1. Question Details

Consider the function

\[ f(x) = e^{-(5 - 3x)^2} \]

Find the derivative of this function

\[ \frac{df}{dx} = \]

2. Question Details

A crate of supplies is dropped from an airplane at an altitude of 3000 meters. Its height, as a function of time, is

\[ h(t) = 3300 - 54t - 300e^{-0.18t} \]

where \( h \) is in meters and \( t \) is in seconds. Answer the following questions. All answers must have correct units.

1. What is the height of the crate at the instant when its velocity is \(-40 \text{ m/s}\)? Be accurate to the nearest meter.

2. The crate has a parachute system that is set to open when the crate reaches the height of 2000 meters. At that instant, how fast is it moving? Be accurate to one decimal place.

3. Suppose the chute never opens. What is the fastest speed that the crate can possibly attain? Be accurate to one decimal place.

   NOTE: This is a question about all possible velocities. One way to approach it would be to compute velocity as a function of time, and then graph the velocity function.

4. The speed you computed in the previous part is called **terminal velocity**. Suppose that the parachute system is set to deploy when the crate reaches 90% of terminal velocity. How high will the crate be when it deploys? Be accurate to the nearest meter.

3. Question Details

The line \( y = kt \) is tangent to the function \( f(t) = 2^t \). Determine the value of the unknown constant \( k \), accurate to 2 decimal places.

**Hint:** The following derivative could be useful:

\[ \frac{d}{dt}(2^t) = \ln(2) \cdot 2^t \]

\[ k = \]

Assignment Details

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