## Assignment 3

**Due on 2019-05-03, 23:59 IST.**

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Let ( f(x) = e^x ) and ( g(x) = \ln(x) ), where ( u(x) = x^2 ) and ( v(x) = \sin(x) ) then the value of ( \frac{dv}{dx} ) over the interval ([1, 3]) is given by</td>
<td>1 point</td>
</tr>
<tr>
<td>2</td>
<td>Let ( f(x) = 1 + x )</td>
<td>1 point</td>
</tr>
<tr>
<td>3</td>
<td>Let ( f(x) = 1 + x^2 )</td>
<td>1 point</td>
</tr>
<tr>
<td>4</td>
<td>Let ( f(x) = 1 + \frac{1}{x} )</td>
<td>1 point</td>
</tr>
<tr>
<td>5</td>
<td>For the above question, if the force applied on the ring is given by ( F(x) = 1.5x ), for all points on the string of length ( 1 ), then the displacement ( x'(t) ) is given by</td>
<td>1 point</td>
</tr>
<tr>
<td>6</td>
<td>For the force given in Question 5, if the sequence is</td>
<td>1 point</td>
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<tr>
<td>7</td>
<td>For the above question, if the force applied on the string is given by ( F(x) = 1.5x ), for all points on the string of length ( 1 ), then the displacement ( x'(t) ) is given by</td>
<td>1 point</td>
</tr>
</tbody>
</table>

### Additional Questions

1. **What is the form of J. D. O'Malley's function for water hammer in a pipe where the time constant is \( c_\text{tau} \)?**

   \[
   G(t) = \frac{1}{\tau} \exp\left(\frac{-t}{\tau}\right)
   \]

   **1 point**

2. **What is the form of J. D. O'Malley's function for water hammer in a pipe where the time constant is \( c_\text{tau} \)?**

   \[
   G(t) = \frac{1}{\tau} \exp\left(\frac{-t}{\tau}\right)
   \]

   **1 point**

3. **Which of the following is true of a J. D. O'Malley's function, \( y(t), x(t) \), in general?**

   - **1 point**
   - **Continuous at \( t = 0 \)**
   - **Discontinuous at \( t = 0 \)**
   - **Continuous at \( t = 0 \)**
   - **Discontinuous at \( t = 0 \)**

4. **In a scattering problem when a bounded object is illuminated by an electromagnetic wave, which of the following theorems is used to express the field outside the object?**

   - **Huygens' Principle**
   - **Extinction Theorem**
   - **Rayleigh's Theorem**
   - **Born's principle**

   **1 point**

5. **In a scattering problem when a bounded object is illuminated by an electromagnetic wave, which of the following theorems is used to evaluate fields on?**

   - **Huygens' Principle**
   - **Extinction Theorem**
   - **Rayleigh's Theorem**
   - **Born's principle**

   **1 point**

6. **What is the electric field \( E \) in the vacuum normal to the surface, and \( \mu \) is the unit vector in the tangential direction, then the tangential magnetic field \( H_{\text{tang}} \) can be written as \( \mathbf{H}_{\text{tang}} = \mathbf{E} \times \mathbf{B} \), where the value of \( x \) is**

   - **J0**
   - **J1**
   - **J2**
   - **J3**

   **1 point**

7. **If \( x(t) \) is an incoming wave at stage \( y \)**

   - **Expression**
   - **Explanation**

   **1 point**

8. **Why is \( G(t) = \frac{1}{\tau} \exp\left(\frac{-t}{\tau}\right) \) shown as the O'Malley's function in the 3D case, instead of \( G(t) = \frac{1}{\tau} \exp\left(\frac{-t}{\tau}\right) \)?**

   Assume the time constant is chosen to be \( 1 \), because \( x(t) = \exp(-t) \) is an outgoing wave at stage \( y \)

   **1 point**

8. **If \( x(t) \) is an incoming wave at stage \( y \)**

   - **Expression**
   - **Explanation**

   **1 point**

9. **What is the form of J. D. O'Malley's function for water hammer in a pipe where the time constant is \( c_\text{tau} \)?**

   \[
   G(t) = \frac{1}{\tau} \exp\left(\frac{-t}{\tau}\right)
   \]

   **1 point**

10. **In a scattering problem when a bounded object is illuminated by an electromagnetic wave, which of the following theorems is used to express the field outside the object?**

    - **Huygens' Principle**
    - **Extinction Theorem**
    - **Rayleigh's Theorem**
    - **Born's principle**

    **1 point**