Exponential Growth & Decay
Homework

Use the output ratio to find the growth/decay factor, determine if the table shows growth or decay, then identify the initial value, and write an exponential equation for the table.

1. **Growth**

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>144</td>
</tr>
<tr>
<td>3</td>
<td>864</td>
</tr>
<tr>
<td>4</td>
<td>5184</td>
</tr>
</tbody>
</table>

\[
\frac{144}{24} = 6
\]

Factor: 6  
Rate: 5  
Initial value: 4

**Eq:** \( y = 4(6)^x \)

2. **Growth**

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>2</td>
<td>0.605</td>
</tr>
<tr>
<td>3</td>
<td>0.6655</td>
</tr>
<tr>
<td>4</td>
<td>0.73205</td>
</tr>
<tr>
<td>5</td>
<td>0.80526</td>
</tr>
</tbody>
</table>

\[
\frac{0.6655}{0.605} = 1.1
\]

Factor: 1.1  
Rate: 0.1  
Initial value: 0.5

**Eq:** \( y = 0.5(1.1)^x \)

3. **Growth**

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>1.2</td>
</tr>
<tr>
<td>3</td>
<td>43.2</td>
</tr>
<tr>
<td>4</td>
<td>259.2</td>
</tr>
<tr>
<td>5</td>
<td>1555.2</td>
</tr>
<tr>
<td>6</td>
<td>9331.2</td>
</tr>
</tbody>
</table>

\[
\frac{259.2}{43.2} = 6
\]

Factor: 6  
Rate: 5  
Initial value: 0.2

**Eq:** \( y = 0.2(6)^x \)

4. **Decay**

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5</td>
<td>200000</td>
</tr>
<tr>
<td>-4</td>
<td>20000</td>
</tr>
<tr>
<td>-3</td>
<td>2000</td>
</tr>
<tr>
<td>-2</td>
<td>200</td>
</tr>
<tr>
<td>-1</td>
<td>20</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

\[
\frac{20000}{200000} = 0.1
\]

Factor: 0.1  
Rate: \((1 - 0.1) = 0.9\)  
Initial value: 2

**Eq:** \( y = 2(0.1)^x \)

5. **Growth**

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1536</td>
</tr>
<tr>
<td>4</td>
<td>12288</td>
</tr>
<tr>
<td>5</td>
<td>98304</td>
</tr>
<tr>
<td>6</td>
<td>786432</td>
</tr>
</tbody>
</table>

\[
\frac{1536}{24} = 64
\]

Factor: 8  
Rate: 7  
Initial value: 3

**Eq:** \( y = 3(8)^x \)

6. **Decay**

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.04</td>
</tr>
<tr>
<td>3</td>
<td>0.008</td>
</tr>
<tr>
<td>4</td>
<td>0.0016</td>
</tr>
<tr>
<td>5</td>
<td>0.00032</td>
</tr>
</tbody>
</table>

\[
\frac{0.008}{0.04} = 0.2
\]

Factor: 0.2  
Rate: \(1 - 0.2 = 0.8\)  
Initial value: 1

**Eq:** \( y = 1(0.2)^x \)
Exponential Functions: Context

7. A car purchased for $24,000 is expected to lose value, or depreciate, at a rate of 8% per year. This situation can be modeled by \( y = 24,000 \cdot (0.92)^t \), where \( t \) is the number of years since the car was purchased. After how many years is the car first worth less than $15,000?

\[
\begin{array}{c|c|c|c|c}
\text{a) 4 years} & \text{b) 5 years} & \text{c) 6 years} & \text{d) 7 years} \\
4 & 5 & 6 & 7 \\
\end{array}
\]

8. A watch purchased for $1200 is expected to gain value at a rate of 5% per year. This situation can be modeled by \( y = 1200 \cdot (1.05)^t \), where \( t \) is the number of years since the car was purchased. After how many years is the car first worth more than $1800?

\[
\begin{array}{c|c|c|c|c}
\text{a) 7 years} & \text{b) 8 years} & \text{c) 9 years} & \text{d) 10 years} \\
7 & 8 & 9 & 10 \\
\end{array}
\]

9. A 500 mL puddle of water is evaporating at a rate of 4% per hour. Write a function that represents the amount of water in the puddle at a given time. Use \( x \) for hours and \( y \) for the amount of water left in the puddle.

\[
y = 500 (1 - 0.04)^x \\
y = 500 (0.96)^x
\]

10. Using the equation from the above problem, determine when the puddle will be reduced to half its original volume.

\[
y = 500 (0.96)^x
\]

\[
\begin{array}{c|c}
x & y \\
5 & 407.69 \\
10 & 332.42 \\
15 & 271.04 \\
16 & \text{260.20} \\
17 & \text{249.79} \\
\end{array}
\]

* The puddle is half its original volume after 17 hours.

11. A dust bunny gathers dust at a rate of 11% per week. The dust bunny originally weighs 0.7 oz. Write a function that represents the weight of the dust bunny at a given time. Use \( x \) for weeks and \( y \) for the weight of the dust bunny.

\[
y = 0.7 (1 + 0.11)^x \\
y = 0.7 (1.11)^x
\]

12. Find the weight of the dust bunny after 7 weeks.

\[
y = 0.7 (1.11)^7 \\
y = 1.45 \text{ oz}
\]