

Math in Action

David Ott

Moderato ♩ = 96

The score is for a symphony orchestra and includes the following parts:

- Flute 1: *mf* (mezzo-forte)
- Flute 2: Rest
- Oboe: *mf* (mezzo-forte)
- Clarinet in B \flat 1: Rest
- Clarinet in B \flat 2: *p* (piano) then *mf* (mezzo-forte)
- Bassoon: *p* (piano) then *mf* (mezzo-forte) then *p* (piano)
- Horn in F 1: *p* (piano)
- Horn in F 2: *p* (piano)
- Trumpet in B \flat : Rest
- Trombone: Rest
- Timpani: Rest
- Mallets: Rest
- Percussion: *p* (piano)
- Harp: Rest
- Violin I: *f* (forte)
- Violin II: *mf* (mezzo-forte)
- Viola: *mf* (mezzo-forte)
- Cello: *pizz.* (pizzicato), *p* (piano), *mf* (mezzo-forte), *mf* (mezzo-forte)
- Contrabass: *p* (piano), *mf* (mezzo-forte), *mpmf* (mezzo-piano)

Math in Action

2

This musical score, titled "Math in Action" and marked with the number "2", is arranged for a large ensemble. The score is organized into systems of staves, each labeled with an instrument or instrument group. The instruments included are Flute 1 (Fl. 1), Flute 2 (Fl. 2), Oboe (Ob.), Clarinet in B-flat 1 (B♭ Cl. 1), Clarinet in B-flat 2 (B♭ Cl. 2), Bassoon (Bsn.), Horn in F 1 (Hn. 1), Horn in F 2 (Hn. 2), Trumpet in B-flat (B♭ Tpt.), Trombone (Tbn.), Timpani (Timp.), Mallets (Mal.), Percussion (Perc.), Harp (Hp.), Violin I (Vln. I), Violin II (Vln. II), Viola (Vla.), Cello (Vc.), and Double Bass (Cb.). The score begins with a rehearsal mark "7" at the top of the first staff. The music is written in a key signature of one flat (B-flat major or D minor) and a common time signature (C). The notation includes various rhythmic values such as quarter, eighth, and sixteenth notes, as well as rests and dynamic markings. The percussion part features a complex rhythmic pattern with accents and rests. The string parts provide a steady accompaniment, with the cello and double bass playing a consistent bass line.

Math in Action

Moderato ♩ = 96

The musical score is organized into three systems, each containing four staves. The first system includes a piano part with dynamics *mf* and *p*. The second system features a drum set part with a *p* dynamic. The third system includes a piano part with dynamics *mf* and *mp*. The score is marked with a tempo of Moderato and a quarter note equal to 96 beats per minute. The music is in 4/4 time and features various melodic lines and accompaniment.

Math in Action

4

The musical score is arranged in a standard orchestral format with 20 staves. The instruments and their parts are as follows:

- Fl. 1:** Melodic line with eighth and quarter notes.
- Fl. 2:** Rested.
- Ob.:** Melodic line with eighth and quarter notes.
- B♭ Cl. 1:** Rested.
- B♭ Cl. 2:** Melodic line with eighth and quarter notes.
- Bsn.:** Bass line with quarter notes.
- Hn. 1:** Rhythmic line with eighth notes.
- Hn. 2:** Rhythmic line with eighth notes.
- B♭ Tpt.:** Rested.
- Tbn.:** Rested.
- Timp.:** Rested.
- Mal.:** Rested.
- Perc.:** Rhythmic line with eighth notes and rests.
- Hp.:** Rested.
- Vln. I:** Melodic line with eighth and quarter notes.
- Vln. II:** Melodic line with eighth and quarter notes.
- Vla.:** Melodic line with eighth and quarter notes.
- Vc.:** Bass line with quarter notes.
- Cb.:** Bass line with quarter notes.

The score is in 3/4 time and begins at measure 17. The key signature has one flat (Bb).

**That was music.
That was also math.
That was math in action.
We just heard music in
a meter of 2. That means
every other beat was
emphasized. We call
that meter.**

Math in Action

Allegretto

Fl. 1 *f*

Fl. 2 *f*

Ob. *f*

B♭ Cl. 1 *mf*

B♭ Cl. 2 *mf*

Bsn. *mf*

Hn. 1

Hn. 2

B♭ Tpt.

Tbn. *mp*

Timp.

Mal.

Perc.

Hp.

