This assignment includes many questions with severely restricted re-submissions. As usual, any problem that has a finite number of choices will only allow a small number of re-submissions. Sometimes this number is as low as 1 or even 0. Pay careful attention to the instructions in each problem.

Instructions
Read today's Notes and Learning Goals

1. Question Details

The graph below shows water level readings from a stream gauge as a function of time. Water level, \( w \), is in inches and time, \( t \), is in weeks. Answer the questions below.

Within the domain \( 0 \leq t \leq 7 \), the rate of change appears to be zero at which times? Select all that apply.

- \( t = 0 \) weeks
- \( t = 1 \) weeks
- \( t = 2 \) weeks
- \( t = 3 \) weeks
- \( t = 4 \) weeks
- \( t = 5 \) weeks
- \( t = 6 \) weeks
- \( t = 7 \) weeks
- There are other times in the domain with zero rate of change.
- The rate of change is never zero in the domain.

Which of the following is true?
Which of the following is true?

- $w'(3) < w'(7)$
- $w'(3) > w'(7)$
- $w'(3) = w'(7)$

From the choices below select the best graph of $w'(t)$.

WARNING! This is worth three times as many points as a normal question and you get only one try.
Think. Sketch your own graph of $w'(t)$ first. Don't guess.

The graph below shows the electric potential in a circuit as a function of time. Potential, $V$, is in volts and time, $t$, is in seconds.
Answer the questions below.
Within the domain $0 \leq t \leq 7$, the rate of change appears to be zero at which times? Select all that apply.

- $t = 0$ sec
- $t = 1$ sec
- $t = 2$ sec
- $t = 3$ sec
- $t = 4$ sec
- $t = 5$ sec
- $t = 6$ sec
- $t = 7$ sec

- There are other times in the domain with zero rate of change.
- The rate of change is never zero in the domain.

Which of the following is true?

- $V'(3) > V'(7)$
- $V'(3) = V'(7)$
- $V'(3) < V'(7)$

Which of the following is true?

- $V'(1) < V'(5)$
- $V'(1) = V'(5)$
- $V'(1) > V'(5)$

From the choices below select the best graph of $V'(t)$.

WARNING! This is worth three times as many points as a normal question and you get only one try. Think. Sketch your own graph of $V'(t)$ first. Don't guess.
The function below shows the temperature of an object that is slowly thawing from frozen to room temperature. The object’s temperature, $T$, is in degrees Celsius and time, $t$, is in hours.

Answer the questions below.

Within the domain $0 \leq t \leq 7$, the rate of change appears to be zero at which times? Select all that apply.
Which of the following is true?

- $T'(0) > T'(1)$
- $T'(0) = T'(1)$
- $T'(0) < T'(1)$

Which of the following is true?

- $T'(1) < T'(5)$
- $T'(1) > T'(5)$
- $T'(1) = T'(5)$

From the choices below select the best graph of $V'(t)$.

**WARNING!** This is worth three times as many points as a normal question and you get **only one try**. Think. Sketch your own graph of $V'(t)$ first. Don't guess.
The graph below shows the height of an object bouncing on the end of an elastic band. Height, $h$, is in cm and time, $t$, is in seconds.

Sketch a graph of $h'(t)$. As usual, you should look for times when the velocity is zero. Also locate and compare different positive and negative velocities. Then select the best match from the choices below.

**WARNING!** This is worth three times as many points as a normal question and you get only one try.
The graph below shows the electric potential in a circuit as a function of time. Potential, $V$, is in volts and time, $t$, is in seconds. Use this graph and/or your graph of $V'(t)$ from earlier in this assignment to answer the questions below.

Within the domain $0 \leq t \leq 7$, when does the maximum (largest positive) rate of change occur? Select all that apply.

- $t = 0$ sec
- $t = 1$ sec
- $t = 2$ sec
- $t = 3$ sec
- $t = 4$ sec
- $t = 5$ sec
- $t = 6$ sec
- $t = 7$ sec
- The maximum rate of change occurs at times not listed above.
- There is no maximum rate of change in the domain.

Within the domain $0 \leq t \leq 7$, when does the minimum (most negative) rate of change occur? Select all that apply.
An object attached to a spring is moving back and forth. The position of the object, measured from a fixed reference point, is a function of time as shown in the table below. Position, \( x \), is measured in cm and time, \( t \), is measured in seconds.

| \( t \) (sec) | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | 5.5 | 6.0 | 6.5 | 7.0 | 7.5 | 8.0 |
|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| \( x \) (cm)  | 0   | 6   | 11  | 14  | 15  | 14  | 11  | 6   | 0   | -6  | -11 | -14 | -15 | -14 | -11 | -6  | 0   |

Using methods from the first week of class, estimate the velocity at time \( t = 0.5 \) seconds. Tolerances are set so that you must make reasonable use of the data. Include correct units.

\[ x'(0.5) = \]

Repeat this until you fill in the table of \( x' \) values below. Tolerances are similar. Do not include units. The table header has them.

<table>
<thead>
<tr>
<th>( t ) (sec)</th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
<th>3.0</th>
<th>3.5</th>
<th>4.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x' ) (cm/s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( t ) (sec)</th>
<th>4.5</th>
<th>5.0</th>
<th>5.5</th>
<th>6.0</th>
<th>6.5</th>
<th>7.0</th>
<th>7.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x' ) (cm/s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Locate the earliest time when the velocity of the object is zero. You only get three tries.


Locate a second time when the velocity of the object is zero. Only three tries.


When does the minimum (most negative) velocity occur? Only three tries


What is the minimum velocity? Only three tries.


7. Question Details

An object is cooling off. Its temperature in Fahrenheit is measured at 5 minute intervals as shown below.

<table>
<thead>
<tr>
<th>$t$ (min)</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T$ (deg F)</td>
<td>60.0</td>
<td>44.2</td>
<td>34.7</td>
<td>28.9</td>
<td>25.4</td>
<td>23.3</td>
<td>22.0</td>
<td>21.2</td>
<td>20.7</td>
<td>20.4</td>
<td>20.3</td>
<td>20.2</td>
<td>20.1</td>
</tr>
</tbody>
</table>

Compute the rate of change of temperature at all times in the table below. Do not include units. Be accurate to one decimal place.

<table>
<thead>
<tr>
<th>$t$ (min)</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{dT}{dt}$ (deg F/min)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Find an instant in time when the object is cooling at a rate of $-0.9$ degrees per minute. You only get three tries.

Find the temperature at the instant when it is cooling at a rate of $-1.5$ degrees per minute. You only get three tries. Units not required.

How fast is it cooling off at the instant the temperature is 22 degrees? Three tries. Units not required.

8. Question Details

An object is launched straight up. Its height as a function of time is given in the table below.

<table>
<thead>
<tr>
<th>$t$ (s)</th>
<th>0.0</th>
<th>0.1</th>
<th>0.2</th>
<th>0.3</th>
<th>0.4</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>0.8</th>
<th>0.9</th>
<th>1.0</th>
<th>1.1</th>
<th>1.2</th>
<th>1.3</th>
<th>1.4</th>
<th>1.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$h$ (m)</td>
<td>5.00</td>
<td>5.65</td>
<td>6.20</td>
<td>6.66</td>
<td>7.02</td>
<td>7.28</td>
<td>7.44</td>
<td>7.50</td>
<td>7.46</td>
<td>7.33</td>
<td>7.10</td>
<td>6.77</td>
<td>6.34</td>
<td>5.82</td>
<td>5.20</td>
<td>4.48</td>
</tr>
</tbody>
</table>

Use any methods on this problem. But note that you are limited to only three tries on each question.

Find an instant in time when the velocity is zero.

Find an instant in time when the velocity is 2.1 m/s.

Find the height at the instant when the velocity is -7.2 m/s.

Find the velocity at the instant the height is 7.1 meters and the object is headed downward.
Assignment Score
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Question Part Score
Solution
Mark
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