Instructions

- This assignment is extra credit.
- Each problem is an application that either uses derivatives or uses integrals. It's your job to decide which.
- The problems are not organized or ordered by type or difficulty.
- Study tip: Work with a partner. Read each problem and decide if it uses integrals or derivatives. Discuss how you would plan the solution.

1. Question Details

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

<table>
<thead>
<tr>
<th>$h$ (ft)</th>
<th>70</th>
<th>69</th>
<th>66</th>
<th>61</th>
<th>54</th>
<th>46</th>
<th>37</th>
<th>27</th>
<th>17</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t$ (s)</td>
<td>0.00</td>
<td>0.25</td>
<td>0.50</td>
<td>0.75</td>
<td>1.00</td>
<td>1.25</td>
<td>1.50</td>
<td>1.75</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Compute $\frac{dh}{dt}$ at the instant when $t = 0.5$ seconds. Round your answer to the nearest whole number. Include units.

$\frac{dh}{dt} \bigg|_{t=0.5} = \boxed{\_\_\_\_\_\_\_\_}$

2. Question Details

The potential across a capacitor is given by

$$V(t) = 12 - 12e^{-1.13t}$$

where $V$ is measured in volts and $t$ is time in seconds. When is the potential changing at 4 volts per second? Be accurate to 2 decimal places. Include units.
3. A projectile is launched straight up. Its height, \( h \), is measured in meters. Time, \( t \), is in seconds. The graph below shows the rate of change of \( h \) in units of meters per second.

If \( h(0) = 20 \) m, what is \( h(5) \)? Give an exact decimal answer with correct units.

\[
h(5) = \quad \text{m}
\]

4. A falling object has height given by \( h(t) = 1200 - 16.1t^2 \) ft, with \( t \) in seconds. How high is it when its velocity is \(-250\) ft/s? Be accurate to one decimal place. Include units.

\[
\quad \text{ft}
\]
5. The function $f(t)$ measures the price of a commodity during one day of trading. The units on $f$ are dollars per pound ($/lb), and $t$ is time in hours.

The graph shows the price change over time. To find the rate of change at the instant when the price is $5 /lb, you need to use the graph.

NOTE: You can use "$" to abbreviate "dollars" in WebAssign units, but you can't put the $-sign in front of the number like you would for American currency. Click here for more info.

6. The table below gives the rate of change of temperature of a cooling object. Temperature, $T$, is measured in Kelvins (K), and time, $x$, is in minutes.

<table>
<thead>
<tr>
<th>$\frac{dT}{dx}$ (K/min)</th>
<th>-3.8</th>
<th>-2.6</th>
<th>-1.8</th>
<th>-1.2</th>
<th>-0.8</th>
<th>-0.6</th>
<th>-0.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x$ (min)</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
</tbody>
</table>

Find the total change in temperature on the time interval $0 \leq x \leq 30$ minutes. Tolerances are wide, but not ridiculous.

7. The potential across a capacitor is given by

$$V(t) = 12 - 12e^{-1.13t}$$

where $V$ is measured in volts and $t$ is time in seconds. At the instant $t = 2$ seconds, find the rate of change of $\frac{dV}{dt}$.

Be accurate to 2 decimal places. Include units.
8. An object is moving up and down with velocity given by
\[ v(t) = -195 \sin(7.8t) \]
where \( v \) is measured in cm per second and \( t \) is time in seconds. (The object is a yo-yo). Its height at time zero is \( h(0) = 100 \) cm. Compute \( h(0.3) \). Be accurate to one decimal place. Include units.
\[ h(0.3) = \]

9. A projectile is launched straight up. Its height, \( h \), is measured in meters. Time, \( t \), is in seconds. The graph below shows the rate of change of \( h \) in units of meters per second.

Compute the total change in height during the time interval \( 2 \leq t \leq 5 \) seconds. Give an exact answer with correct units.
\[ \Delta h = \]

10. A falling object has height given by \( h(t) = 1200 - 16.1t^2 \) ft, with \( t \) in seconds. What is the rate of change of height at the instant \( t = 3 \) s? Be accurate to one decimal place. Include units.
The function \( f(t) \) measures the price of a commodity during one day of trading. The units on \( f \) are dollars per pound (\$/lb), and \( t \) is time in hours.

