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**Instructions**
Read today's [Notes and Learning Goals](#)
A model rocket is launched straight upward. During the first four seconds of powered flight, its height is given by

\[ h(t) = 16.1t^2 - 1.75t^3 \quad 0 \leq t \leq 4 \]

with \( t \) in seconds and \( h \) in feet. Answer the following questions. Round all answers to two decimal places. Include correct units.

a. How high is the rocket when \( t = 3 \) seconds?
   
   [ ]

b. What is the velocity of the rocket when \( t = 2 \) seconds?
   
   [ ]

c. What is the acceleration of the rocket when \( t = 1 \) second?
   
   Acceleration is the rate of change of velocity.
   
   [ ]

d. Find a time during the powered flight, but not \( t = 0 \), when the acceleration is zero.
   
   [ ]

e. How high is the rocket at the instant it is accelerating at 10 ft/s\(^2\)?
   
   [ ]

f. When the rocket is moving at 35 ft/s, how fast is its velocity changing?
   
   [ ]
The height of a moving object is given by \( h(t) = 3.0 + 2.7 \sin(1.3t + 0.9) \) where \( t \) is measured in seconds and \( h \) is measured in feet. Answer the following questions. Round all answers to three decimal places. Include correct units.

a. Find the velocity of the object at the instant when \( t = 4 \) seconds.

b. Find the first instant after \( t = 0 \) when the velocity is 0.

c. Find the next instant in time when the velocity is 0.

d. Find the acceleration at the first instant \( t > 0 \) the height is 4 feet.

The height of an object is given by \( h(t) = 3 + 2 \cos(kt) \) where \( t \) is measured in seconds, \( h \) is measured in feet, and \( k > 0 \) is an unknown constant. If the acceleration of this object at \( t = 0 \) is \(-5.5 \text{ ft/s}^2\), find the velocity of this object at \( t = 1.5 \) seconds. Round answer to two decimal places and include correct units.
A projectile is launched straight upward. Its height, \( h \), in feet, is a function of time, \( t \), in seconds. Its velocity is

\[
\frac{dh}{dt} = 100 - 32t \text{ ft/sec.}
\]

a. Write a formula for all possible height functions by guessing an antiderivative of the above formula. Include +C for an unknown constant.

\[ h(t) = \]

b. You know that the height at time \( t = 2 \) seconds is 160 feet. Use this to find the value of the unknown constant \( C \).

\[ C = \]

c. Find a formula for \( h(t) \).

\[ h(t) = \]
The current in a circuit, \( i \), is a function of time, \( t \), with \( i \) in amperes and \( t \) in seconds.
The rate of change of current is
\[
\frac{di}{dt} = 210\sin(17.5t) \text{ amps/sec.}
\]
The initial value for current is \( i(0) = 0 \).

a. Find the formula for the rate of change of the rate of change of the current.
\[
\frac{d^2i}{dt^2} = \ldots
\]

b. Find the formula for \( i(t) \) in two steps.
   I. Find a formula for all possible current functions by guessing an antiderivative. Include +C for an unknown constant.
   \[
i(t) = \ldots
\]
   II. Use the initial condition, \( i(0) = 0 \), to find the unknown constant and give the formula for \( i(t) \).
   \[
i(t) = \ldots
\]

c. What is the current when \( t = 0.5 \) seconds? Be accurate to two decimal places.
\[
\ldots
\]
d. Find the first time after \( t = 0 \) when the current is zero again. Be accurate to three decimal places.
\[
\ldots
\]
e. How fast is \( \frac{di}{dt} \) changing at the instant \( t = 0.5 \) seconds? Be accurate to the nearest whole number.
\[
\ldots
\]
A falling object has acceleration given by

\[ a(t) = -9.8e^{-0.2t} \text{ m/s}^2, \text{ and} \]

Its initial velocity is

\[ v(0) = 0 \text{ m/s}. \]

Its initial height is

\[ h(0) = 3000 \text{ m}. \]

a. Find the velocity function.

\[ v(t) = \]

b. Find the height function.

\[ h(t) = \]
A object is heating up. Its temperature, $T$, is a function of time, $t$, with $T$ in kelvin and $t$ in minutes. Suppose you know that:

$$\frac{d^2T}{dt^2} = -1.17e^{-0.15t} \text{ K/min}^2,$$

$$\left.\frac{dT}{dt}\right|_{t=0} = 7.80 \text{ K/min}, \text{ and}$$

$$T(0) = 298 \text{ K}.$$

a. Find a formula for $\frac{dT}{dt}$.

$$\frac{dT}{dt} =$$

b. What is the temperature of the object at the instant $t = 20$ min? Be accurate to two decimal places.

$$=$$

c. When does the temperature reach 345 K? Be accurate to two decimal places.

$$=$$
8. Question Details

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with \( t \) in seconds and \( h \) in feet. Answer the following questions. All questions are high stakes with only one submission allowed.

a. During the powered flight, is the velocity ever negative?
   
   - No
   - Yes

b. During the powered flight, is the velocity ever decreasing?
   
   - No
   - Yes

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9. Question Details

A model rocket is launched straight upward. During the first four seconds of powered flight its height is given by

\[ h(t) = 16.1t^2 - 1.75t^3 \quad 0 \leq t \leq 4 \]

with \( t \) in seconds and \( h \) in feet. At the instant when \( t = 4 \) seconds, the fuel cuts off. From that point in time onward, the rocket has constant acceleration of -32.2 ft/s\(^2\). When does it hit the ground? Be accurate to three decimal places.

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Assignment Details

Name (AID): Higher Order Derivatives: Applications (10862449)  
Submissions Allowed: 100  
Feedback Settings  
Before due date