequalities
direct variation	percent increase/decrease	tangent figures
divisor	perpendicular	tangent line
domain of a function	planar	term
edge	polyhedron	transformation
equiangular	polynomial	translation
equidistant	prime factorization	triangular numbers
expected value	principal square root	trisection
exponent	proper divisor	twin primes
exterior angle of a polygon	proper factor	union
factor	proper fraction	unit fraction
finite	quadrant	variable
frequency distribution	quadrilateral	whole number
frustum	random	y-intercept
function	range of a data set	
GCF	range of a function	



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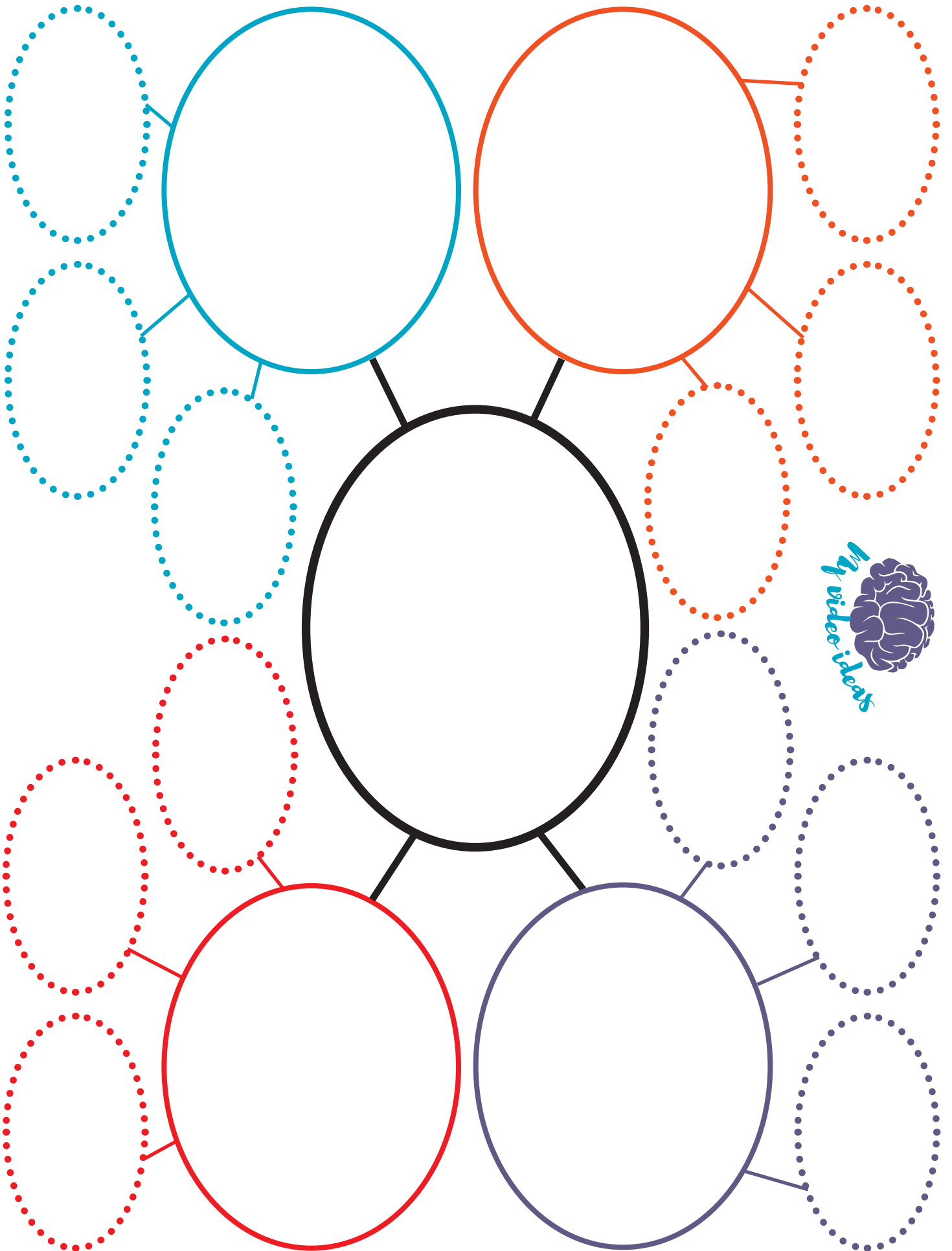
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# STORYBOARD TEMPLATE

