Solutions to Math 111 Final Exam Winter 2017

1. (a) 40 kilometers per hour
   (b) $t = 5$ hours
   (c) $[0.5, 2.5]$
   (d) 0.9 hours.

2. (a) AC and AVC do not intersect with $AC > AVC$.
   (b) 14 dollars per Kapelo
   (c) 7.5 dollars per Kapelo
   (d) $FC = TC - VC$. You can use any q to compute TC and VC from AC and AVC. $FC = 30$.
   (e) $MC = MR = 20$ when $q = 5.5$. Then, $TR = 110$ thousand, $TC = 5.5 \times 14.3 = 78.73$ thousand so the Profit is 31.27 thousand.

3. (a) f opens up because $0.4 > 0$.
   (b) f increases after $x = 2.8$. g decreases after $x = 4.2$. So f increases and g decreases when $x > 4.2$.
   (c) $h(x) = -1.025x^2 + 7.49x + 2.28$ has maximum when $x = 7.49/2.05$ which is $h(7.49/2.05) \approx 15.96$.
   (d) When $h(x) = 0$, $x = 7.6$ and $y = f(7.6) = g(7.6) = 17.08$.

4. (a) $\dfrac{3}{x+1} - \dfrac{2}{x-5} = 2$

$$3(x-5) - 2(x+1) = 2(x+1)(x-5)$$

$$0 = 2x^2 - 9x + 7$$

$$x = \frac{9 \pm \sqrt{81 - 56}}{4} = 1 \text{ or } 3.5.$$

   (b) $1.43 = \dfrac{(1.03)^{7x} - 1}{0.27}$

$$ln(1.3861) = \ln(1.03)^{7x} = 7x \ln(1.03)$$

$$x = \frac{\ln(1.3861}{7 \ln(1.03)} \approx 1.578$$

   (c) $0.3 = 2.4 \ln(3 + 2.1x)$

$$0.125 = \frac{0.3}{2.4} = \ln(3 + 2.1x)$$

$$e^{0.125} = 3 + 2.1x$$

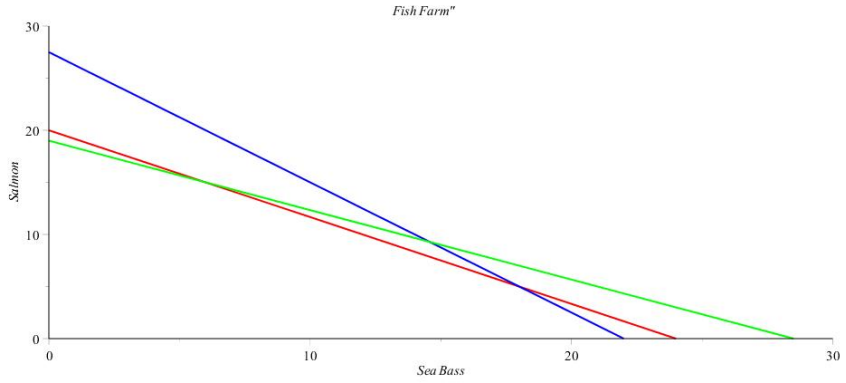
$$x = \frac{e^{0.125} - 3}{2.1} \approx -0.889.$$

5. (a) $TR = 2 \times 4.20 = 8.40$. $VC = 2 \times AVC(2) = 7.12$ so $TC = 8.52$. You make a loss of 0.12 hundred dollars or \$12.

   (b) When $MC = AVC$ so $q = \frac{7.54}{6.05} \approx 1.25$ OR at the lowest point of AVC when $q = \frac{7.56}{6.04} \approx 1.25$. In any case, $SP = AVC(1.25) \approx \$1.87$.

   (c) When $MC = MR = 4.20$ so $q = 1.487$ or 0.178. At $q = 1.487$ we switch from $MR > MC$ to $MR < MC$ so that is when the maximum profit is achieved. $TR = 4.20 \times 1.49 = 6.258$ hundred dollars. $TC = 1.4 + 1.49 \times AVC(1.49) = 4.44$ hundred dollars. So the maximum profit is \$181.80.

6. x-number of Sea Bass, y- number of Salmon. Constraints: Shrimp (red) $0.1x + 0.12y = 2.4$, Sardines (blue) $0.1x + 0.08y = 2.2$, Anchovies (green) $0.04x + 0.06y = 1.12$.



   Intersection points $(6, 15)$ and $(18, 5)$. Other corners to check: $(0, 0)$, $(0, 19)$, $(22, 0)$. The objective function is $f = x + y$ and the maximum number if fish is $18 + 5 = 23$.

7. (a) i. $S = 32000\left(1 + \dfrac{0.032}{12}\right)^{36} \approx 35,219.79$ so the interest is $I = 3219.79$.

   ii. $S = 320003^{3 \times 0.0315} \approx 35171.49$ so the interest is $I = 3171.49$.

   iii. The interest is $I = 32000 \times 0.035 \times 3 = 3360$ which is the maximum.

   (b)
$$350000 = R\frac{1 - \left(1 + \frac{0.0396}{12}\right)^{-360}}{\frac{0.0396}{12}}$$
   so $R \approx 1662.89$.

8. (a) $5183.75 + 0.25(45000 - 37650) = 7021.25$

   (b) $7021.25/24 = 292.55$.

   (c)
$$S = 292.55\frac{\left(1 + \frac{0.012}{24}\right)^{24} - 1}{\frac{0.012}{24}} \approx 7061.72$$

   (d) $S = 7061.72\left(1 + \dfrac{0.012}{24}\right)^{7} \approx 7086.47$

   (e) $7086.47 - 7021.25 = \$65.22$.