



PRIMARY CLASSROOM LESSON PLAN

Math and Music

Inspired by

Short Ride In A Fast Machine by John Adams

Written by Patrick Bailey

For:

- Key Stage 2 in England and Wales
- Second Lever, P5-P7 in Scotland
- Key Stage 1/Key Stage 2 in Northern Ireland

Learning outcomes:

Learners will create a minimalist class composition using mathematical elements:

- factors
- prime number sequence
- number bonds
- number patterns

Learners will also:

- listen to and reflect on a work for orchestra
- perform as an ensemble

Curriculum checklist:

Mathematics

- represent and use number bonds and related subtraction facts
- identify multiples and factors

- know and use the vocabulary of prime numbers, prime factors and composite (nonprime) numbers
- identify common factors, common multiples and prime numbers

Music

- play and perform in solo and ensemble contexts
- listen with attention to detail and recall sounds with increasing aural memory

This is a write up of a workshop given for teachers with musicians from the BBC Philharmonic as part of BBC Ten Pieces. The following notes could make a series of 2 or 3 lessons or you could pull out ideas to make one lesson.

Lesson 1

Introduce the music to the class. [Watch the performance on the BBC Ten Pieces website](#). Ask the class to think about how the machine looks:

- what colour is it?
- is it on wheels, on water or in the air?
- where are they going in it?
- how do they feel – scared? excited?
- they could design and draw their own Fast Machine

Factors/multiples

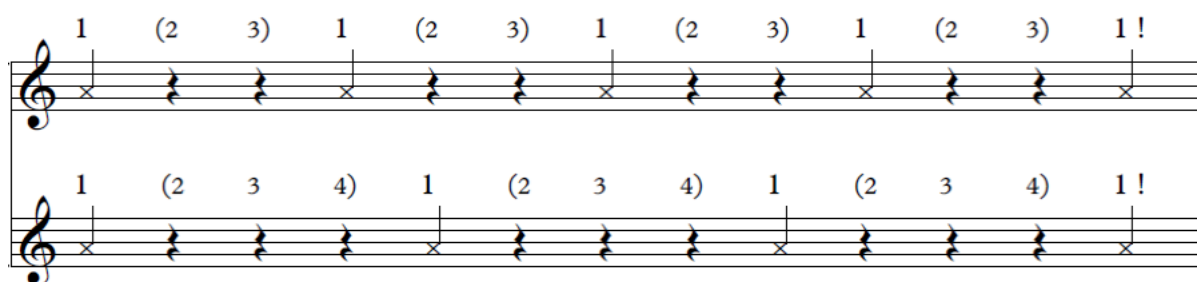
The first task is for the whole class. You could do this with everyone clapping or pupils could have instruments - either one they are learning or an instrument from the school's supply. Do use pitched instruments (xylophones, glockenspiels, chime bars, keyboards, relevant apps) as well as unpitched percussion (drums, shakers, tambourines). If you are using pitched instruments, stick to the pitches D, E, A (which is where John Adams starts).

Take the number 12. Ask the class what the factors of 12 are - 2, 3, 4, 6 (and 1 and 12).

Ask one reliable learner to set a steady pulse on a woodblock or drum (if you like, you can search for an online metronome and find out what '100' sounds like – this is a good tempo for this exercise).

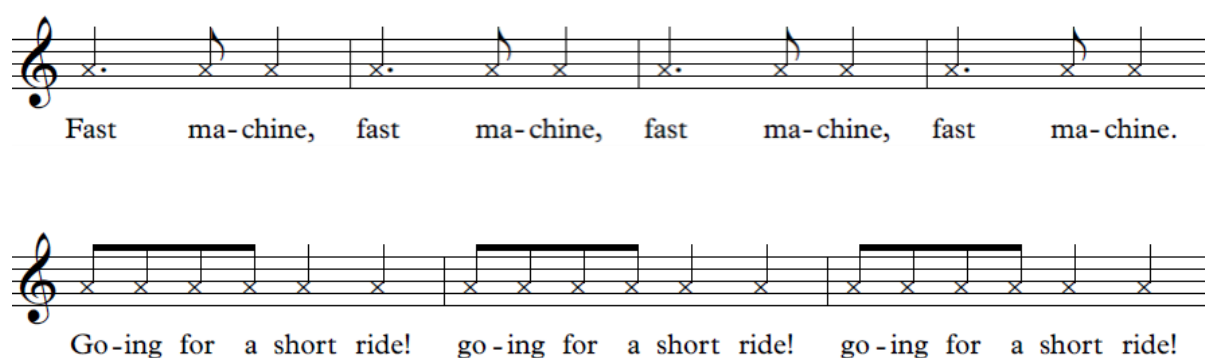
- get the class to count in cycles of three beats (you can explain time signatures if you like – 3/4)
- while counting out loud, get everyone to clap on 'one'
- now ask them to continue counting in their heads but not out loud - keep the claps on 'one'
- now repeat these steps but thinking in cycles of four beats (4/4)
- now, divided the class into two...starting at the same time, one half do the exercise in 3 and the other, the exercise in 4. Before you do it, can they predict what might happen by using their understanding of the factors of 12?

If you notated it, this is what a complete cycle of the pattern would look like:



You could ask the class: if we played the complete pattern 4 times, how many beats would it last? ($4 \times 12 = 48$). So the final 'one' where everyone plays together is on the 49th beat (as it is the start of the next cycle). Practice playing this four times through, ending confidently on the final 'one!'. You may need one more, reliable, volunteer to help count this and signal the end.

