Name ________________________________

Student ID #:_________________________  Section ____________________________

HONOR STATEMENT

“I affirm that my work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam.”

SIGNATURE: ________________________________

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

- This exam consists of this cover sheet followed by 3 problems on 3 pages. Please check that you have a complete exam.
- You are allowed to use a scientific, non-graphing, non-programmable calculator and one sheet of hand-written notes during this exam. The use of all other sources is prohibited.
- Turn your cell phone OFF and put it away for the duration of the exam.
- You may not listen to headphones or earbuds during the exam.
- Unless otherwise indicated, you must show your work or write a few words to justify your answers. Clearly show all calculations. The correct answer with no supporting work may result in no credit.
- If you use a guess-and-check method when an algebraic method is available, you may not receive full credit.
- Unless otherwise specified, you may round your final answer to two digits after the decimal.

GOOD LUCK!
1. (20 points) You may round your final answers to two digits after the decimal.

   (a) What principal must you invest in a savings account earning 4.5% interest, compounded semi-annually, so that the balance after 5 years is $800?

   ANSWER: $

   (b) You make a one-time deposit of $4000 into an account paying 7.25%, compounded continuously. After how many years is the balance $10,000?

   ANSWER: __________ years

   (c) A diamond ring appreciates in value over time. Each year, the ring is worth 5% more than it was the year before. How long does it take for the ring to quadruple in value?

   ANSWER: __________ years

   (d) Which would you choose for a savings account:
       (A) 6%, compounded quarterly, or
       (B) 5.94%, compounded continuously?
       (Justify your answer.)

   ANSWER: Account ______
2. (14 points)

(a) You win $2,100,000 ($2.1 million) in a state lottery. You give one-third of your winnings to a friend, one-third to charity, and set up an annuity with the rest at 9%, compounded monthly. What amount will this annuity pay at the beginning of each month for the next 10 years?

ANSWER: $

(b) Immediately after graduating from college, Julian started a savings plan, depositing $200 at the end of each month in an account paying 3% interest, compounded monthly. After 6 years, Julian stopped making payments but left the money in the account, gaining interest at the same rate, for an additional 4 years.

i. How much money was in the account 10 years after Julian graduated?

ANSWER: $

ii. How much interest did he earn during these 10 years?

ANSWER: $

3. (16 points)

(a) Sheila wants to buy a car. She can get a 4-year loan with an interest rate of 2.94%, compounded monthly and she can afford a $300 monthly payment. How large a down-payment must she make to purchase a car that costs $18,000?

ANSWER: $oxed{}$

(b) A business borrows $450,000 at a rate of 8%, compounded quarterly, and makes regular payments of $12,000 at the end of every quarter. How many quarterly payments must be made to pay off the loan? (Round to the NEAREST whole quarter.)

ANSWER: _______________________quarters
4. (12 points) Below is the graph of distance traveled vs. time for a car.

(a) What is the car’s average speed during the 5-minute interval beginning at $t = 35$?

ANSWER: ________________ miles per minute

(b) Name a value of $t$ at which average trip speed is 1 mile per minute.

ANSWER: $t = $ ________________ (name only one)

(c) Find an interval, beginning at $t = 10$ during which the average speed of the car is 1 mile per minute.

ANSWER: from $t = 10$ to $t =$ ________________

(d) Compute the lowest value of the car’s average trip speed.

ANSWER: ________________ miles per minute
5. (12 points) A car and a bus start from the same place and drive on a straight road in the same direction. Use \( C(t) \) and \( B(t) \) to denote the distance (in miles) they each traveled, respectively, after \( t \) minutes. For each of the following sentences, translate from the given language into the indicated language.

(a) **Graphical Language:** The slope of the diagonal line through the graph of \( C(t) \) at \( t = 4 \) is 0.7.

**Functional Notation:**

(b) **Functional Notation:** \[ \frac{B(5 + h) - B(5)}{h} = 1.2. \]

**English:**

(c) **English:** After 5 minutes, the bus was ahead of the car by 2 miles.

**Functional Notation:**

(d) **English:** At \( t = 9 \), the bus is in the location that the car was \( h \) minutes earlier.

**Functional Notation:**
6. (11 points) Market research for a small business shows that, in a certain city neighborhood, consumers will purchase 24 Widgets if the price is $794 and 104 Widgets if the price is $774. The business owner can supply 20 Widgets if the price is $759 and 100 if the price is $799. Find the equilibrium point if the supply and demand functions are linear.

ANSWER: \((q, p) = \)
7. (15 points)

The graphs at right show marginal cost and average variable cost for producing Things. The formulas for these functions are

\[ MC(q) = \frac{1}{2}q^2 - 6q + 23 \]
\[ AVC(q) = \frac{1}{6}q^2 - 3q + 23, \]

where \( q \) is in hundreds of Things and \( MC \) and \( AVC \) are in dollars per Thing.

(a) Compute the shutdown price.

ANSWER: _______________ dollars per Thing

(b) Recall that marginal revenue at \( q \) hundred Things is given by

\[ MR(q) = \frac{TR(q + 0.01) - TR(q)}{0.01}. \]

The total revenue for selling \( q \) hundred Things is given by \( TR(q) = -4q^2 + 52q \). Compute the formula for \( MR(q) \) and simplify as much as possible.

ANSWER: \( MR(q) = \) _______________

(c) What quantity maximizes profit? (This question requires you to use the formula for \( MR(q) \) that you found in part (b). If you were unable to find that formula, you may answer this question for partial credit using the incorrect formula \( MR(q) = -5q + 61.82 \).)

ANSWER: \( q = \) _______________ hundred Things