

## MAT 120

## Quiz 5

Fall 2022

1. Which of the following are true identities?

i)  $\sin(-x) = \sin(x)$       ii)  $\cos(-x) = \cos(x)$       iii)  $\sin(-x) = -\cos(x)$

- a) i) only      b) iii) only      c) ii) only      d) i) and ii) only      e) ii) and iii) only

Correct Answer: ii) only

2. Which of the following are true identities?

i)  $\sin(x - \frac{\pi}{2}) = \cos(x)$       ii)  $\cos(x - \frac{\pi}{2}) = \sin(x)$       iii)  $\sin(x - \frac{\pi}{2}) = -\cos(x)$

- a) i) only      b) iii) only      c) ii) only      d) i) and ii) only      e) ii) and iii) only

Correct Answer: ii) and iii) only

3. If a harmonic seventh chord is played with the four fundamental frequencies 400, 500, 600, and 700 Hz, then what is the smallest number of beats that can occur between any two harmonic partials of these four harmonic tones?

- a) 120      b) 20      c) 50      d) 75      e) 100

Correct Answer: 100

4. Same question for the four fundamental frequencies 400, 500, 600, and 720 Hz.

- a) 120      b) 20      c) 50      d) 75      e) 100

Correct Answer: 20

5. In the previous two problems the highest and lowest notes of the chord are a minor seventh apart. What is the cent value difference between these two minor sevenths to the nearest 5 cents?

- a) 15      b) 25      c) 10      d) 50      e) 35

Correct Answer: 50

6. Suppose a signal has amplitude  $A_1 = 4$  and then this is changed to a new amplitude  $A_2 = 0.125$ . What is the decibel level of the amplitude ratio  $A_2/A_1$ ?

- a)  $-12$                       b)  $-24$                       c)  $-18$                       d)  $-6\sqrt{2}$                       e)  $-30$

Correct Answer:  $-30$

7. 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  $16A_1$ . What is the decibel level of the multiplier  $x$ ?

- a) 6                              b) 12                              c) 18                              d) 9                              e) 30

Correct Answer: 12

8. If  $x$  is the frequency ratio for an equal-tempered minor sixth, then what amplitude ratio in decibels is represented by  $x$ ?

- a) 6                              b) 3                              c) 8                              d) 4                              e) 1.5

Correct Answer: 4

9. 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 perfect fourth above the old tone, what is the decibel level increase represented by  $x$ ?

- a) 2                              b) 4                              c) 3.5                              d) 2.5                              e) 3

Correct Answer: 2.5

10. Suppose we tune a piano using Just Perfect Fifths with ratio  $\frac{3}{2}$  for the first seven perfect fifths (from  $C$  to  $C\sharp$ ) and the remaining fifths use a meantone perfect fifth with ratio  $\sqrt{2} \left(\frac{5}{4}\right)^{\frac{1}{4}}$ , leaving the final fifth from  $F$  to  $C$  to be determined by the others. How far off will this final perfect fifth be from Equal Temperament, to the nearest cent value?

- a) 2                              b) 4                              c) 5                              d) 0                              e) 10

Correct Answer: 0

Note: In Equal Temperament the fifths are all 700 cents, and  $12 \cdot 700 = 8400$ . In this problem we use seven just fifths, of 702 cents each, and four meantone fifths, of 696.6 cents each. If we make the last fifth, from  $F$  to  $C$ , 700 cents, we will see how far off we are from 8400.

$$7 \cdot 702 + 4 \cdot 696.6 + 700 = 8400.4$$

So the last fifth would only be 0.4 cents off!