Exponential Growth

Terminology:
The exponent or power or index (plural: indices) or order or logarithm is the small number written as a superscript to show how many times the main number (the base) is to be multiplied by itself.

Eg: $3^2 = 3 \times 3 = 9$ and $1.2^5 = 1.2 \times 1.2 \times 1.2 \times 1.2 \times 1.2 = 2.48832$

One of the most common uses of the exponential function is in compound interest. To calculate the amount owed at an interest rate of 20%, use the formula:

$$Debt = Original \times 1.2^n$$

where $n$ is the number of years

1. A credit card company charges 20% annual interest on loans. Complete the table to show how much you would owe over time if you borrowed £1000 initially:

<table>
<thead>
<tr>
<th>Years</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt</td>
<td>£1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This function can be written as:

$$y = 1000 \times 1.2^x$$

where $y$ is the amount of debt and $x$ is the number of years

2. Plot the graph of $y = 1000 \times 1.2^x$

3. Use the formula to fill in the following:

a) A normal credit card charges 20% interest.  
20% Credit Card Loan of £1000:

$$6\text{ years: }£\underline{\hspace{2cm}} \quad 12\text{ years: }£\underline{\hspace{2cm}}$$

(Add this point to your graph)

b) A £1000 bank loan charges just 5% interest. 
5% Bank Loan of £1000:

$$6\text{ years: }£\underline{\hspace{2cm}} \quad 12\text{ years: }£\underline{\hspace{2cm}}$$

c) £1000 invested in savings earns 2% interest. 
2% Savings of £1000:

$$6\text{ years: }£\underline{\hspace{2cm}} \quad 12\text{ years: }£\underline{\hspace{2cm}}$$
Exponential Growth SOLUTIONS

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The exponent or power or index (plural: indices) or order or logarithm is the small number written as a superscript to show how many times the main number (the base) is to be multiplied by itself.

Eg: \(3^2 = 3 \times 3 = 9\) and \(1.2^5 = 1.2 \times 1.2 \times 1.2 \times 1.2 \times 1.2 = 2.48832\)

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\[\text{Debt} = \text{Original} \times 1.2^n\]

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</tr>
</thead>
<tbody>
<tr>
<td>Debt</td>
<td>£1000</td>
<td>£1200</td>
<td>£1440</td>
<td>£1728</td>
<td>£2073.60</td>
<td>£2488.32</td>
<td>£2985.98</td>
</tr>
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This function can be written as:

\[y = 1000 \times 1.2^x\]

where \(y\) is the amount of debt and \(x\) is the number of years

2. Plot the graph of \(y = 1000 \times 1.2^x\)

3. Use the formula to fill in the following:

a) A normal credit card charges 20% interest.

20% Credit Card Loan of £1000:

6 years: £2985.98  12 years: £8916.10

(Add this point to your graph)

b) A £1000 bank loan charges just 5% interest.

5% Bank Loan of £1000:

6 years: £1340.10  12 years: £1795.86

c) £1000 invested in savings earns 2% interest.

2% Savings of £1000:

6 years: £1126.16  12 years: £1268.24