No books or notes are allowed. Please read the problems carefully and do all you are asked to do. You must show your work! You can use the back page as a scratch paper. Do the problems at the space provided.

<table>
<thead>
<tr>
<th>Total/100</th>
<th>#1</th>
<th>#2</th>
<th>#3</th>
<th>#4</th>
<th>#5</th>
<th>#6</th>
<th>#7</th>
<th>#8</th>
</tr>
</thead>
</table>

1 (total points: 12). Record shows that a company that produces radios has the total cost $C(q) = 31,000$ if $q = 1000$ radios are produced, and it has the total cost $C(q) = 80,000$ if $q = 8000$ radios are produced. Suppose that the cost function is linear.

(a) (8 points). Find a formula for the cost function.

(b) (4 points). Find the fixed costs and the variable cost per radio.

2 (total points: 12 points).

(a) (7 points). A $25,000 robot depreciates linearly down to a value of zero in 20 years. Find a formula for its value as a function of time.

(b) (5 points). How much is the robot worth five years after its purchase?
3 (total points: 13). The demand and supply curves for a certain product are given in terms of price, $p$ dollars per unit, by

\[ D(p) = 100 - 2p \quad \text{and} \quad S(p) = 3p - 50. \]

(a) (5 points). Find the equilibrium price and quantity.

(b) (5 points). If a specific tax of $6 per unit is imposed on the producers, find the new equilibrium price and quantity.

(c) (4 points). Predict the total tax revenue of the government due to the trading of the product.
4 (total points: 12). In each of the items (a)-(d), determine if the function is a power function. If it is a power function, write it in the form \( y = kx^p \) and give the values of the coefficient \( k \) and the exponent \( p \).

(a) (3 points). \( y = -\frac{1}{2x+1} \)

(b) (3 points). \( y = e^{\ln x^2} \)

(c) (3 points). \( y = \frac{5}{\sqrt{x}} \)

(d) (3 points). \( y = x(2x^2)^3 \)

5 (total points: 13). A cup of coffee contains 100 mg of caffeine which leaves the body at a continuous rate of 16\% per hour.

(a) (6 points). Write a formula for the quantity, \( Q \) mg, of caffeine in the body \( t \) hours after drinking a cup of coffee.

(b) (7 points). Use logarithms to find the half-life of the caffeine.
6 (total points: 12). The following table gives partial data of a function $f(x)$.

<table>
<thead>
<tr>
<th>$x$</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(x)$</td>
<td>16</td>
<td>24</td>
<td>36</td>
<td>54</td>
<td>81</td>
</tr>
</tbody>
</table>

(a) (6 points). Could the function $f(x)$ be linear or exponential.

(b) (6 points). Find a formular for the function.

7 (total points: 12). Assume that Bank A offers a savings account that compounds interest semi-annually (twice per year), and Bank B offers one that compounds continuously. Assume that both accounts have the same 6% effective annual yield.

(a) (7 points). Find the annual interest rate (nominal rate) of the account of Bank B.

(b) (5 points). Without further computation, determine which account will have higher balance in 20 years if each is opened right now with $5,000 initial deposit.
8 (total points: 13). You invest $10,000 in an account which pays interest compounded continuously. 
(a) (6 points). How much money is in the account after 8 years, if the annual interest is 4%?

(b) (7 points). If you want the account to contain $18,000 after 8 years, what yearly interest rate is needed?