Name_____ Date_____

Stepping Through the Mathematical Modelling Process

Display **Slide 2**. Lead a whole-class discussion regarding questions students have about how ranked lists are created. Students might discuss collecting survey results, listening to experts, looking at previous ranked lists, etc.). Record all ideas. To remove bias, students might suggest ways to gather data, or recommend making decisions based on specific criteria.

Display **Slide 3**. Have students work in pairs or small groups throughout the activity. Ensure students are not deciding on artists or groups they personally enjoy, as their role is to eliminate bias. Listen for students who are making important decisions about which data would be most helpful, and which data would be difficult to collect or of less importance.

Display **Slide 4**. As a class, make a list of possible criteria students suggest (for example: most songs on the radio, richest artists, most awards, longest careers, how many YouTube views, etc.). Discuss which of these criteria would be easiest to collect data on.

Have students compare the two representations shown on **Slide 5**. Discuss the criteria that is being used to determine an "artist score."

Display **Slide 6**. Have students use the data on Master 10 a-c: Artist Data Charts to make decisions about which 10 artists they will choose and how well they believe their chosen artists will score. Listen for how students are making informed decisions about which artists to choose/not choose.

As a class, have groups share their top 3 artists, then discuss the results shown on **Slide 7**. The scores for all artists are shown on Master 13 a-c: Artist Scores. Students might notice some patterns in the results (i.e., artists before the digital era are more likely to score high since "units sold" could result in a greater number of points; the number of #1 singles mattered most for some artists since it had a × 10 multiplier in the code). Discuss the assumptions made so far (e.g., which category is more important than another in determining "best artist", which categories yield the greatest values) as well as any potential biases made in creating the model (e.g., does this model favour specific genres or time periods?).

Display **Slide 8**. In their groups, have students make decisions about which criteria they believe would be the most important and decide which multiplier to include for each one. Students may include as many or as few criteria as they see fit. They may decide to include the Spotify data.

Name_____ Date_____

Stepping Through the Mathematical Modelling Process (cont'd)

You may want to distribute digital copies of the Excel Spreadsheet, Master 11: Artist Data so students can insert their own algebraic formulas, then use the sort feature to create their top 10 lists. Encourage students to try several different codes/algebraic formulas to create what they believe is the least biased top-10 list.

This is a key moment to assess students' understanding of the variables at play with this context. Listen for students who are making informed decisions about which criteria should be worth the most. Encourage students to analyze their results to help them determine whether any changes should be made to their formulas to limit any possible biases.

Bring students back together to share some of the justifications for their mathematical models (i.e., their formulas), as well as their results.

Teachable Moment

The mathematical modelling process is useful when attempting to make important decisions. In this lesson, we aimed to reduce bias by using data to carefully develop a mathematical model. Students were asked to try to reduce bias, but likely believed the model was successful if the results were what **they thought were acceptable** and rejected outcomes **they** did not see as valid. Mathematics used in the real world often includes biases of those who employ the mathematics.

The original formula used to develop the mathematical model valued certain criteria more than others. Students who included total Spotify streams should have noticed that the values were already quite high compared to the values of the other criteria. Multiplying by a value between 0 and 1 can have the same result as dividing by a number greater than 1.