Instructions

- Read today's Notes and Learning Goals
- As usual, numerical questions will allow 100 submissions.
- Multiple choice and matching questions will be much more limited. Think carefully before you submit. Maybe discuss your answers with other students.

1. Question Details

A stone is tossed in the air from ground level with an initial velocity of 20 m/s. Its height at time \( t \) is \( h(t) = 20t - 4.9t^2 \) m.

Compute the stone's average velocity over the time interval [0.5, 2.5]. Include units in your answer.

2. Question Details

A stone is tossed into the air from ground level with an initial velocity of 33 m/s. Its height at time \( t \) is

\[ h(t) = 33t - 4.9t^2 \text{ meters (m)} \]

Compute the stone's average velocity over the time intervals \([2, 2.1]\), \([2, 2.01]\), \([2, 2.001]\), and \([1.9, 2]\), \([1.99, 2]\), \([1.999, 2]\). Round all answers to three decimal places and always include units.

<table>
<thead>
<tr>
<th>( t ) interval</th>
<th>([2, 2.1])</th>
<th>([2, 2.01])</th>
<th>([2, 2.001])</th>
</tr>
</thead>
<tbody>
<tr>
<td>average ROC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( t ) interval</th>
<th>([1.9, 2])</th>
<th>([1.99, 2])</th>
<th>([1.999, 2])</th>
</tr>
</thead>
<tbody>
<tr>
<td>average ROC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Estimate the instantaneous velocity \( v \) at \( t = 2 \). Round answer to one decimal place.

\( v \approx \)
3. Question Details

With an initial deposit of $100, the balance in a bank account after $t$ years is

$$f(t) = 100(1.07)^t$$

dollars

What are the units of the rate of change of $f(t)$?

- years
- years per dollar
- dollars per year
- dollars
- none of the above

Estimate the instantaneous rate of change at $t = 0.5$ years by computing the average rate of change on small intervals both to the left and to the right of $t = 0.5$.

a. Intervals to the left of $t = 0.5$. Round answers to three decimal places.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Average Rate of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>[0,0.5]</td>
<td></td>
</tr>
<tr>
<td>[0.4,0.5]</td>
<td></td>
</tr>
<tr>
<td>[0.49,0.5]</td>
<td></td>
</tr>
</tbody>
</table>

b. Intervals to the right of $t = 0.5$. Round answers to three decimal places.

<table>
<thead>
<tr>
<th>Interval</th>
<th>Average Rate of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>[0.5,1]</td>
<td></td>
</tr>
<tr>
<td>[0.5,0.6]</td>
<td></td>
</tr>
<tr>
<td>[0.5,0.51]</td>
<td></td>
</tr>
</tbody>
</table>

c. Use the above to estimate the instantaneous rate of change at $t = 0.5$ (rounded to two decimal places).

4. Question Details

The table below gives the height, $h$, of a falling object (in meters) at various times, $t$ (in seconds).

<table>
<thead>
<tr>
<th>$h$ (m)</th>
<th>47.69</th>
<th>47.01</th>
<th>46.24</th>
<th>45.39</th>
<th>44.47</th>
<th>43.46</th>
<th>42.38</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t$ (s)</td>
<td>0.7</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
<td>1.1</td>
<td>1.2</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Compute the average velocity of the object on each of the following intervals. Use two decimal places of accuracy for each average velocity.

1. [0.7,1.0]
2. [0.8,1.0]
3. [0.9,1.0]
4. [1.0,1.1]
5. [1.0,1.2]
6. [1.0,1.3]

7. Estimate the instantaneous velocity when $t = 1$ s. Be accurate to at least one decimal place.
Note: As in previous matching problems, your submissions are limited. You can see how many submissions remain by clicking on the "+" next to the question number.

The figure below shows a function, \( h(t) \), and four lines labeled A, B, C and D. Here \( h \) is the height of an object in meters and \( t \) is time in seconds. Each line corresponds to a velocity (perhaps instantaneous; perhaps average.) Match the letters to the appropriate velocities below. Put the letter E on the velocity that does not correspond to any line.

![Graph](image_url)

- **Velocity at \( t = 2 \) s**
- **Instantaneous velocity at \( t = 1 \) s**
- **Velocity on \([1,3]\)**
- **Instantaneous velocity when \( t = 3 \) s**
- **Average velocity on \([1,2]\)**
6. Question Details

An object is thrown upward. Its height is a function of time, \( h(t) \) as shown in the table below.

<table>
<thead>
<tr>
<th>( t ) (s)</th>
<th>0.00</th>
<th>0.25</th>
<th>0.50</th>
<th>0.75</th>
<th>1.00</th>
<th>1.25</th>
<th>1.50</th>
<th>1.75</th>
<th>2.00</th>
<th>2.25</th>
<th>2.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>( h ) (ft)</td>
<td>0</td>
<td>19</td>
<td>36</td>
<td>51</td>
<td>64</td>
<td>75</td>
<td>84</td>
<td>91</td>
<td>96</td>
<td>99</td>
<td>100</td>
</tr>
</tbody>
</table>

Graph the function on the domain \( 0 \leq t \leq 2.5 \) seconds. After your graph is complete answer the following questions:

**WARNING:** You only get one try on each question. Discuss your answers with a study partner before you submit!

1. As time passes, is the height increasing or decreasing?
   - Decreasing
   - Increasing

2. As time passes, is the the object speeding up or slowing down?
   - Speeding up
   - Slowing down

3. At which time is the height greater: \( t = 1 \) second or \( t = 2 \) seconds?
   - 1 sec
   - 2 sec

4. At which time is the velocity greater: \( t = 1 \) second or \( t = 2 \) seconds?
   - 2 sec
   - 1 sec

7. Question Details

The graph represents the position of a moving particle as a function of time \( t \). If the instantaneous velocities of the particle at \( t = 1, 2, \) and \( 3 \) are \( v_1, v_2, \) and \( v_3 \), respectively, arrange the values of \( 0, v_1, v_2, v_3 \), in increasing order.

- \( v_1 < 0 < v_3 < v_2 \)
- \( v_2 < 0 < v_1 < v_3 \)
- \( v_1 < 0 < v_2 < v_3 \)
- \( v_1 < v_3 < 0 < v_2 \)
- \( v_2 < v_3 < 0 < v_1 \)
- \( v_1 < v_2 < 0 < v_3 \)
The graphs below represent the position $s$ of a particle as a function of time $t$. Match each graph with one of the following statements about the particle's movement.

- speeding up
- speeding up and then slowing down
- slowing down
- slowing down and then speeding up

(A) \hspace{3cm} (B) \hspace{3cm} (C) \hspace{3cm} (D)
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