FALLING OBJECT MODEL  When an object is dropped, the speed with which it falls continues to increase. Ignoring air resistance, its height \( h \) can be approximated by the falling object model.

**Falling object model:** \( h = -16t^2 + s \)

Here \( h \) is measured in feet, \( t \) is the number of seconds the object has fallen, and \( s \) is the initial height from which the object was dropped.

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**Example 4  Write a Falling Object Model**

An engineering student is a contestant in an egg dropping contest. The goal is to create a container for an egg so it can be dropped from a height of 32 feet without breaking. Write a model for the egg’s height. Disregard air resistance.

**Solution**

The initial height is \( s = 32 \) feet.

\[
\begin{align*}
\frac{h}{H11005/H11002} &= 16\frac{t}{H11001}^2 + \frac{s}{H11005/H11002} \\
\frac{h}{H11005/H11002} &= 16\frac{t}{H11001}^2 + 32 \\
\end{align*}
\]

**ANSWER**  The falling object model for the egg is \( h = -16t^2 + 32 \).

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**Example 5  Use a Falling Object Model**

How long will it take the egg container in Example 4 to reach the ground? Round your solution to the nearest tenth.

**Solution**

Ground level is represented by \( h = 0 \) feet. To find the time it takes for the egg to reach the ground, substitute 0 for \( h \) in the model and solve for \( t \).

\[
\begin{align*}
\frac{h}{H11005/H11002} &= -16\frac{t}{H11001}^2 + 32 \quad &\text{Write falling egg model from Example 4.} \\
0 &= -16\frac{t}{H11001}^2 + 32 \quad &\text{Substitute 0 for } h. \\
-32 &= -16\frac{t}{H11001}^2 \quad &\text{Subtract 32 from each side.} \\
2 &= \frac{t}{H11001}^2 \quad &\text{Divide each side by } -16. \\
\pm\sqrt{2} &= t \\
1.4 \approx t \\
\end{align*}
\]

**ANSWER**  The egg container will reach the ground in about 1.4 seconds.

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**Checkpoint**

Suppose the egg dropping contest in Example 4 requires the egg to be dropped from a height of 64 feet.

8. Write a falling object model for the egg container when \( s = 64 \).

9. According to the model, how long will it take the egg container to reach the ground?