WARM UP

1. 300 Hz 600 Hz 900 Hz 1200 Hz 1500 Hz

2. a) $a = 2n\pi \quad n \in \mathbb{R}$

b) $a = (2n+1)\pi \quad n \in \mathbb{R}$

Exercises

1. a). 400 Hz

b). 400 Hz

c). 200 Hz

d). 200 Hz

e). 100 Hz

Yes. They match up.

2. a). $h(t) = A\sin(wt - \phi - \pi)$

b). There is a phase shift of $\frac{2\phi + \pi}{w}$

There would not be aural difference perceived because shifting a single sine wave does not result in a change to our perception.

3. Proof: $A\sin(wt+\phi) + A\sin(wt+\phi+\pi) = 0$

$\sin(x+y) = \sin x \cos y + \cos x \sin y$

Suppose $y = \pi$.

$\sin(x+\pi) = \sin x \cos\pi + \cos x \sin\pi$

$\cos\pi = -1 \qquad \sin\pi = 0$

Therefore $\sin(x+\pi) = -\sin x$

Substitute x for $wt+\phi$

$\sin(wt+\phi+\pi) = -\sin(wt+\phi)$

$A\sin(wt+\phi) + A\sin(wt+\phi+\pi)$

$= A\sin(wt+\phi) - A\sin(wt+\phi)$

$= 0 \qquad$ Q. E. D.

5.

a). $400 \times 2^{2} = \boxed{1600 \text{ HZ}}$

b). $\sqrt[12]{2}$

Because if one semitone is $\sqrt[12]{2}$ the frequency above, then 12 semitones, which is an octave, would make up 2 times the frequency.

c). $f = f_{init} \times \left(\sqrt[12]{2}\right)^{S}$

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