Section I – Short Answer

Answer in the space provided. Show your work.

1. Consider the function

   \[ f(x) = \frac{x^2 - x - 2}{x^2 - 3}. \]

   (a) Find the zeros of this function.

   (b) Find the domain of this function. Express your answer in interval notation.
2. Consider the following graph of \( y = f(x) \).

Determine:
(a) The domain of \( f \).

(b) The range of \( f \).

(c) The \( x \)-intercept(s).

(d) Interval(s) where the function is positive.

(e) Open interval(s) where the function is increasing.

(f) Turning point(s) of the function.
3. Functions $f$, $g$ and $h$ are defined by $f(x) = x^2 + 2x - 4$, and the following table and graph:

<table>
<thead>
<tr>
<th>$x$</th>
<th>$g(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Determine:
(a) $(f + g)(2)$

(b) $(f \circ h)(2)$

(c) $(\frac{f}{h})(2)$
4. Let \( f(x) = 2x^2 - 3x + 1 \). Find \( \frac{f(x + h) - f(x)}{h} \).

5. (a) Describe the transformations (in the order that they are applied) of the base function \( y = x^3 \) that produce the function \( y = -(x - 1)^3 \).

(b) Use part (a) to graph \( y = -(x - 1)^3 \).
6. Sketch a graph of the piecewise defined function given by

\[ f(x) = \begin{cases} 
-x & \text{for } x \leq 0 \\
 x^2 + 2 & \text{for } x > 0.
\end{cases} \]

7. Let \( f(x) = \sqrt{x-2} \) and \( g(x) = x^2 - 9 \). Find the domain of the function \( \frac{f}{g} \).

8. The equation \( x^2 + y^2 - 2y - 8 = 0 \) describes a circle. By completing the square, find the center and radius of this circle.
9. Suppose that the total cost of purchasing a home is the sum of the selling price, a 5% sales tax and a processing fee of $2000.
   (a) Show that the total cost of purchasing a house with selling price \( x \) is given by the function
   \[
   f(x) = 1.05x + 2000.
   \]

   (b) Explain why \( f(x) \) is one-to-one. (You can do this either graphically or algebraically).

   (c) Find the inverse function \( f^{-1} \).

   (d) Calculate \( f^{-1}(100000) \). Explain what your answer means in terms of purchasing a home.
Section II – Multiple Choice

Circle the correct answer. No partial credit will be given.

1. Which of the following tables determine \( y \) as a function of \( x \)?

\[
\begin{array}{|c|c|}
\hline
x & y \\
\hline
1 & 0 \\
2 & 1 \\
3 & 4 \\
5 & 4 \\
\hline
\end{array}
\quad
\begin{array}{|c|c|}
\hline
x & y \\
\hline
2 & 9 \\
4 & 5 \\
5 & 4 \\
\hline
\end{array}
\quad
\begin{array}{|c|c|}
\hline
x & y \\
\hline
5 & 2 \\
6 & 3 \\
7 & 5 \\
5 & 6 \\
\hline
\end{array}
\]

(A) All of them  
(B) 1 and 2 only  
(C) 2 only  
(D) 1 and 3 only  
(E) 2 and 3 only

2. Which of the following is/are graphs of functions?

(A) All of them  
(B) 3 only  
(C) 2 and 3 only  
(D) 2 and 4 only  
(E) 3 and 4 only
3. The temperature of a solution in a lab experiment is given by

\[ F(t) = 0.16t^2 - 1.6t + 35 \]

where \( t \) is measured in hours and \( F \) is the temperature in degrees celsius.

Which of the following is the rate of change of the temperature of the solution between \( t = 2 \) hours and \( t = 4 \) hours?

(A) 0 °C/hour  
(B) 0.64 °C/hour  
(C) −0.64 °C/hour  
(D) 1.28 °C/hour  
(E) −1.28 °C/hour