1. Jennifer Lawrence receives a bonus. If she invests her money at an interest rate of 7.2% compounded continuously, how long does it take her to double her original investment? (Comparing this problem to the problem you just had on your quiz, what do you think we are trying to get you to notice by asking this question?)

\[ 2A = A \times (1.072)^n \]
\[ n = 9.63 \text{ years} \]

### Instantaneous Rate of Change

<table>
<thead>
<tr>
<th>Method 1</th>
<th>Method 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \lim_{h \to 0} \frac{f(a + h) - f(a)}{h} )</td>
<td>( \lim_{b \to a} \frac{f(b) - f(a)}{b - a} )</td>
</tr>
</tbody>
</table>

2. The distance in feet of an object from a starting point is given by \( s(t) = 2t^2 - 5t + 10 \), where \( t \) is time in seconds.

a) Find the average velocity of the object from 2 seconds to 4 seconds. Recall that velocity is the rate of change of distance, i.e., velocity = distance/time.

b) Using Method 1, find the instantaneous velocity at 4 seconds.

c) Using Method 2, find the instantaneous velocity at 4 seconds.

\[
\begin{align*}
\text{(a)} & \quad \text{Average velocity} = \frac{s(4) - s(2)}{4 - 2} = \frac{12 - (-2)}{2} = 7 \\
\text{(b)} & \quad \lim_{h \to 0} \frac{f(4 + h) - f(4)}{h} = \lim_{h \to 0} \frac{2(4 + h)^2 - 5(4 + h) - 52}{h} = 11 \\
\text{(c)} & \quad \lim_{b \to 4} \frac{2b^2 - 5b + 40 - 52}{b - 4} = \lim_{b \to 4} \frac{2b^2 - 5b - 12}{b - 4} = \lim_{b \to 4} (2b + 3) = 11
\end{align*}
\]
3. The cost to transport a mobile home depends on the distance, $x$ in miles that the home is moved. Let $C(x)$ represent the cost to move a mobile home $x$ miles. One firm charges as follows.

<table>
<thead>
<tr>
<th>Cost per mile</th>
<th>Distance in Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>$84.00$</td>
<td>$0 &lt; x \leq 150$</td>
</tr>
<tr>
<td>$83.00$</td>
<td>$150 &lt; x \leq 400$</td>
</tr>
<tr>
<td>$82.50$</td>
<td>$400 &lt; x$</td>
</tr>
</tbody>
</table>

Find the cost to move a mobile home the following distances:
- a) 130 miles
- b) 150 miles
- c) 210 miles
- d) 400 miles
- e) 500 miles
- f) Where is the graph of $C(x)$ discontinuous?

(a) $130 \times 4 = 520$  (b) $150 \times 4 = 600$  (c) $210 \times 3 = 630$

(d) $400 \times 3 = 1200$  (e) $500 \times 2.5 = 1250$

(f) $A \pm x = 150, 400$. These two points are discontinuous.

4. The revenue (in thousands of dollars) from producing $x$ units of an item is

$$R(x) = 10x - 0.002x^2$$

a) Find the average rate of change of revenue when production is increased from 1000 to 1001 units.

b) Find and interpret the instantaneous rate of change of revenue when 1000 units are produced. (This number is called the marginal revenue at $x = 1000$)

c) Find the additional revenue if production is increased from 1000 to 1001 units.

d) Compare your answers for parts a, b, and c. What do you find?

(a) \[
\frac{R(1001) - R(1000)}{1001 - 1000} = 10 - 0.002(1001)^2 + 0.002(1000)^2 = 5.998
\]

(b) \[
\lim_{h \to 0} \frac{R(1000 + h) - R(1000)}{h} = \lim_{h \to 0} \frac{10000 + (10h - 0.002)(1000 + h)^2}{h}
\]

(c) \[
R(1001) - R(1000) = 5.998
\]

d: part (a) and (c) are the same.