

Form/Organization/Structure • Sequence/Pattern •
Creating • Compare and Contrast •



MCC4.OA.2: Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.

MCC4.NF.3: Understand a fraction a/b with $a > 1$ as a sum of fractions $1/b$.

GRADE 5

MCC5.OA.1: Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

MCC5.OA.2: Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation "add 8 and 7, then multiply by 2" as $2 \times (8 + 7)$. Recognize that $3 \times (18932 + 921)$ is three times as large as $18932 + 921$, without having to calculate the indicated sum or product.

GRADE 6

MCC6.EE.1: Write and evaluate numerical expressions involving whole-number exponents.

MCC6.EE.2: Write, read, and evaluate expressions in which letters stand for numbers.

MCC6.EE.2c: Evaluate expressions at specific values for their variables. Include expressions that arise from formulas in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$.

MCC6.EE.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

GRADE 7

MCC7.EE.4: Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

MCC7.EE.4a: Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$ where p , q , and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

GRADE 8

MCC8.EE.7: Solve linear equations in one variable.

GRADES 9-12

MCC9-12.A.SSE.1: Interpret expressions that represent a quantity in terms of its context.

MCC9-12.A.REI.1: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

Georgia Performance Standards

MUSIC**GRADE K**

MKGM.2: Performing on instruments, alone and with others, a varied repertoire of music

MKGM.3: Reading and notating music

MKGM.4: Improvising melodies, variations, and accompaniments

MKGM.5: Composing and arranging music within specified guidelines

MKGM.6: Listening to, analyzing, and describing music

MKGM.10: Moving, alone and with others, to a varied repertoire of music

GRADE 1

M1GM.2: Performing on instruments, alone and with others, a varied repertoire of music

M1GM.3: Reading and notating music

M1GM.4: Improvising melodies, variations, and accompaniments

M1GM.5: Composing and arranging music within specified guidelines

M1GM.6: Listening to, analyzing, and describing music

M1GM.10: Moving, alone and with others, to a varied repertoire of music

Idea Contributed by Maribeth Yoder-White and Pamela Walker

GRADE 2

M2GM.2: Performing on instruments, alone and with others, a varied repertoire of music

M2GM.3: Reading and notating music

M2GM.4: Improvising melodies, variations, and accompaniments

M2GM.5: Composing and arranging music within specified guidelines

M2GM.6: Listening to, analyzing, and describing music

M2GM.10: Moving, alone and with others, to a varied repertoire of music

GRADE 3

M3GM.2: Performing on instruments, alone and with others, a varied repertoire of music

M3GM.3: Reading and notating music

M3GM.4: Improvising melodies, variations, and accompaniments

M3GM.5: Composing and arranging music within specified guidelines

M3GM.6: Listening to, analyzing, and describing music

M3GM.10: Moving, alone and with others, to a varied repertoire of music

GRADE 4

M4GM.2: Performing on instruments, alone and with others, a varied repertoire of music

M4GM.3: Reading and notating music

M4GM.4: Improvising melodies, variations, and accompaniments

M4GM.5: Composing and arranging music within specified guidelines

M4GM.6: Listening to, analyzing, and describing music

M4GM.10: Moving, alone and with others, to a varied repertoire of music

GRADE 5

M5GM.2: Performing on instruments, alone and with others, a varied repertoire of music

M5GM.3: Reading and notating music

M5GM.4: Improvising melodies, variations, and accompaniments

M5GM.5: Composing and arranging music within specified guidelines

M5GM.6: Listening to, analyzing, and describing music

M5GM.10: Moving, alone and with others, to a varied repertoire of music

GRADE 6

M6GM.3: Reading and notating music

M6GM.4: Improvising melodies, variations, and accompaniments

M6GM.5: Composing and arranging music within specified guidelines

M6GM.6: Listening to, analyzing, and describing music

GRADE 7

M7GM.3: Reading and notating music

M7GM.4: Improvising melodies, variations, and accompaniments

M7GM.5: Composing and arranging music within specified guidelines

M7GM.6: Listening to, analyzing, and describing music

GRADE 8

M8GM.3: Reading and notating music

M8GM.4: Improvising melodies, variations, and accompaniments

M8GM.5: Composing and arranging music within specified guidelines

M8GM.6: Listening to, analyzing, and describing music

GRADES 9-12

MHS.3: Reading and notating music

MHS.4: Improvising melodies, variations, and accompaniments

MHS.5: Composing and arranging music within specified guidelines

MHS.6: Listening to, analyzing, and describing music

National Standards

MUSIC

Standard 3: Improvising melodies, variations, and accompaniments

Standard 4: Composing and arranging music within specified guidelines

Standard 5: Reading and notating music

Standard 6: Listening to, analyzing, and describing music

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Curriculum guides provide differentiated ideas and activities aligned to a sampling of standards. The guides do not necessarily imply mastery of standards, but are intended to inspire and equip educators.

