# Intervals

If you look at a piano keyboard, you will see the notes each have different keys on the keyboard. The notes all have different pitches (or frequencies if you are also a scientist), changing gradually from the lowest note, at the left-hand end of the keyboard, up to the highest note at the right-hand end.

The difference in pitch between each note and its nearest neighbour (whether it's a black or white key) is called a **semitone**. For the sake of the piano, and most of our work with other instruments, the semitone is the smallest difference or **interval** we will be dealing with.

A difference of two adjacent key steps (whether we're counting black or white keys) is called a **tone**.

If you look at the fingerboard of a guitar, the difference between the note from any string, held on any fret, and that same string on the immediate next fret is a semitone. In the same way, a two-fret difference using the same string is a tone.

# Scales

Almost all Western music written before 1900 didn't use all of the keys on the keyboard – or all of the notes of other instruments, but a selection of them, organised into different scales.

A scale is a series or progression of notes that repeats itself every **octave**.

For the physicists among us, an octave difference happens every time we double or halve the frequency or pitch of the sound. For example, in "concert pitch" tuning, the A above middle C is tuned to 440Hz. So the A one octave below is 220Hz, and the A one octave above is at 880Hz, and so on.

The octave gets its name from the eight notes that are in any **major** or **minor** scale. However, it we look at our piano keyboard or guitar fretboard, we see that there are actually twelve semitone intervals to choose from in any octave – hence we say that we don't use all of them – but which ones we use depends on the **key** in which we are playing or composing. I'll explain more about keys later.

For today, we are going to concentrate on major scales. We'll visit minor scales and others in a later session. Let's learn to walk before we try to run!

Every scale is made-up of a repeating set of intervals, in much the same way a school timetable is made-up of a repeating set of subjects. No scale uses every key on the keyboard (or fret on the fretboard) in the same way no GCSE student studies every subject on the options list.

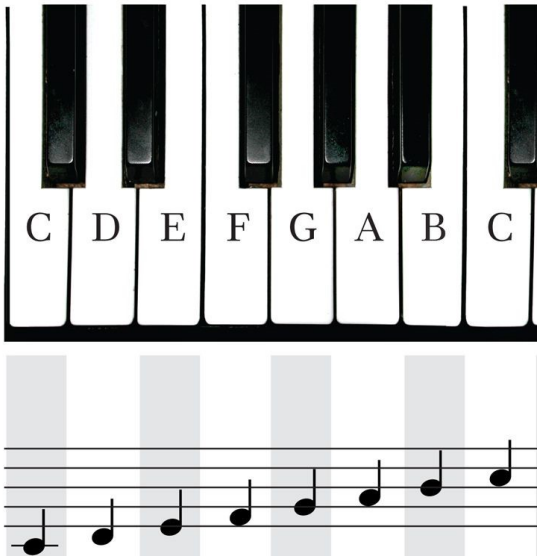
For any major scale, the intervals follow the same pattern:

**Tone – tone – semitone – tone – tone – tone – semitone**

## How does this work?

Let's look at the easiest major scale to get our heads around – the scale of C major. That's the major scale that uses only the white keys on the piano.

Take a look at the diagram below (the notation is in the treble clef):




Check those intervals – remember we need to count every key – the black ones are just as important as the white ones. For a semitone, we need to play the immediate next key; for a whole tone, we need to go up the keyboard counting "miss one, play one".

We start on **C** – the **root note** or **tonic** note of our scale.

Now we want an interval of a whole **tone**, so we ignore that black key above the C.

That takes us to **D** as the second note of our scale.

Now we want another whole **tone** interval, so we ignore that black key above the D.

This takes us to **E**.

Now we want a **semitone** interval. Since the very next key from E is F …

This takes us to **F**.

Now we want another whole **tone** interval, so we ignore that black key above the F.

This takes us to **G**.

… and we want another whole **tone**, so again, ignore that black key …

Taking us to **A**

… and a third whole **tone** …

We get to **B**

… and that final **semitone** …

Takes us to the next **C**, one octave above the middle C we started on.

… and you'll see we've only used seven out of the twelve keys along the way.

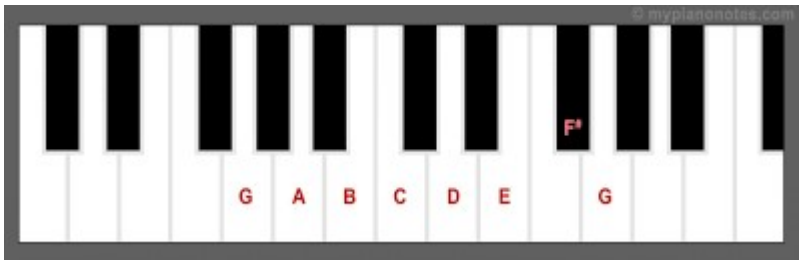
# Keys

We've just looked at the scale of C major. But we can start a scale on any key on the piano, so long as we still follow the same rules; the same pattern of whole tone and semitone intervals as we go up our scale.

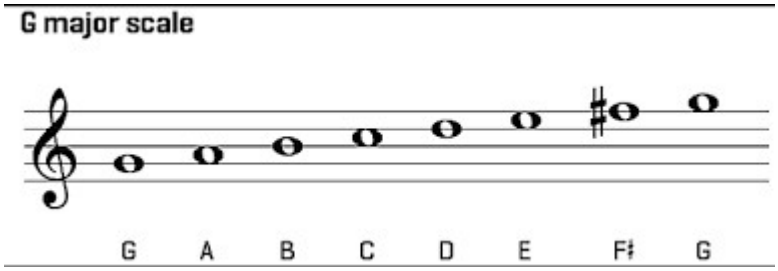
Here's the scale of G major – so, a major scale:

**tone – tone – semitone – tone – tone – tone – semitone**

but this time starting on G. As you can see, the white keys still work out OK until we get to that final tone, where we need to use the black key above the F to get our last two intervals right. This note is a semitone above F but it's not yet G. We call this note **F sharp**. It's written as **F♯** - here's the scale of G major on a keyboard:




… and here's how it's written on the stave, starting from the G above Middle C:



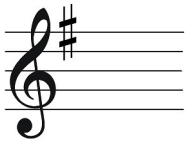

So, if we're writing a piece in G major, then we need to make sure every F is actually an F sharp. Not so difficult when we get used to the idea.

## *Key signatures*

As we just saw, when we're writing music in G major, we no longer use the note F, we replace it with **F♯**. That's all well and good, but then we have to remember to keep writing the sharp symbol, ♯ every time we put an F in the work. We need some way of showing which key we're working in, so we don't need to keep writing in those sharp signs every time we need one.

To do this, we put a key signature at the start of each line of the stave, telling the performer(s) that they are to read the score as G major, and play an F sharp every time they read an F on the stave.

Here's what it looks like:



We can use key signatures for any key we choose to write in. Here's the scale of D major and its key signature on the stave: