(1) Add the needed sharps or flats to notes so that the following gives the Dorian scale tones 1 to 8, from F to F.

![Music notation](https://example.com/music_notation.png)

(2) Complete each excerpt with a measure that repeats the rhythm of the first measure, employing:

- **(a) diatonic transposition down one scale tone.**

  ![Music notation](https://example.com/music_notation.png)

- **(b) chromatic transposition up a minor third.**

  ![Music notation](https://example.com/music_notation.png)

(3) Give the (total) duration in beats of:

- **(a) a dotted eighth note in 2/4 time.**

  ![Music notation](https://example.com/music_notation.png)

- **(b) a sixteenth note 9-tuplet in 4/4 time.**

  ![Music notation](https://example.com/music_notation.png)
(4) Given that $A_4$ is tuned to 440 Hz, give the frequencies of these pitches:

(a) the pitch which is 35 cents sharp of $F_4$

(b) the pitch which is a comma of Pythagoras above middle C

(5) Use properties of logarithms to express in terms of logarithms of prime numbers:

$$\log_b \left[ \left( \frac{\sqrt[3]{13}}{18} \right) \right] =$$

(6) Express each of these intervals two ways: as real number ratios using integers or quotients of integers with possible radicals, and in cents, rounding off the latter at 2 digits to the right of the decimal.

(a) the septimal minor seventh

(b) the keyboard whole step

(7) Label each chord by letter with suffix above, and by Roman numeral with suffix below. Assume the major (Ionian) mode.

(a) ![Chord A](image)
(b) ![Chord B](image)
(c) ![Chord C](image)

(8) Suppose a musical tone is sounding $E_4^b$, and suppose its second harmonic has amplitude 3 and phase shift $\pi/4$. Express the second harmonic in the form $g(t) = A\sin(ct) + B\cos(ct)$, for explicit numbers $A, B,$ and $c$. 
(9) On the staff below indicate the keyboard’s best approximation of harmonics 2 through 11 of the given note.

(10) For each scale tone $\hat{\text{1}}$ to $\hat{\text{8}}$, write the fraction that expresses the ratio of that scale tone to $\hat{\text{1}}$ in the just intonation diatonic scale.

$\hat{\text{1}}$
$\hat{\text{2}}$
$\hat{\text{3}}$
$\hat{\text{4}}$
$\hat{\text{5}}$
$\hat{\text{6}}$
$\hat{\text{7}}$
$\hat{\text{8}}$

(11) Create the 5-tone row chart for the original row: $[0] [2] [4] [3] [1]$, expressing each entry as an element of $\mathbb{Z}_5$ in the form $[r]$, where $0 \leq r < 5$. 

\[ \begin{array}{ccc} \\
\end{array} \]
Suppose the function $y = f(t)$ is the periodic function of period $P$ corresponding to a musical tone, and suppose the graph of $y = f(t)$ is:

For each of the functions below, sketch its graph AND explain how its associated tone compares that of $f(t)$.

(a) $y = \frac{1}{2} f(t)$

(b) $y = f(2t)$

(c) $y = f(t) + c$

(d) $y = f(t - c)$