Help your students build creative problem solving skills by connecting music and math!

Counting with Cups... And More!

Help students recognize and cultivate creative and critical thinking using various activities that connect math and music! Consider valuable curriculum connections that assist in the development of problem solving skills through fun and engaging learning experiences.

Essential Question: How can connecting math and music aid students in their problem solving abilities and cultivate creative and critical thinking?

Process

Wake-up and Warm-up

- Students stand in the space (no formation). Leader claps (or plays) the beat while students walk to the pulse.
- Leader plays 4 beats (while students move), then students stop and clap 4 beats (same tempo as leader).
- Continue game, moving around the room freely.
- Have students stop in front of someone and clap their partner's hands for the second set of 4 claps. Thus, the sequence becomes:
 - move to leader's beat (set 1 = 4 beats)
 - stop and clap beat alone (set 2 = 4 beats)
 - move to leader's beat (set 3 = 4 beats)
 - stop and clap partner's hands (set 4 = 4 beats).
- Have students move to new partner each time.
- Extend by adding additional movements and/or body percussion for subsequent sets of 4 beats (e.g., move to leader's beat; clap beat alone; move to leader's beat; clap partner's hands; move to leader's beat; pat beat; etc.).
- Turn this sequence into a mathematical equation ($4+4+4+4=16$ or $4 \times 4=16$)
- Experiment with different tempos and different number of beats (i.e., slower tempo, use body percussion or instruments to show $3+3+3+3=12$ or $3 \times 4=12$).
- Introduce a variety of rhythm instruments (rhythm sticks, drum, wood block, triangle, tambourine).
- Take time to discuss the various shapes of each instrument (compare and contrast both shapes and sounds—timbre).
- Use students to demonstrate to group various equations that can be solved. Teacher will have 2 students play $6+6+=12$.
- Then have students work in pairs to "play" equations and have partner solve. For example if a notecard shows $4+4=8$, one student would play 4 beats with one instrument or body percussion (such as clapping) and the other student would have to solve by saying "you demonstrated $4+4=8$. Then switch roles.
- Then challenge the students to just play the answer (for example, 8). The other student must find a way to "play" 8, such as $2+2+2+2$.

Question and Answer

- Display visuals of numbers.

1	2	3	4	5	6	7	8
1	2	3	4	5	6	7	-

- Have students speak numbers in given tempo.
- Have students clap once on each number while speaking; repeat, eliminating speech.
- Divide into 2 groups, ask the question (1st 8 beats) and the other providing the answer (2nd 8 beats); reverse.
- Have students (in 2 groups) only clap on their EVEN number (first with speech, then without)
- Have students only clap on ODD numbers (first with speech, then without).
- Have students clap twice on one number of their choice; extend to clapping twice on two numbers.
- Discuss how if we clap twice on one beat (or one number) it represents 2 half beats. Show the fraction $1/2$.
- Under each of the numbers, now draw "stick notation" to show quarter notes and eighth notes. Quarter note = 1 and the eighth note = $1/2$
- Leader provides a question via clapping; students use part of the question in their answer (e.g., "use the first part of my question as the first part of your answer").
- Extend to other body percussion, found sound, and/or unpitched percussion.
- Divide into pairs, with one person providing the question and another, the answer; reverse.
- Lead students to understanding of phrase length.
- Extend to moving; add to recording if desired ("Hora Agadati" or "Jai Ho").

Materials

- Variety of unpitched percussion instruments
- Plastic cups in various colors and sizes
- Rhythm sticks or dowel rods
- Sound source (e.g., iPod and dock)
- Recordings
- Question/Answer visual
- Large pads and markers
- Paper and writing utensils (pencils, markers, crayons, etc.)
- Small whiteboards and markers
- Note cards with mathematical equations

Vocabulary

Body Percussion

Sounds produced by striking or scraping parts of the body; typically includes snapping, clapping, patting, and stamping

Steady Beat

An unchanging continuous pulse

Timbre

The unique quality of a sound; also known as tone color or tone quality

Dynamics

Volume of sound (loudness, quietness)

Found Sound

Sounds produced by non-traditional sound sources in the environment (e.g., scraping a ruler along a binder spine, tapping a pencil on a desk)

Phrase

A musical sentence

Retrograde

A musical line which is the reverse of a previously or simultaneously stated line

Rondo

A form of composition in which the first section recurs throughout the piece, alternating with different sections (e.g., A-B-A-B-A or A-B-A-C-A, etc.). This form is found especially in compositions of the Baroque and Classical eras.

