• Suppose you put $1 million in a savings account, earning 100% interest annually.
  In one year you will have $P = 1(2)^1 = 2$ million.

• Suppose you put $1 in a savings account, earning 100% annual interest compounded monthly.
  In one year you will have $P = 1(1.0833)^{12} = 2.6121$ million.

• Suppose you put $1 in a savings account, earning 100% annual interest compounded daily.
  In one year you will have $P = 1(1 + \frac{1}{365})^{365} = 1(1.0027397)^{365} = 2.71454$ million.

• Suppose you put $1 in a savings account, earning 100% annual interest compounded 1000 times in the year.
  In one year you will have $P = 1(1 + \frac{1}{1000})^{1000} = 1(1.001)^{1000} = 2.7169$ million.

• Suppose you put $1 in a savings account, earning 100% annual interest compounded infinitely many times in the year.
  In one year you will have $P = 1(1 + \frac{1}{n})^n$ as $n \to \infty = e \approx 2.718$ million.
• 1.6.38
What continuous percent growth rate is equivalent to an annual percent growth rate of 10%?

• 1.6.37
What annual percent growth rate is equivalent to a continuous percent growth rate of 8%
Section 1.7

Exponential Growth and Decay
The **doubling time** of an exponentially increasing quantity is the time required for the quantity to double.  
The **half-life** of an exponentially decaying quantity is the time required for the quantity to be reduced by a factor of one half.

1. The half-life of nicotine in the blood is 2 hours. A person absorbs 0.4 mg of nicotine by smoking a cigarette. Fill in the following table with the amount of nicotine remaining in the blood after $t$ hours. Estimate the length of time until the amount of nicotine is reduced to 0.04 mg.

<table>
<thead>
<tr>
<th>$t$ (hours)</th>
<th>0</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nicotine (mg)</td>
<td>0.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Problem 1**
Based on the table, determine the hourly rate of decay of nicotine in the bloodstream.
Recall that the half-life is 2 hours.
An amount $P_0$ is deposited in an account paying interest at a rate of $r$ per year. Let $P$ be the balance in the account after $t$ years.

- If interest is compounded annually, then $P = P_0(1 + r)^t$.
- If interest is compounded continuously, then $P = P_0e^{rt}$, where $e = 2.71828$.

5. You invest $5000$ in an account which pays interest compounded continuously.

(a) How much money is in the account after 8 years, if the annual interest rate is 4%?

(b) If you want the account to contain $8000$ after 8 years, what yearly interest rate is needed?

Problem 5