MAT 120 **Practice Questions** Fall 2020

1. Suppose a signal has amplitude $A_1 = 2$ and then this is changed to a new amplitude $A_2 = 0.25$. What is the decibel level of the amplitude ratio A_2/A_1?

   a) -18 b) -30 c) $-6\sqrt{2}$ d) -12 e) $-8\sqrt{2}$

2. A signal has amplitude A_1, which is multiplied by some number x to give the new value A_2, and if A_2 is multiplied by x, then the value of the amplitude is now $8A_1$. What is the decibel level of the multiplier x?

   a) 18 b) 30 c) 9 d) 6 e) $2\sqrt{2}$

3. If x is the frequency ratio for an equal-tempered tritone, then what amplitude ratio in decibels is represented by x?

   a) 8 b) 1.5 c) 3 d) 6 e) $2\sqrt{2}$

4. Suppose a harmonic tone has amplitude A, and fundamental frequency F, and that both A and F are increased by a factor x. If the new tone is an equal-tempered major third above the old tone, what is the decibel level increase represented by x?

   a) 4 b) 3 c) 5 d) 2 e) 6

5. A note has fundamental frequency F and amplitude A. Both quantities are multiplied by $\frac{9}{4}$. The resulting note has both a cent value increase and a decibel increase. What is the cent value increase, to the nearest 100?

   a) 1600 b) 1200 c) 1300 d) 1500 e) 1400

6. A note has fundamental frequency F and amplitude A. Both quantities are multiplied by $\frac{9}{4}$. The resulting note has both a cent value increase and a decibel increase. What is the decibel value increase, to the nearest decibel?

   a) 6 b) 10 c) 9 d) 8 e) 7

7. Here is a partial list of the permutations of the symbols a,b,c: abc, acb, bac, bca. How many permuations are missing from this list?

   a) 4 b) 2 c) 0 d) 1 e) 3

8. Here is a partial list of the subsets of size two of the set of symbols $\{a, b, c\}$: $\{a, b\}$, $\{a, c\}$, $\{b, c\}$. How many subsets are missing from this list?

   a) 4 b) 2 c) 0 d) 1 e) 3

9. Here is a partial list of the permutations of length two taken from the symbols a,b,c,d: ab, ac, ad, bc, bd, cd. How many permuations are missing from this list?

   a) 6 b) 2 c) 0 d) 3 e) 4

10. Here is a partial list of the subsets of size two of the set of symbols $\{a, b, c, d\}$: $\{a, b\}$, $\{a, c\}$, $\{b, c\}$. How many subsets are missing from this list?

    a) 4 b) 2 c) 0 d) 1 e) 3

11. Rewrite $\sin\frac{\pi}{3}\cos\frac{\pi}{4}$ as a sum of two sine functions.

a) $\frac{1}{2}\sin\frac{\pi}{3}+\frac{1}{2}\sin\frac{\pi}{2}$ b) $\frac{1}{2}\sin\frac{\pi}{2}+\frac{1}{2}\sin\frac{\pi}{3}$ c) $\frac{1}{2}\sin\frac{\pi}{6}+\frac{1}{2}\sin\frac{\pi}{4}$ d) $\frac{1}{2}\sin\frac{7\pi}{12}+\frac{1}{2}\sin\frac{\pi}{12}$ e) $\frac{1}{2}\sin\frac{\pi}{12}+\frac{1}{2}\sin\frac{11\pi}{12}$

12. Approximately how many beats per second would be generated by playing a note which is three just major thirds above $A220$ and another note which is a perfect octave above $A220$, if we are just listening to the fundamental frequencies?

a) 10 b) 20 c) 25 d) 5 e) 15

13. If a tone is generated by the function $\sin(1000\cdot 2\pi t)$ and the envelope is generated by the function $\sin 3\pi t$, then we should hear amplitude oscillations at how many beats per second? (Hint: first sketch the graph and label the period, then see how many beats will occur per second by taking into account the positive and negative oscillations of the higher frequency graph.)

a) 2.5 b) 3 c) 1 d) 1.5 e) 2

14. If a tone is generated by the function:

$$\sin(80\cdot 2\pi t)+\sin(160\cdot 2\pi t)+\sin(240\cdot 2\pi t)+\sin(320\cdot 2\pi t)+\cdots$$

and another tone is generated by the function:

$$\sin(100\cdot 2\pi t)+\sin(200\cdot 2\pi t)+\sin(300\cdot 2\pi t)+\sin(400\cdot 2\pi t)+\cdots$$

then you would hear which interval?

a) minor third b) perfect fourth c) perfect fifth d) major third e) major second

15. If you increase the amplitude of a signal four times, each time by the same factor R, and the final signal is twice as loud as the original, then what dB is represented by the amplitude ratio R?

a) 2 b) 3 c) 2.5 d) 3.5 e) 1.5

16. A note has frequency F and amplitude A. Both quantities are multiplied by $\sqrt[6]{2}$. The resulting note has both a cent value increase and a decibel increase. Choose the correct pair (cents, decibels):

a) $(300, 2)$ b) $(100, 2)$ c) $(500, 3)$ d) $(200, 2)$ e) $(200, 1)$

17. Here is a partial list of the permutations of the symbols a,b,c,d: *abcd*, *abdc*, *acbd*, *acdb*, *adbc*, *adcb*. How many permutations are missing from this list?

a) 12 b) 20 c) 18 d) 10 e) 15

18. An interval of two *commas* (of any type) is slightly flat to an equal-tempered:

a) tri-tone b) minor third c) whole tone d) quarter-tone e) semitone

19. In the Bach-Lehman temperament, how many of the perfect fifths are equal-tempered?

a) 3 b) 5 c) 4 d) 6 e) 2

20. In the Bach-Lehman temperament, how many of the perfect fifths are slightly flat to equal-tempered?

a) 3 b) 5 c) 4 d) 6 e) 2