When is the rate of change of the price exactly zero? Tolerances are reasonable, but you will have to use some care reading the graph.

A falling object has height given by \( h(t) = 1200 - 16.1t^2 \) ft, with \( t \) in seconds. When is its velocity \(-100\) ft/s? Be accurate to 3 decimal places. Include units.

The potential across a capacitor is given by
\[
V(t) = 12 - 12e^{-1.13t}
\]
where \( V \) is measured in volts and \( t \) is time in seconds. Find \( V'(t) \) at the instant when \( V(t) = 6 \) volts. Be accurate to two decimal places. Include units.

An object is moving up and down with velocity given by
\[
v(t) = -195\sin(7.8t)
\]
where \( v \) is measured in cm per second and \( t \) is time in seconds. (The object is a yo-yo). Find the rate of change of velocity at the instant \( t = 0.5 \) seconds. Be accurate to one decimal place. Include units.
15. Question Details

A projectile is launched straight up. Its height, \( h \), is measured in meters. Time, \( t \), is in seconds. The graph below shows the rate of change of \( h \) in units of meters per second.

\[ h' \ (\text{m/s}) \]

If \( h(0) = 20 \) meters, what is the maximum height? Give an exact answer with units.

\[ h_{\text{max}} = \]

16. Question Details

The price of a certain commodity is expected to change at a rate of

\[ \frac{dP}{dt} = \frac{15 \ (0.5t + 1)^2}{\text{$/lb/day}} \]

It is currently priced at 8 \$/lb. Predict the price 10 days from now.

17. Question Details

Suppose that \( \sin \theta = \frac{x}{z} \). In this problem:

- \( x \), \( z \) and \( \theta \) are all functions of time, \( t \).
- \( x \) and \( z \) are measured in miles; \( \theta \) in radians, and \( t \) in hours.
- \( \frac{dx}{dt} = -60 \text{ mph.} \)

Find \( \frac{d\theta}{dt} \) when \( z = 2 \) miles, \( \theta = \frac{\pi}{6} \), and \( \frac{dz}{dt} = -55 \text{ mph.} \)

Be accurate to two decimal places. Include units.

18. Question Details

A falling object has height given by \( h(t) = 1200 - 16.1t^2 \) ft, with \( t \) in seconds. What is the rate of change of velocity at the instant \( t = 3 \) s? Be accurate to one decimal place. Include units.
19. A projectile is launched straight up. Its height, \( h \), is measured in meters. Time, \( t \), is in seconds. The graph below shows its velocity in meters per second.

Find the rate of change of velocity at the instant \( t = 2 \) seconds. Give an exact answer with units.

20. An object is moving up and down with velocity given by
\[
v(t) = -195 \sin(7.8t)
\]
where \( v \) is measured in cm per second and \( t \) is time in seconds. (The object is a yo-yo).
Find the rate of change of height at the instant \( t = 0.5 \) seconds. Be accurate to one decimal place. Include units.
21. Question Details

The function $f(t)$ measures the price of a commodity during one day of trading. The units on $f$ are dollars per pound ($/lb), and $t$ is time in hours.

What is the price at the instant when $f'(t) = 0$? Tolerances are reasonable, but you will have to use some care reading the graph.

NOTE: You can use "$" to abbreviate "dollars" in WebAssign units, but you can't put the $-sign in front of the number like you would for American currency. Click here for more info.

22. Question Details

The price of a certain commodity is expected to change at a rate of

$$\frac{dP}{dt} = \frac{15}{(0.5t+1)^2} \text{ $/lb/day}$$

How much will the price change during the time interval $0 \leq t \leq 5$ days? Round your answer to the nearest penny/lb.

23. Question Details

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

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When is the velocity of the object $-30$ ft/s? Round to the nearest quarter of a second.
The table below gives the rate of change of temperature of a cooling object. Temperature, $T$, is measured in Kelvins (K), and time, $x$, is in minutes.

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<td>20</td>
<td>25</td>
<td>30</td>
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</table>

Assuming that $T(0) = 350$ K, estimate $T(30)$.

NOTE: WebAssign will only accept "K" for Kelvins. Don't try any other abbreviations or unit conversions. Tolerances are wide, but not ridiculous.

$T(30) =$