Tempo

The speed of the beat

Classroom Tips

Depending on the age of your students, you may find it important to discuss proper use of, and care for, instruments prior to use. Discuss "resting" position, meaning no sound at all from instruments. Also discuss moving through "space" without touching anything else around. Pretend you are in a bubble and cannot touch anything or anyone in your surroundings.

- Have students walk 8 beats and then "answer" using body percussion for the next 8 beats.
- Ask mathematical questions such as, if each phase is 8 beats and we have 4 phases, how many total beats?
- Extend to ask questions about the patterns. If we walk the first phase, use body percussion the next phrase and then walk the next phrases, that could be called A B A pattern.
- Have students work in pairs to create a "composition" using rhythm instruments that contains between 2 and 6 phrases (each phrase must be between 6 and 12 beats). Have them label the phrases with capital letters and then show equations for "how they play" each phrase (as demonstrated in the previous activity).

Composing with Cups

- Display different colored cups and have students reach consensus about desired sound for each (e.g., blue – quarter note, yellow – eighth notes, clear – quarter rest). Introduce in silence having students use creative and critical thinking to figure out the values (number of sounds for each cup) independently first.
- Teacher should lead this activity in silence changing cups (number of sounds) and even length of phrase prior to any discussion.
- Have individual students create rhythmic patterns for others to perform. Have students "conduct" their patterns.
- Experiment with performing multiple patterns at the same time (having 2 groups perform simultaneously), reading in retrograde (reverse order), adding dynamics (loud/soft), etc.
- Add to recording as desired (we used Sousa's "Stars and Stripes Together").
- As extension, have 2 groups facing each other. Have a student compose a pattern behind a group and the group facing him/her performs the rhythm. The group with their back to the composer writes the rhythm using traditional or "stick" notation.
- Have students work in small groups to create their own composition with cups. Notate their composition. Be able to explain mathematically concepts embedded in their composition. Then, perform for the group.

Assessment

Each activity contains an information assessment at the end of the process.

Common Core Georgia Performance Standards

MATHEMATICS

GRADE K

MCCK.CC.3: Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).

MCCK.CC.4: Understand the relationship between numbers and quantities; connect counting to cardinality.

MCCK.CC.6: Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.

MCCK.OA.1: Represent addition and subtraction with objects, fingers, mental images, drawings, sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.

MCCK.OA.2: Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.

MCCK.OA.3: Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).

MCCK.OA.5: Fluently add and subtract within 5.

MCCK.G.2: Correctly name shapes regardless of their orientations or overall size.

GRADE 1

MCC1.OA.1: Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

MCC1.OA.6: Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., $8 + 6 = 8 + 2 + 4 = 10 + 4 = 14$); decomposing a number leading to a ten (e.g., $13 - 4 = 13 - 3 - 1 = 10 - 1 = 9$); using the relationship between addition and subtraction (e.g., knowing that $8 + 4 = 12$, one knows $12 - 8 = 4$); and creating equivalent but easier or known sums (e.g., adding $6 + 7$ by creating the known equivalent $6 + 6 + 1 = 12 + 1 = 13$).

MCC1.OA.7: Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? $6 = 6$, $7 = 8 - 1$, $5 + 2 = 2 + 5$, $4 + 1 = 5 + 2$.

MCC1.G.1: Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.

GRADE 2

MCC2.OA.2: Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers.

GRADE 3

MCC3.OA.1: Interpret products of whole numbers, e.g., interpret 5×7 as the total number of objects in 5 groups of 7 objects each. For example, describe a context in which a total number of objects can be expressed as 5×7 .

MCC3.OA.2: Interpret whole-number quotients of whole numbers, e.g., interpret $56 \div 8$ as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. For example, describe a context in which a number of shares or a number of groups can be expressed as $56 \div 8$.

MCC3.OA.7: Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that $8 \times 5 = 40$, one knows $40 \div 5 = 8$) or properties of operations. By the end of Grade 3, know from memory all products of two one-digit numbers.

MCC3.NF.1: Understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.

MCC3.NF.3: Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

GRADE 4

MCC4.OA.1: Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.