

EXAM I

Math 109 / Music 109A, Spring 2018

Name _____ Id _____

Each problem is worth 10 points.

1. 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) $f(x) = -x^2 + 2$

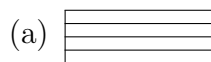
(b) $g(x) = -1 + \cos \frac{x}{4}$

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

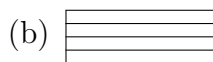
(a) $7, -22$;

(b) $3, 102\ell + 4$, where ℓ some integer.

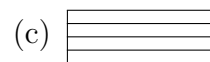
3. Write the indicated note as a whole note, choosing and notating an appropriate clef.



F₄



A₅[♯]



E₂^b

4. For the set $\{(a, b) \in \mathbb{Z}^2 \mid b \neq 0\}$ show that the relation \sim defined by $(a, b) \sim (a', b')$ iff $ab' - a'b = 0$ 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 $k \equiv \ell$ iff $m \mid (k - \ell)$ is an equivalence relation. Explain why there are exactly m equivalence classes.

5. Add the needed sharps or flats to notes so that the following gives the Lydian scale tones $\hat{1}$ to $\hat{8}$, from D to D. (Do not alter D; do not write in a key signature.)

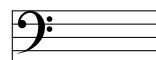


6. For the following modes and tonic notes, indicate the appropriate key signature on the given staff, taking note of the clef:

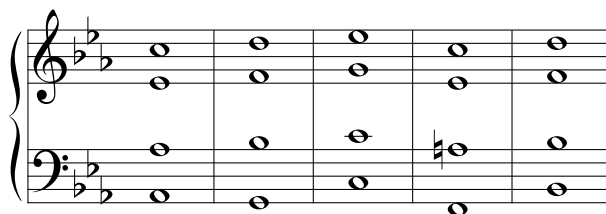
(a) Phrygian with tonic D



(c) Aeolian with tonic G \sharp



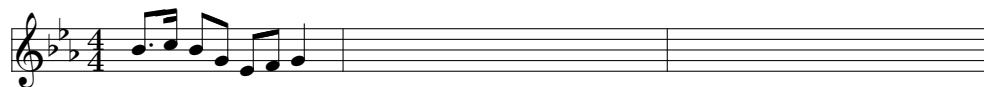
7. Identify each chord in this major mode (Ionian) passage. Above the staff label each chord by root note class with suffix (e.g., B \flat 7). Below the staff, label each chord by root scale tone (e.g. \flat III \flat 7).



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 two scale tones 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 quarter note in $\frac{3}{2}$ time.

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

(c) a quarter note quintuplet 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 the first two lines of musical notation for the song "Mary Had A Little Lamb". Both staves 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,". The second line contains the lyrics: "Ma- ry had a lit- tle lamb, his fleece was white as snow." The melody consists of quarter notes and half notes.