Unit # 4 Exponents Review

Exponent Rules

Rule 1: To Multiply Powers with the same base, keep the base and add the exponents.
\[ a^n \times a^m = a^{n+m} \]

\[ 5^2 \times 5^3 = 5^4 \]

Rule 2: To Divide Powers with the same base, keep the base and subtract the exponents.
\[ a^n \div a^m = a^{n-m} \]

\[ 3^4 \div 3^1 = 3^3 \]

Rule 3: Raising one Power to another Power, keep the base the same and multiply the exponents
\[ (a^n)^m = a^{n\cdot m} \]

\[ (2^2)^3 = 2^6 \]

\[ \left(\frac{3^3}{3^4}\right) = 3^3 \]

Rule 4: Anything to the exponent 0 is one \[ x^0 = 1 \]

Rule 5: The rule for negative exponents is \[ x^{-n} = \left(\frac{1}{x}\right)^n \]

\[ 5^{-1} = \frac{1}{5^1} \]

\[ 5^{-2} = \frac{1}{5^2} \]

Graphs and Tables of Exponential Relations

<table>
<thead>
<tr>
<th>x</th>
<th>(3^x)</th>
<th>((1/3)^x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>0.33</td>
<td>9</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>1/9</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
<td>1/27</td>
</tr>
</tbody>
</table>

Exponential Growth when 
\( b \) is bigger than 1

Exponential Decay when 
\( b \) is between 0 and 1
Exponential Growth and Decay

\[ y = A(b)^x \]

when growing \( b = 1 + \% \) divide \% by 100 first

when decaying \( b = 1 - \% \) divide \% by 100 first

Examples:

The projected populations, \( P \), of the city of Halifax can be modelled by \( P = 117000(1.018)^x \), after 2006.

a) What was the population in 2006?

b) What is the population predicted to be in 2020?

\[ x = 2020 - 2006 = 14 \]
\[ P = 117000(1.018)^{14} \approx 150195 \]

Guess & check \( x = 30 - 31 \) years

The deer population is decreasing by 5\% a year in Ontario. If the population is 2500 now, determine a model for the population in \( n \) years. Use your model to predict the population 10 years from now.

\[ P = A(b)^x \]
\[ P = 2500(0.95)^x \]
\[ P = 2500(0.95)^{10} \approx 1497 \]