Unit #4 Exponents Review

Exponent Rules

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

\[ (2^3)(2^2) = 2^5 \quad \text{Evaluate: } 32 \]

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

\[ \frac{2^3}{2^1} = 2^2 \quad \text{Evaluate: } 2 \]

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

\[ (3^3)^3 = 3^9 \quad \text{Evaluate: } 729 \]

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

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

\[ \frac{5^0}{1} = 1 \quad \text{Ex. } 2^{-2} = \frac{1}{2^2} = \frac{1}{4} \]

\[ (\frac{3}{2})^{-2} = (\frac{3}{2})^2 = \frac{9}{4} \]

Graphs and Tables of Exponential Relations

<table>
<thead>
<tr>
<th>x</th>
<th>(1/3)^x</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>9</td>
</tr>
<tr>
<td>-1</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Exponential Growth when
\[ b \text{ is bigger than } 1 \]

Exponential Decay when
\[ b \text{ is between } 0 \text{ and } 1 \]

\[ 0.33\left(\frac{1}{3}\right) \]
Exponential Growth and Decay

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

- 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 \( P = 117000(1.018)^t \), after 2006.

a) What was the population in 2006?

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

\[
P = 117000(1.018)^{14}
\]

\[
P = 150195
\]

2020 - 2006 = 14

Guess & Check: About 30 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.

\[
b = 1 - 0.05
\]

\[
b = 0.95
\]

\[
P = 2500(0.95)^n
\]

\[
P = 2500(0.95)^{10}
\]

\[
P = 1497
\]