Vln. I *f*

Vln. II *mf*

Vla. *mf*

Vc. *f*

Cb. *f*

That music emphasized every third beat. One 2 3.

That's called a meter of 3

Comparing meters of 2 or 3, 2 is the most natural. that's because our bodies are built in twos. Two legs, two feet. two arms, two eyes, two ears.

Let's hear it again. Can you feel that meter of 3?

Math in Action

6

Allegretto

The musical score is for a piece titled "Math in Action", page 6. It features a variety of instruments. The woodwinds (Flutes 1 & 2, Oboe, Clarinets 1 & 2, Bassoon, Horns 1 & 2, Trumpets, and Trombone) play melodic lines with dynamic markings of *f* and *mf*. The strings (Violins I & II, Viola, Cello, and Double Bass) provide harmonic support with dynamic markings of *f* and *mf*. The percussion section includes Timpani, Mallets, and Percussion, with the Timpani playing a rhythmic pattern. The Harp is present but has no notation. The score is marked *Allegretto* and includes a rehearsal mark at measure 29.

Let's try one more: the number 5. It is quite unnatural to us.

Math in Action

Allegro moderato

This page of the musical score, titled "Math in Action", page 7, covers measures 37 through 42. The tempo is marked "Allegro moderato". The score is arranged for a full orchestra and includes the following parts:

- Fl. 1:** Starts at measure 37 with a dynamic of *f*. It has a melodic line with accents and slurs.
- Fl. 2:** Remains silent throughout the measures.
- Ob.:** Starts at measure 37 with a dynamic of *f*. It has a melodic line similar to Fl. 1.
- B. Cl. 1:** Starts at measure 40 with a dynamic of *f*. It plays a rhythmic pattern of eighth notes.
- B. Cl. 2:** Starts at measure 40 with a dynamic of *f*. It plays a rhythmic pattern of eighth notes.
- Bsn.:** Starts at measure 37 with a dynamic of *f*. It plays a rhythmic pattern of eighth notes.
- Hn. 1 & 2:** Remains silent throughout the measures.
- B. Tpt.:** Remains silent throughout the measures.
- Tbn.:** Starts at measure 37 with a dynamic of *mf*. It plays a rhythmic pattern of eighth notes.
- Timp.:** Remains silent throughout the measures.
- Mal.:** Remains silent throughout the measures.
- Perc.:** Remains silent throughout the measures.
- Hp.:** Remains silent throughout the measures.
- Vln. I:** Starts at measure 37 with a dynamic of *f*. It has a melodic line with accents and slurs.
- Vln. II:** Starts at measure 37 with a dynamic of *f*. It has a melodic line with accents and slurs.
- Vla.:** Starts at measure 37 with a dynamic of *f*. It has a melodic line with accents and slurs.
- Vc.:** Starts at measure 37 with a dynamic of *f*. It has a melodic line with accents and slurs, including a "pizz." (pizzicato) instruction at measure 41.
- Cb.:** Starts at measure 37 with a dynamic of *f*. It has a melodic line with accents and slurs, including a "pizz." (pizzicato) instruction at measure 41.

The score is written in 3/4 time and features various musical notations such as dynamics (*f*, *mf*), accents, slurs, and articulation marks like "pizz.". The key signature has one flat (B-flat).

**Math is about meter.
Music is about meter.
Meter is about measurement.
Math for instance tells us how
long something is, an inch,
a foot, a mile.
Music measures beats.
Like our heartbeat, music
begins with the beat, a
continuous, steady beat.
Music begins
with the beat.**

Vamp snapping fingers.

Fl. 1

Fl. 2

Ob.

B♭ Cl. 1

B♭ Cl. 2

Bsn.

Hn. 1

Hn. 2

B♭ Tpt.

Tbn.

Timp.

Mal.

Perc.

Hp.

Vln. I

Vln. II

Vla.

Vc.

Cb.

Moderato ♩ = 96

The cellos and
basses will play
notes that
match the beats
you just heard.

44

Fl. 1

Fl. 2

Ob.

B♭ Cl. 1

B♭ Cl. 2

Bsn.

Hn. 1

Hn. 2

B♭ Tpt.

Tbn.

Timp.

Mal.

Perc.

Hp.

Vln. I

Vln. II

Vla.

Vc. *pizz.*
mp pizz.

Cb. *mp*

Math in Action

10

Every note they played was repeated. Each note was heard two times. That means the music is measured in groups of two. You heard 8 different notes each played twice. Math tells us we heard a total of 16 notes. $2 \times 8 = 16$. We use the word meter to measure music.

