By providing my signature below I acknowledge that I abide by the University’s academic honesty policy. This is my work, and I did not get any help from anyone else during the exam:

Name (sign): ____________________________  Name (print): ____________________________

Student Number: __________________________

Instructor’s Name: __________________________  Class Time: __________________________

- If you need extra space use the last page.
- Please show your work. **An unjustified answer may receive little or no credit.**
- If you make use of a theorem to justify a conclusion then state the theorem used by name.
- Your work must be **neat**. If I can’t read it (or can’t find it), I can’t grade it.
- The total number of possible points that is assigned for each problem is shown here. The number of points for each subproblem is shown within the exam.
- Please turn off your mobile phone.
- A calculator is not necessary, but numerical answers should be given in a form that can be directly entered into a calculator.

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<thead>
<tr>
<th>Problem Number</th>
<th>Points Possible</th>
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- **Common identities:**
  \[
  \cos(\alpha + \beta) = \cos(\alpha)\cos(\beta) - \sin(\alpha)\sin(\beta),
  \]
  \[
  \sin(\alpha + \beta) = \sin(\alpha)\cos(\beta) + \cos(\alpha)\sin(\beta).
  \]

1. [2 Bonus] Common Knowledge: How many orbits has Pluto completed since its discovery?
2. Determine all of the values of $x$ for each question below that satisfy the given equation. If no values of $x$ satisfy the equation provide a brief justification as to how you arrived at your conclusion.

(a) [5 pts] \[ \frac{x}{x + 2} = 4. \]

(b) [5 pts] \[ \sqrt{4 - x} = x. \]

(c) [5 pts] \[ |x + 3| = 7 \]
3. The questions below refer to the function

\[ g(x) = \begin{cases} 
  x + 3 & -3 \leq x < -1, \\
  -x^2 + 4x - 2 & 0 < x \leq 3.
\end{cases} \]

(a) [5 pts] Make a rough sketch of the graph of the function, \( g(x) \), using the axis below.

(b) [5 pts] Determine the range and domain of the function, \( g(x) \).
4. Two functions are given below. The graph of $h(x)$ is on the left, and the function $s(x)$ is defined on the right.

$$s(x) = x^2 - 4.$$ 

(a) [5 pts] Determine the value of $s(h(-2))$.

(b) [5 pts] Determine the value of $h(s(-2))$.

(c) [2 pts] Determine the y-intercepts of $h(s(x))$.

(d) [2 pts] Determine the x-intercepts of $h(s(x))$. 

______

Points earned: _____ out of a possible 14 points
5. The questions below refer to the following graph of a function, \( k(x) \).

\[
\begin{array}{c}
\text{graph of } k(x) \\
\end{array}
\]

(a) [10 pts] use the axes below to sketch a graph of the function \( k(x - 3) + 1 \).

\[
\begin{array}{c}
\text{graph of } k(x - 3) + 1 \\
\end{array}
\]

(b) [5 pts] The graph of the function \( b(x) \) is given below. Determine the values of \( a, b, c, \) and \( d \) so that

\[
b(x) = ak(bx + c) + d.
\]
6. The questions below refer to the function

\[ p(x) = 3x^2 - 2x + 1. \]

(a) [5 pts] Determine the average rate of change from \( x = 1 \) to \( x = 3 \).

(b) [5 pts] Determine a formula for the secant line through the points on the graph of the function \( p(x) \) at \( x = 1 \) and \( x = 3 \).

(c) [5 pts] For what values of \( x \) is \( p(x) \) increasing and what values is it decreasing? Also determine the values of \( x \) where a local minima or local maxima occur including a brief justification why the points are a minima or a maxima.
7. A company will rent temporary office space. The cost to rent a floor of a building is a fixed $60,000 for the first four weeks. After the first four weeks the cost is an additional $12,500 per week.

(a) [9 pts] Determine the function that provides the total cost to rent the floor for a given number of weeks, $t$. Express your function using proper piecewise function notation.

(b) [8 pts] A design group will pay $98,000 to rent the floor. How long can they use the floor?
8. [14 pts] Determine the two numbers that sum to fifteen whose product is as large as possible. (Justify your solution and do not state an intuitive guess.)
Extra space for work. **Do not detach this page.** If you want us to consider the work on this page you should print your name, instructor and class meeting time below.

Name (print): _____________ Instructor (print): _____________ Time: _____________