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# 2018-2019 VOTING GUIDE

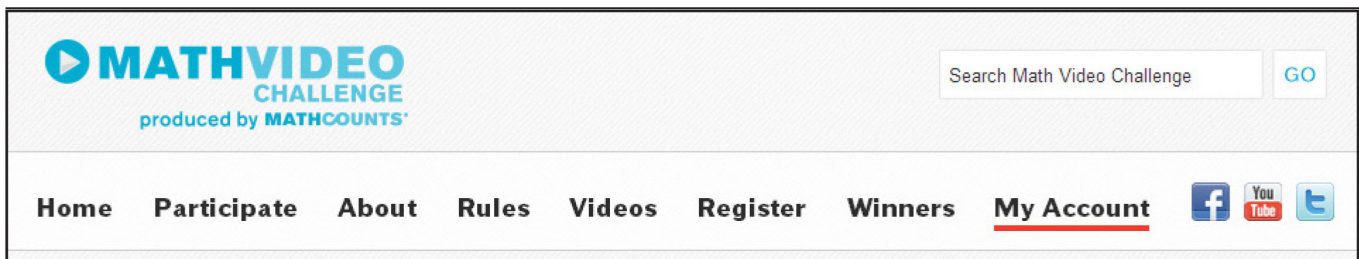


You must have a Math Video Challenge website account to vote for videos in the competition. If you are already a student or Team Advisor participating in the contest, then you *do not* need to create a separate voting account.

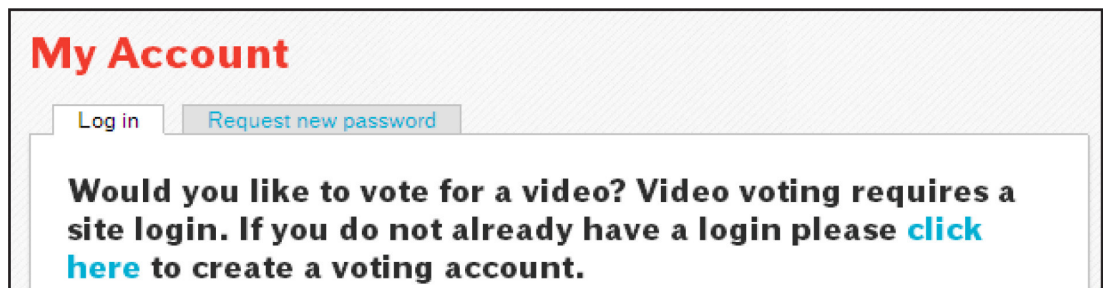
This Voting Guide includes information about how to create a Math Video Challenge voting account and how to link it to a social media account. Logged in users can vote for each video in the competition *once every 24 hours*. Remember, the General Voting Period is from *Wednesday, February 13 through Thursday, March 14*.

## ACCOUNT CREATION

To create an account first go to [videochallenge.mathcounts.org](http://videochallenge.mathcounts.org) and click on the **My Account** tab at the top of the page, as shown below.



Next, click on the [click here](#) link, as shown at right.



You then will be taken to an account creation webform. This form will require you to submit a user

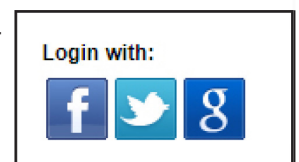
ID, email address, and password. You will also have the option to link your Math Video Challenge account to a social media site (details below).

