

# EXAM I

Math 109 / Music 109A, Spring 2009

Name \_\_\_\_\_ Id \_\_\_\_\_

Each problem is worth 10 points.

1. Aural: Notate the rhythm (one measure each).

(a)  $\left| \frac{4}{4} \right|$  (b)  $\left| \frac{12}{8} \right|$

Circle the triad type.

(c) major  
minor  
diminished

(d) minor  
minor  
diminished

2. Sketch the graphs of these functions by starting with a more basic function and applying one or more geometric transformations (shifts or stretches). Use the space on page 4 if you need it.

(a)  $f(x) = \frac{1}{2}x^2$

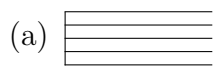
(b)  $g(x) = -1 + \sin 2x$

3. For the following pairs of integers  $m, n$ , find the numbers  $q$  and  $r$  whose existence is asserted in the division algorithm ( $n = qm + r$ ):

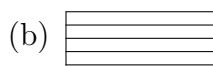
(a)  $11, -101$  ;

(b)  $5, 3035\ell + 9$ , where  $\ell$  some integer.

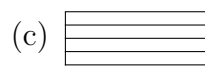
4. Write the indicated note as a whole note on the given staff, choosing and notating an appropriate clef.



$G_2$



$C_5^\sharp$



$B_3^b$

5. For the set  $\{(a, b) \in \mathbb{Z}^2 \mid b \neq 0\}$  show that the relation  $\sim$  defined by  $(a, b) \sim (a', b')$  if and only if  $ab' - a'b = 0$  is an equivalence relation. Explain how the set of equivalence classes are in one-to-one correspondence with the set of rational numbers  $\mathbb{Q}$ .

OR

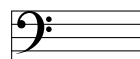
For the set  $\mathbb{Z}$  and a fixed positive integer  $m$ , show that the relation  $\equiv$  defined by  $k \equiv \ell$  if and only if  $m \mid (k - \ell)$  is an equivalence relation. Explain why there are exactly  $m$  equivalence classes.

6. For the following modes and tonic notes, indicate the appropriate key signature on the given staff, taking note of the clef:

(a) Lydian with tonic D



(c) Aeolian with tonic B<sup>b</sup>



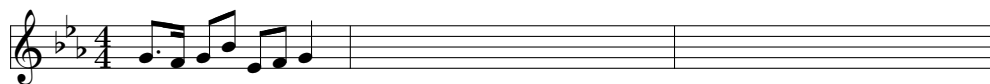
7. Add the needed sharps or flats to notes so that the following gives the Locrian scale tones  $\hat{1}$  to  $\hat{8}$ , from D to D. (Do not alter D.)



8. Extend the following melody with two measures having the same rhythm, employing the following transformations. Do not write in a key change.

(a) diatonic up one scale tone in the second measure

(b) chromatic up a major third (from the original) in the third measure



9. Give the total duration in beats of:

(a) a doubly-dotted half note in  $\frac{4}{4}$  time.

(b) a half note in  $\frac{9}{8}$  time (compound time signature).

(c) a sixteenth note 9-tuplet in  $\frac{4}{4}$  time.

10. For the song *Mary Had A Little Lamb*, give the form (e.g., AABC) by dividing it into segments consisting of two bars. Locate and identify a translation other than that which comes from the overall form.

The image shows two lines of musical notation for the song "Mary Had A Little Lamb". Both lines are in G major (one sharp) and 3/4 time. The first line contains the lyrics "Ma- ry had a lit- tle lamb, lit- tle lamb, lit- tle lamb," and the second line contains "Ma- ry had a lit- tle lamb, his fleece was white as snow." The melody consists of quarter notes and half notes.

Ma- ry had a lit- tle lamb, lit- tle lamb, lit- tle lamb,

Ma- ry had a lit- tle lamb, his fleece was white as snow.