EXTENSION: To make the music's texture a bit richer, you could expand from playing on the 1st beat of 3 or the 1st beat of 4 and invent a little repeated rhythm that lasts 3 or 4 beats. It might look like this (remember that you can add pitches – D, E & A):



Create a sequence using prime numbers

In the first section of Short Ride, you can hear some swirly figures played by flutes and metal percussion instruments. They get closer together each time they are played and help the music build to an endpoint. We are going to re-create this using a sequence of prime numbers (you could use any sequence you like – squares, cubes, Fibonacci sequence etc). The trick is to reverse the sequence so the numbers get smaller. Here are the primes:

11 7 5 3 2 (1!)

Select some students to play this sequence – you only need four or five

Get them to use glocks, xylophones, the high notes of a keyboard (or if you have a budding flautist or recorder player, they could join in)

Practice counting this cycle out loud to the same speed/tempo as used previously:

1 2 3 4 5 6 7 8 9 10 11, 1 2 3 4 5 6 7, 1 2 etc

Then, on each 'one' play a quick, downward swipe or glissando. The pitches don't matter – just start from a high point!

Swipe! (2 3 4 5 6 7 8 9 10 11) Swipe! (2 3 4 5 6 7) Swipe! (2 3 4 5) etc

If you add these primes together what do you get? (28)

So, if you want to get the cycle of 12 beats and this prime number sequence to end together on 'one!' where should the prime number sequence start? This is quite a complex piece of calculation but worth pursuing. It may need a little trial and error but that is all part of the art of composing! [TIP: If the prime number team count 20 beats after the 12s start, it should work]

Make sure you all write down what you have done – what instrument you are playing, what numbers you are counting, how many repeats you have to make.

Lesson 2

You might want to start by revising the previous lesson. That little bit of music you have created will act as the introduction to our big piece.

Music from Number Bonds

Let's take the number 8. Ask the class: what are the number bonds? **1+7; 6+2, 5+3, 4+4 etc**

Can we also add number bonds with 3 numbers? **3+3+2, 1+3+4 etc**

Divide the class into four groups or five groups. You can put like-minded instruments together or mix each group up. It can work both ways.

Each group needs to choose one of the number bonds. It is a good idea to have a couple of 2 digit number bonds and 3 digit ones. Imagine we have **6+2, 3+5, 3+2+3, 1+3+4**.

Keeping the same tempo as before, each group needs to count their 8 beat cycle, clapping on the 'one' of their respective number bonds e.g. **1 2 3 1 2 3 4 5**

You can add pitches in here. Use more notes for this section: **C D E F# G A** (or F if there are no F#s)

When each group has practiced theirs, put them all together playing at the same time (with your time-beating woodblock player if needed)

EXTENSION: like the previous lesson, you can fill up the silent beats with more notes or with a rhythm. It might look like this:

The image shows two staves of musical notation. The first staff has a treble clef and a key signature of one sharp (F#). It contains eight quarter notes with stems pointing down, corresponding to the numbers 1 through 5 in the sequence below. The second staff also has a treble clef and a key signature of one sharp. It contains a sequence of notes: a quarter note (1), a dotted quarter note (2), an eighth note (3), a quarter note (4), a quarter note (5), a quarter note (6), a quarter note (7), a quarter note (8), and a quarter note (9). The lyrics 'Num - ber bonds drive my fast ma - chine a - long!' are written below the notes, with hyphens indicating syllables across multiple notes.

You can now work out an order for each group to enter and how many times in total everyone plays.

See if you can go back to your 'introduction' piece from the previous lesson and then add this new section on (you can link the two sections with the woodblock playing a few beats on its own).

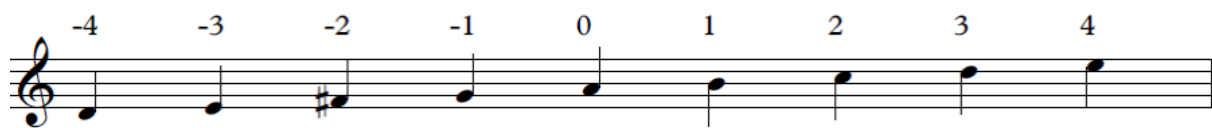
This may be enough for this lesson so you can end it here. Again, make sure everyone has written down what they are doing.

Lesson 3

Number patterns and melody

This next idea is not used by John Adams but by another composer who, like Adams, is sometimes called a 'minimalist' composer – Arvo Pärt (pronounced as in pear). You can add it to the previous section from Lesson 2 or it can be done instead of that section.

We are going to use a sequence of notes with 0 at the centre and positive and negative numbers either side:



Ask the learners to invent an elegant sequence of numbers. They could mirror each other with 0 as the axis like this:

0 1 0 -1 0 2 1 0 -2 -1 0 ...can you complete this?

Or, you could start a sequence off and see whether they can complete it.

If another way of doing this presents itself, take it. There are many ways of using this series of numbers. You can make it as short or as long as you like as time permits.

My sequence above, 0 1 0 -1 0 2 1 0 -2 -1 0, looks like this when the notes are used:



To play this melody, take one, confident, player who plays a pitched instrument from each group or convert one of your groups to a 'melody' group. They can experiment with the rhythm of the notes – it does not need to be complicated. One note every two beats will sound great. Get them to practice it.

Now you are ready to put your piece together

You should have 4 distinct sections for your piece, which can be performed consecutively to create a big, mathematical masterpiece!

Section 1:	factors of 12 sequence
Section 2:	prime number sequence
Section 3:	number bond sequence
Section 4:	number pattern melody

Think creatively about the ending – one last loud note of joy as the fast machine arrives? Fading out as the fast machine drives off into the distance? What do the group want to do?

Give it a title and perform your piece to the school.

Further exploration

[BBC Ten Pieces Short Ride in a Fast Machine by John Adams](#) - Further lesson plans and other resources