Once you submit this information you will receive an email asking you to validate your account. After validating your email address, your account creation will be complete and you'll be able to log in at [videochallenge.mathcounts.org](http://videochallenge.mathcounts.org) to vote throughout this year's contest.

## SOCIAL MEDIA LOGIN

During the account creation process you will have the option of linking your Math Video Challenge account to Facebook, Twitter, or Google+. You can link to these by clicking on the icon of that site on the account creation webform (as shown at right).

Linking your Math Video Challenge account to one of your social media accounts can save you time, because if you are logged in at your social media account, you can log in automatically at the Math Video Challenge website. To do this, simply click on the appropriate site icon (as shown at left); you will not be required to enter a user ID and password to log in, as long as you are logged in at your social media account.



**If you need any assistance with voting or registration please contact [videochallenge@mathcounts.org](mailto:videochallenge@mathcounts.org).**



# SAMPLE ASSESSMENT TOOL

with point values pre-assigned



Name \_\_\_\_\_

Video Title \_\_\_\_\_

## 24 POINTS - MATHEMATICAL CONTENT

\_\_\_\_\_ (0-6 pts) An appropriate approach to the solution of the problem is used.

\_\_\_\_\_ (0-6 pts) The facts and logic are correct. There are no errors.

\_\_\_\_\_ (0-6 pts) The use of vocabulary and notation are correct.

\_\_\_\_\_ (0-6 pts) The solution is explained in a way that is clear to the viewer.

## 30 POINTS - COMMUNICATION

\_\_\_\_\_ (0-6 pts) The mathematical thinking is communicated coherently and in a logical manner.

\_\_\_\_\_ (0-6 pts) The video uses time effectively.

\_\_\_\_\_ (0-6 pts) The important ideas are emphasized.

\_\_\_\_\_ (0-6 pts) Sufficient detail is used.

\_\_\_\_\_ (0-6 pts) The method of communication (verbal/written/etc.) is clear and easy to understand.

## 24 POINTS - CREATIVITY

\_\_\_\_\_ (0-6 pts) The style of the video is well-suited for the audience/middle school students.

\_\_\_\_\_ (0-6 pts) The story line of the video is engaging.

\_\_\_\_\_ (0-6 pts) The video shows imagination by the creators.

\_\_\_\_\_ (0-6 pts) The video is memorable.

## 10 POINTS - REAL-WORLD APPLICATION OF MATH

\_\_\_\_\_ (0-10 pts) The video presents a clear, real-world application of the math concept(s) in the problem.

## 12 POINTS - VIDEO LOGISTICS

\_\_\_\_\_ (0-6 pts) The video is no more than 5 minutes in length.

\_\_\_\_\_ (0-6 pts) The video was submitted on time.

## BONUS POINTS

\_\_\_\_\_ (0-2 pts) A real-world application of the concept is shown that is not part of the original problem.

\_\_\_\_\_ (0-2 pts) The video production quality is excellent.

\_\_\_\_\_ (0-2 pts) The problem selected is a more difficult problem to solve and explain.

\_\_\_\_\_ (0-2 pts) More than one solution to the problem is shown.

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**TOTAL POINTS** (out of 100)

# BLANK ASSESSMENT TOOL

*without pre-determined point-values*



Name \_\_\_\_\_

Video Title \_\_\_\_\_

## POINTS - MATHEMATICAL CONTENT

- \_\_\_\_\_ ( pts) An appropriate approach to the solution of the problem is used.
- \_\_\_\_\_ ( pts) The facts and logic are correct. There are no errors.
- \_\_\_\_\_ ( pts) The use of vocabulary and notation are correct.
- \_\_\_\_\_ ( pts) The solution is explained in a way that is clear to the viewer.

## POINTS - COMMUNICATION

- \_\_\_\_\_ ( pts) The mathematical thinking is communicated coherently and in a logical manner.
- \_\_\_\_\_ ( pts) The video uses time effectively.
- \_\_\_\_\_ ( pts) The important ideas are emphasized.
- \_\_\_\_\_ ( pts) Sufficient detail is used.
- \_\_\_\_\_ ( pts) The method of communication (verbal/written/etc.) is clear and easy to understand.

