
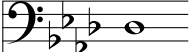




# Homework 1





Math 109 / Music 109A, Fall 2022

Due Monday, September 19.

1. Identify these notes by letter and subscript (e.g.,  $F_4$  or  $C_2^\sharp$ ):

(a)  (b)  (c)  (d) 

2. Identify these intervals, as upward intervals, by name (e.g., major third) and by measurement in semitones:

(a)  (b)  (c)  (d) 

3. For the following pairs of integers  $m, n$ , find the numbers  $q$  and  $r$  whose existence is asserted in the Division Algorithm (p. 2 of the text):

(a)  $12, 41$  ;

(b)  $9, -28$  ;

(c)  $3, 3^{19} + 7$  ;

(d)  $5, 30k + 7$ , where  $k$  is some integer.

4. For each of the following sets and relations determine whether or not an equivalence relation has been defined. Explain why or why not. If so, describe the set of equivalence classes.

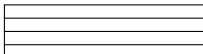
(a) The set of people having a single residence in the United States; “lives in the same state as”.

(b)  $\mathbb{R}; \geq$ .

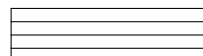
(c) The set of keyboard note classes;  $\sim$  defined by  $N \sim N'$  if and only if the modular interval between  $N$  and  $N'$  is either the unison interval or a tritone (up or down).

5. For the set  $\mathbb{Z}$  and a fixed positive integer  $n$ , show that the relation  $\equiv$  defined by  $k \equiv \ell$  if and only if  $n \mid (k - \ell)$  is an equivalence relation.
6. Choosing an appropriate clef, write on the staff, and name with subscript, the note which is:

(a) a major third above  $B_2$ . 

(b) a fourth above  $G_3^\sharp$ . 

(c) a major ninth below  $D_6^\sharp$ . 

(d) a tritone below  $A_4^b$ . 

7. For each of the two sequences of notes below, give the scale tone of each note, labelling it by “hatted” number (e.g.,  $\hat{2}$ ). NOTE: The first passage is in the major mode; the second is in the minor mode.



8. For the following modes and tonic notes, indicate the appropriate key signature on staff paper:

