A. Demand and Supply (20 pts) YOU MUST SHOW YOUR WORK!!!

The market for widgets is:

<table>
<thead>
<tr>
<th>PRICE</th>
<th>QUANTITY DEMANDED</th>
<th>QUANTITY SUPPLIED</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>70</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>52</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>34</td>
<td>25</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>34</td>
</tr>
<tr>
<td>Etc.</td>
<td>Etc.</td>
<td>Etc.</td>
</tr>
</tbody>
</table>

\[ \frac{\Delta Q_d}{\Delta P} = -13 \quad \text{Etc.}, \quad \frac{\Delta Q_s}{\Delta P} = \frac{-15}{-3} = 5 \]

1. (2 pts) \[ \frac{\Delta Q_d}{\Delta P} = 9 \quad -3 \] What is the demand equation \((Q=f(P))\)?

2. (2 pts) \[ \frac{\Delta Q_s}{\Delta P} = -5 \quad +3 \] What is the supply equation \((Q=f(P))\)?

3. (2 pts) \[ \frac{\Delta Q_d}{\Delta P} = 0.18 \] What is the elasticity of demand at \(P=5\) (not equilibrium)?

4. (2 pts) \[ \varepsilon = \frac{3}{28} = 1.18 \] What is the elasticity of supply at equilibrium?

5. (2 pts) \[ Q = 7.83, \quad P = 47 \] What is the maximum revenue point (both \(P\) and \(Q\)) on the demand equation?

6. (2 pts) \[ Q_s = \frac{y}{z} = \frac{(28)9}{2} = 130 \frac{7}{5} \] What is the size of the producer surplus (a number answer required) at equilibrium?

7. (2 pts) \[ Q_c = \frac{62}{10} = \frac{15}{2} \] What is the value to consumers of what is purchased (a number answer required) at equilibrium?

8. (3 pts) \[ \frac{\Delta x}{\Delta y} = -21.94 = -12.4 \] If income decreases by 10\%, the demand shifts to \(Q_d=112-10P\). What is the income elasticity? Also, what is the economic term used for a good with this income elasticity?

9. (3 pts) \[ \frac{\Delta x}{\Delta y} = -21.94 = -12.4 \] The price of a good increases by 5\%, the demand shifts to \(Q_d=79-2P\). What is the cross elasticity? Also, what is the economic term used for a good with this cross elasticity?

B. (10 pts) Use the same demand and supply curves for A(#1 & #2). What happens if there is a price floor at \(P=13\)? (The government does NOT buy the surplus). Draw a rough diagram below and then fill in the following table:

<table>
<thead>
<tr>
<th>(P_c)</th>
<th>(P_p)</th>
<th>(Q_c)</th>
<th>(Q_p)</th>
<th>(\Delta CS)</th>
<th>(\Delta PS)</th>
<th>(\Delta GR)</th>
<th>(DWL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>13</td>
<td>16</td>
<td>16</td>
<td>(\frac{16}{28})</td>
<td>(\frac{16}{28})</td>
<td>0</td>
<td>-36</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(\frac{-128}{28})</td>
<td>(32-28=4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
C. (10 pts) Use the same demand and supply curves for A(1 & 2). What happens if there is a $6 subsidy? 
Draw a rough diagram below and then fill in the following table:

<table>
<thead>
<tr>
<th>Pc</th>
<th>Pp</th>
<th>Qc</th>
<th>Qp</th>
<th>ΔCS</th>
<th>ΔPS</th>
<th>ΔGR</th>
<th>DWL</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>15</td>
<td>40</td>
<td>40</td>
<td>2</td>
<td>1</td>
<td>-36</td>
<td>-10</td>
</tr>
</tbody>
</table>

\[ Q^d = Q^s \]

D. Comparative Statics (10 pts) Draw demand and supply curves for the good below. Then show a new curve or curves in the same diagram (with arrows to show in which direction the curve or curves have shifted.) Then circle the best answer to each of the following questions.

1. The two major uses of oil is for transportation (to make gasoline or petrol for cars) or to make electricity. What happens to the price of gasoline if we find cheaper ways to make electricity (by using natural gas or nuclear energy, for example).

Demand will shift \( \text{RIGHT/LEFT/NO SHIFT} \)
Supply will shift \( \text{RIGHT/LEFT/NO SHIFT} \)
Equilibrium price will \( \text{RISE/FALL/UNCERTAIN CHANGE} \)
Equilibrium quantity will \( \text{RISE/FALL/UNCERTAIN CHANGE} \)

2. Many people believe that mutton doesn’t taste very good unless you eat it with mint sauce. What will happen to the market for mutton if a new plant disease hits mint plants causing a decrease in the world’s supply of mint?

Demand will shift \( \text{RIGHT/LEFT/NO SHIFT} \)
Supply will shift \( \text{RIGHT/LEFT/NO SHIFT} \)
Equilibrium price will \( \text{RISE/FALL/UNCERTAIN CHANGE} \)
Equilibrium quantity will \( \text{RISE/FALL/UNCERTAIN CHANGE} \)
Let \( P_x = 3X^{1/3}Y^{2/3} \), (Careful: exponent of \( X \) is not equal to exponent of \( Y \)) \( dU/dX = X^{-1/3}Y^{2/3} \), \( dU/dY = 2X^{1/3}Y^{-1/3} \)
\( P_x = 5 \), \( P_y = 10 \) and \( I = \$60 \)

1. (2 pts) \( 3(4)(4) = 48 \) What is the level of happiness at \( X = 64 \), \( Y = 8 \)?

2. (2 pts) \( \frac{4}{(64)^{1/3}} = \frac{4}{16} = \frac{1}{4} \) What is the marginal utility of \( X \) at this point? \( mU_x = \frac{2(16)}{2} = 4 \)

3. (2 pts) \( \frac{1}{16} \) What is the slope of the indifference curve at this point?

4. (2 pts) \( \frac{4}{5} \) At this point, which is larger: the marginal utility of the last dollar spent on \( X \) or the marginal utility of the last dollar spent on \( Y \)? (You must show both marginal utilities per dollar spent)

5. (2 pts) \( \frac{1}{4} \) To increase your utility (for the same dollars spent), should you trade in some \( X \) to get more \( Y \) or trade in some \( Y \) to get more \( X \)?

6. (2 pts) \( \frac{506}{110} = 4.6 \) What would it cost to buy this point? \( (X = 64, Y = 8) \)

7. (2 pts) \( \frac{10}{16} = 1 \) unit of \( Y \) If you bought \( X = 10 \), what is the most \( Y \) you could afford to buy with \( \$60 \)?

8. (2 pts) \( y = 16 \) What is \( Y \) if \( X = 16 \) on the same indifference curve (as \( #1 \))? \( \frac{48 = 3x^{1/3}y^{2/3}}{16 = (16)^{1/3}y^{2/3}} \)

9. (2 pts) \( y = 16 \) What is the value of \( Y \) on the income consumption curve when \( X = 16 \)?

10. (5 pts) \( X = 4, Y = 4 \) \( U = 12 \) What are the values of \( X \) and \( Y \) which give you the maximum satisfaction given the above income constraint? How much happiness do you have?

For the rest of this problem, suppose \( P_x \) has decreased to \$2.

11. (2 pts) \( y = 6.4 \) What is the value of \( Y \) on the new income consumption curve when \( X = 16 \)?

12. (5 pts) \( X = 10, Y = 4 \) \( U = 3(110)^{1/6} \) Find the new values of \( X, Y \) and \( U \) which maximize happiness.

13. (4 pts) \( y = 4 \) \( U = 12 \) The equation for the PCC for \( X \) (as a function of \( Y \) or \( Y \) as a function of \( X \)) for \( P_x = \$10 \) and \( l = \$60 \)?

14. (4 pts) \( X = \frac{20}{P_x} \) What is the equation for the demand curve \( X \) (as a function of \( P_x \) alone) for \( P_y = \$10 \) and \( l = \$60 \).

15. (4 pts) \( y = 2.947 \) \( U = 12 \) Calculate the intermediate point - both \( X \) & \( Y \). (The amount of \( X \) and \( Y \) you would consume to have the same happiness of \#10 when you are paying \$2 to buy \( X \)).

16. (2 pts) \( 60 + 12 = 72 \) What is the equivalent increase in income caused by the decrease in the price of \( X \)?

17. (6 pts) Draw a rough diagram clearly showing the TWO budget constraints, TWO indifference curves and TWO ICC curves of your answers to \#10, \#12 & \#15. Carefully show (in your diagram) the income effect and the substitution effect of the decrease in the price of \( X \).
A. Long Run vs. Short Run (40 pts)

SHOW WORK (Neatly please!)

1. (2 pts) \[ \frac{d^2y}{dx^2} = \frac{2}{x} \]

For the point \( L = 64 \) and \( K = 125 \), what isoquant are we on?

2. (3 pts) \[ \frac{K}{L} = \frac{125}{128} = 0.976 \]

At the point \( (L = 64, K = 125) \) which is steeper? (K on the Y-axis)

The isocost curve or the isoquant? Explain.

3. (2 pts) \[ L = 8K \]

Find the equation for the output expansion path.

4. (3 pts) \[ T = 2(2x^2) + 27(x_1) = 12x \]

Find the long run total cost function (total cost as a function of \( X \) alone)

5. (3 pts) \[ T = 2(3x^2) + 32(20) = 1240 + \frac{x^2}{1600} \]

Suppose \( K \) is stuck at \( K = 20 \) in the short run. Find the short run total cost function. (total cost as a function of \( X \) alone)

6. (10 pts) Complete the following table for Point A, Point B and Point C.

<table>
<thead>
<tr>
<th>L</th>
<th>K</th>
<th>X</th>
<th>TC</th>
<th>AC</th>
<th>MC</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>25</td>
<td>100</td>
<td>1200</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>312.5</td>
<td>20</td>
<td>100</td>
<td>1265</td>
<td>12.65</td>
<td>18.75</td>
</tr>
<tr>
<td>160</td>
<td>20</td>
<td>80</td>
<td>960</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

7. (4 pts) Draw a rough diagram showing the isoquant and isocost curves that are your answers to Point A, Point B and Point C. Show isoquants, isocosts for all three points. Also draw and label the output expansion path in this diagram. YOU MUST LABEL the points A, B & C in this diagram.

8. (4 pts) Draw another rough diagram showing the long run average and marginal cost curves and also the short run average and marginal cost curves. YOU MUST LABEL the points A, B & C in this diagram.

9. (4 pts) \( X = 120 \) \( \pi = 1520 \) If \( P = 27 \) (and \( K \) is stuck at \( K = 5 \) in the short run), how much \( X \) should you produce to make the most profit? What is the profit?

\[ \frac{\pi}{1600} = 27 \]

\[ \frac{x^2}{1600} = \frac{9}{3} = 3240 \]

\[ X = 100 \]
B. AP/MP to AC/MC (9 pts) (This is NOT the same production function as in part A.) Suppose $K=21$, $w_K=90$ and $w_L=500$. Here is the number of widgets we can produce if we hire the number of workers given in the table. (Careful. This is NOT the same production function as in A.) (HINT: You DO NOT have to fill in the whole table (it will take too much time). If you keep track of things with rough diagrams of AP/MP and AVC/MC/AC you will be able to answer the questions below)

L: $X$: \[ \begin{array}{c|c|c|c|c} X & AP & MP & TC & AC \hline 0 & 0 & 0 & 0 & \infty \hline 1 & 10 & 10 & 11 & 11 \hline 2 & 20 & 20 & 21 & 10.5 \hline 3 & 30 & 30 & 31 & 10 \hline 4 & 40 & 40 & 41 & 9.75 \hline 5 & 50 & 50 & 50 & 8.8 \hline 6 & 60 & 60 & 60 & 8.33 \hline 7 & 70 & 70 & 70 & 8 \hline 8 & 80 & 80 & 80 & 7.5 \hline 9 & 90 & 90 & 90 & 7 \hline 10 & 100 & 100 & 100 & 6.5 \end{array} \]

1. (5 pts) $X=100$ $AVC = \frac{w_L}{w_K} = \frac{500}{21} = 20$ What amount of $X$ gives you the smallest average variable cost? What is that average variable cost?

3. (5 pts) $X=15.9$ $AC = 35$ What amount of $X$ is the "break even" point? What is the average cost at this point?

3. (5 pts) $X=150$ $\Pi = 1791.8$ If $P=45.4545$ (500/11), what amount of $X$ gives the greatest profit? What is that profit?

\[ \Pi = 150 \left( \frac{500}{11} \right) - 630 \]
MICROECONOMICS 103  
QUIZ #4  
3 August 2016  
NAME: ANSWERS

You MUST show work for full credit!!

1. Quantity: You must show work for full credit!!

Variable Cost:  
<table>
<thead>
<tr>
<th>Q</th>
<th>TC</th>
<th>MC</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>125</td>
<td>60</td>
<td>62.5</td>
</tr>
<tr>
<td>3</td>
<td>185</td>
<td>60</td>
<td>61.67</td>
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<td>4</td>
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<td>60.83</td>
</tr>
<tr>
<td>7</td>
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<td>60</td>
<td>61</td>
</tr>
<tr>
<td>8</td>
<td>485</td>
<td>60</td>
<td>60.62</td>
</tr>
<tr>
<td>9</td>
<td>545</td>
<td>60</td>
<td>60.56</td>
</tr>
<tr>
<td>10</td>
<td>605</td>
<td>60</td>
<td>60.5</td>
</tr>
<tr>
<td>11</td>
<td>665</td>
<td>60</td>
<td>60.45</td>
</tr>
<tr>
<td>12</td>
<td>725</td>
<td>60</td>
<td>60.42</td>
</tr>
<tr>
<td>13</td>
<td>785</td>
<td>60</td>
<td>60.43</td>
</tr>
<tr>
<td>14</td>
<td>845</td>
<td>60</td>
<td>60.43</td>
</tr>
<tr>
<td>15</td>
<td>905</td>
<td>60</td>
<td>60.33</td>
</tr>
<tr>
<td>16</td>
<td>965</td>
<td>60</td>
<td>60.31</td>
</tr>
</tbody>
</table>

2. Suppose consumers would like to buy a certain product at: Qd=650-5P.

The variable cost to a firm of making a unit of the product is VC=3Q^2 + 2Q + 48. The fixed cost is FC=144.

a) (5 pts) If this is a perfectly competitive industry with 98 firms, what is the equilibrium price? How many units of Q will each firm produce? How much economic profit will each firm make?

- MC = 6Q + 2
- TR = 650 - 5Q
- Q^opt = 650 / 2 = 325
- TR = 625
- AC = TC / Q = 625 / 325 = 1.93
- Profit = TR - TC = 625 - 625 = 0

b) (5 pts) If one firm became a monopoly interested only in short run profit, what would P, Q, and profit be?

- P = 13.5
- Q = 12
- Profit = 540

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