## POINTS - CREATIVITY

- \_\_\_\_\_ ( pts) The style of the video is well-suited for the audience/middle school students.
- \_\_\_\_\_ ( pts) The story line of the video is engaging.
- \_\_\_\_\_ ( pts) The video shows imagination by the creators.
- \_\_\_\_\_ ( pts) The video is memorable.

## POINTS - REAL-WORLD APPLICATION OF MATH

- \_\_\_\_\_ ( pts) The video presents a clear, real-world application of the math concept(s) in the problem.

## POINTS - VIDEO LOGISTICS

- \_\_\_\_\_ ( pts) The video is no more than 5 minutes in length.
- \_\_\_\_\_ ( pts) The video was submitted on time.

## BONUS POINTS

- \_\_\_\_\_ ( pts) A real-world application of the concept is shown that is not part of the original problem.
- \_\_\_\_\_ ( pts) The video production quality is excellent.
- \_\_\_\_\_ ( pts) The problem selected is a more difficult problem to solve and explain.
- \_\_\_\_\_ ( pts) More than one solution to the problem is shown.

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**TOTAL POINTS** (out of )

# 2018-2019 OFFLINE PERMISSION FORM

**TEAM ADVISOR:** Please give this Offline Registration Form to the parent/guardian whose name you provided during your online registration. If you need to update this information, you can log in at the Math Video Challenge website (<http://videochallenge.mathcounts.org>) and make any necessary changes online. *Do not give this form to any parents/guardians who have completed or will complete the online permission form.*

**PARENT/GUARDIAN:** As soon as possible, please complete this Offline Registration Form and email it to [videochallenge@mathcounts.org](mailto:videochallenge@mathcounts.org) or mail it to MATHCOUNTS – Math Video Challenge Registrations, 1420 King Street, Alexandria, VA 22314. *Your child cannot participate in the Math Video Challenge without your permission.*

**TEAM INFORMATION:** (\*required information)

**!** *If your son/daughter is participating in more than one Math Video Challenge team, please write the names of all teams and team advisors on this form.*

Team Advisor Name\* \_\_\_\_\_

Team Name\* \_\_\_\_\_

**STUDENT INFORMATION:** (\*required information)

**!** *If you have more than one child participating in the Math Video Challenge this year, you must complete a separate permission form for each child.*

First & Last Name\* \_\_\_\_\_ Grade Level (circle one)\* 6 7 8

**Ethnicity (circle one)\***

White	Hispanic, Latino or Spanish Origin	Black or African American	Asian	American Indian or Alaskan Native	Middle Eastern or North African	Native Hawaiian or Pacific Islander	Multiple Categories or Other	Prefer not to answer
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Email Address \_\_\_\_\_ Gender (circle one) M F Other

Name of Student's Official School of Record\* \_\_\_\_\_

School City\* \_\_\_\_\_ School State\* \_\_\_\_\_

**PARENT/GUARDIAN INFORMATION:** (\*required information)

First & Last Name\* \_\_\_\_\_ Phone Number\* \_\_\_\_\_

Email Address \_\_\_\_\_

By signing below I attest that I am the parent/guardian of the above-mentioned minor and give permission for my child to participate in the Math Video Challenge video contest. My child and I agree to be bound by the terms and conditions of participation.

*A copy of the terms and conditions of participation can be found at <http://videochallenge.mathcounts.org/rules> or can be requested by emailing [videochallenge@mathcounts.org](mailto:videochallenge@mathcounts.org) or mailing a self-addressed stamped envelope to: MATHCOUNTS – Math Video Challenge Rules, 1420 King Street, Alexandria, VA 22314. Please direct any questions to MATHCOUNTS at [videochallenge@mathcounts.org](mailto:videochallenge@mathcounts.org) or (703) 299-9006.*

Printed Name of Parent/Guardian

Signature of Parent/Guardian

Date