Now we add a tune in the violins to match the music of the cellos and basses.

The musical score is organized into systems. The first system includes Fl. 1, Fl. 2, Ob., B♭ Cl. 1, B♭ Cl. 2, and Bsn. The second system includes Hn. 1, Hn. 2, B♭ Tpt., and Tbn. The third system includes Timp. and Mal. The fourth system includes Perc. The fifth system includes Hp. The sixth system includes Vln. I, Vln. II, Vla., Vc., and Cb. The Vc. and Cb. parts include the instruction *mp pizz.* and the Vc. part includes *mp*. The number 52 is written above the first staff of each system.

60

Fl. 1

Fl. 2

Ob.

B♭ Cl. 1

B♭ Cl. 2

Bsn.

Hn. 1

Hn. 2

B♭ Tpt.

Tbn.

Timp.

Mal.

Perc.

Hp.

Vln. I
mf

Vln. II

Vla.

Vc.
mp
pizz.

Cb.

That little tune when combined with the music played by the cellos and basses felt natural to us. Two is so basic to our bodies. When we walk we put our bodies in motion. We combine beat and meter. Every step we take represents the BEAT, as long as it's steady. When we count only the left leg as we walk, we have METER. L R L R 1 2 1 2. Beat and meter create rhythm. Rhythm is about systematic arrangement. To do something over and over without change. The earth revolves around the sun every 24 hours over and over creating one day. The moon is full every 28 nights. We get hungry every 5 or 6 hours. Some of us, nore like 2 or 3 hours That's rhythm. A few moments ago, we heard music in a meter of 3. We'll hear it again, but something has been changed. See if you can tell what's different.

Math in Action

12

Allegro $\text{♩} = 80$

The musical score is arranged in systems. The first system includes Fl. 1, Fl. 2, Ob., B♭ Cl. 1, B♭ Cl. 2, and Bsn., all marked *f*. The second system includes Hn. 1, Hn. 2, B♭ Tpt., and Tbn., all marked *f*. The third system includes Timp., Mal., and Perc., all marked *f*. The fourth system includes Hp. The fifth system includes Vln. I (marked *mf*), Vln. II (marked *p*), Vla. (marked *p*), Vc. (marked *mp*), and Cb. (marked *mp*). The score is in 3/4 time and begins at measure 68.

Obviously, that was a lot faster than the first time we heard it. That brings us to tempo. Tempo is the speed of the beat. Slow, fast, or anything in between. Faster music is likely to be more energetic. Just like our heartbeats faster when we run, or if we are frightened. A slower tempo is more peaceful, just like our heartbeat slows, when we are at rest. In review, rhythm has three separate parts that work together, The music we just heard was fast. In music Allegro is the word that means FAST. The next piece is SLOW.. It is marked ADAGIO.

Math in Action

Adagio

Fl. 1 *mp*

Fl. 2 *mp*

Ob. *mp*

Bs. Cl. 1 *p*

Bs. Cl. 2 *p*

Bsn. *p*

Hn. 1 *p*

Hn. 2 *p*

B^b Tpt. *p*

Tbn. *p*

Timp.

Mal.

Perc.

Hp.

Vln. I

Vln. II

Vla.

Vc.

Cb.

Math in Action

14

Molto allegro

Now we increase the tempo to Molto allegro. Listen for the increased energy created.

Fl. 1 *f*

Fl. 2 *f*

Ob. *f*

B♭ Cl. 1 *f*

B♭ Cl. 2 *f*

Bsn. *f*

Hn. 1 *ff*

Hn. 2 *ff*

B♭ Tpt. *f*

Tbn. *f*

Timp. *f*

Mal.

Perc.

Hp.

Vln. I *f*

Vln. II *f*

Vla. *f*

Vc. *f*

Cb. *f*

arco

pizz.

Rhythm is the basis of all music. Let's hear how rhythm makes the story of Pinocchio come alive!

Musical score for measures 85-90. The score includes parts for Flute 1 & 2, Oboe, Bass Clarinet 1 & 2, Bassoon, Horns 1 & 2, Trumpet, Trombone, Timpani, Mallets, Percussion, Harp, Violin I & II, Viola, Violoncello, and Contrabass. The key signature is B-flat major. Dynamics include *mp*, *pp*, *ff*, *pizz.*, and *arco*. The score shows a rhythmic pattern of eighth and sixteenth notes across the woodwinds and strings, with dynamic markings indicating changes in volume.