1

I have uploaded an excel spredsheet, that contains the harmonics, aliased frequencies, the absolute value of those frequencies, and them all sorted.

2

a.
$\omega = 2\pi f = 2 * \pi * 261.6 = 1643.68$
b.
From equation 2.55 in the book $sin(\theta) = -i\frac{e^{i\theta} - e^{-i\theta}}{2}$
So in our case:
Let $\phi = 2 * \pi * 261.6 * i/rate$ (where i is the iteration in the for loop)
Then $sin(\phi) = -i\frac{e^{i\phi} - e^{-i\phi}}{2}$ would be expression for the phasor representing middle C.

3

SNR - Signal to Noise Ratio
DR- Dynamic Range

64 bit Integer:
$SNR = DR = 20\ log_{10}(2^{64}) = 385.31$

64 Bit Floating Point
$DR = 6.02 * 2^{11} = 12328.96$
$SNR = 6.02 * 52 = 313.04$

4

a.
$\frac{-4+i}{-3+2i} = \frac{-4+i}{-3+2i} * \frac{-3-2i}{-3-2i} = \frac{12+8i-3i-2i^2}{13} = \frac{14+5i}{13}$

b.1.
$(i+1)^6 = ((i+1)^2)^3 = (1+2i+i^2)^3 = (2i)^3 = -8i$

Absolute Value: 8
Complex Conjugate: $8i$

b.2.
$i^{17} = i^{16}i^1 = (i^4)^4 i = i$
Absolute Value: 1
Complex Conjugate: $-i$

c.
$i^5 + i + 1 = i^4 i + i + 1 = 1 + 2i$

d.1
$8 = 8(cos(2\pi k) + isin(2\pi k)), k \in \mathbb{Z}$

d.2
$6 = 6(cos(\frac{\pi}{2}k) + isin(\frac{\pi}{2}k)), k \in \mathbb{Z}$