Mixer Round Answers

Fall 2014 CHMMC

1. 0.83; calculator; [0.7;1]
2. 13.4L; current market rate; [6.7; 26.8]
3. about 400 billion; NPR; [200 billion; 800 billion]
4. 45,086,079; Mathematica; [20 million; 100 million]
5. 45,060; Wikipedia List of spaceflight records; [22,500; 90,000]
6. 130 billion; Wikipedia; [65 billion; 260 billion]
7. 31,000; "How much time do Americans spend eating?." The Free Library. 2008 Frozen Food Digest, Inc. 10 Nov. 2014; [15,500; 62,000]
8. Not known exactly; my inbox; [400; 800]
9. Solving $\frac{421+b}{421}\frac{b-1}{b} < 1$ gives $b < \frac{1+\sqrt{1685}}{2}$, so $b < 20.99$. Therefore he should sell when $b = 20$, or $k = 345$.
10. $45 - 6 = 39$
11. player 1 loses
12. 8/7 Let $2y = x$, so we are trying to find the max of

$$\frac{2^n y^n}{1 + y + \dots y^{2n}}$$

By the AM-GM inequality, we know

$$y^n = \sqrt[2n+1]{1 * y * y^2 * \dots y^{2n}} \leq \frac{1 + y + \dots y^{2n}}{2n+1}$$

with equality iff $1 = y = \dots = y^{2n} = 1$. Thus the function maximizes at $y = 1$, giving $\frac{2^n}{2n+1}$.

13. 2/3 Telescoping, we see that

$$a_n = a_1 - \frac{z}{1} + \frac{z}{2} + \frac{z}{n} - \frac{z}{n+1}$$

Therefore, $a_n = \frac{z(n+1)-zn}{n(n+1)} = \frac{z}{n(n+1)}$ so $a_y = \frac{z}{y(y+1)}$.