1. The equation for the table on the left is \( y = x + 33 \). The equation for the table on the right is \( y = 2^x \).

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td>2</td>
<td>27</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\text{\( x \)} & \quad \text{\( y \)} \\
5 & \quad 32 \\
6 & \quad 128 \\
7 & \quad 512 \\
8 & \quad 2048 \\
\end{align*}
\]

2. Evaluate \( y = -2(4)^x \) for \( x = -2 \) and \( x = 3 \). No decimals!

\[
\begin{align*}
\text{\( y = -2(4)^{-2} \)} & = -2 \left(\frac{1}{16}\right) \\
& = -\frac{1}{8} \\
\text{\( y = -2(4)^3 \)} & = -2(64) \\
& = -128 \\
\end{align*}
\]

3. Shawn buys a motorcycle. 5 years later he decides to sell it. He uses the following equation to determine his selling price:

\[ Y = 4500(0.83)^5. \]

Describe what each value in the equation represents:

- **4500** initial price of motorcycle
- **5** number of years

What is the decay factor? \( 0.83 \)

What is the rate of depreciation? \( 17\% \).
4. Make a table of values and graph \( f(x) = 2\left(\frac{1}{4}\right)^x \) and \( h(x) = 0.5 \cdot 2^x \). Where do they intersect? (estimate, then use a graphing calculator for the exact value)

<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td>( 2(\frac{1}{4})^{-2} )</td>
<td>( 2(\frac{1}{4})^{-1} )</td>
<td>( 2(\frac{1}{4})^0 )</td>
<td>( 2(\frac{1}{4})^1 )</td>
<td>( 2(\frac{1}{4})^2 )</td>
</tr>
<tr>
<td></td>
<td>( 2 \cdot 16 = 32 )</td>
<td>( 2 \cdot 4 = 8 )</td>
<td>( 2 \cdot 1 = 2 )</td>
<td>( 2 \cdot \frac{1}{2} = 1 )</td>
<td>( 2 \cdot \frac{1}{4} = \frac{1}{2} )</td>
</tr>
<tr>
<td>( h(x) )</td>
<td>( 0.5(2)^{-2} )</td>
<td>( 0.5(2)^{-1} )</td>
<td>( 0.5(2)^0 )</td>
<td>( 0.5(2)^1 )</td>
<td>( 0.5(2)^2 )</td>
</tr>
<tr>
<td></td>
<td>( \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16} )</td>
<td>( \frac{1}{4} \cdot \frac{1}{2} = \frac{1}{8} )</td>
<td>( \frac{1}{2} \cdot 1 = 0.5 )</td>
<td>( \frac{1}{2} \cdot 2 = 1 )</td>
<td>( \frac{1}{4} \cdot 4 = 1 )</td>
</tr>
</tbody>
</table>

\((0.607, 0.794)\)

5. You have $300 in birthday money to put into a savings account. You want to use the money in 4 years. Which bank is the best option?

**Meerhaeghe Money Maker: 4% compounded annually**

\[
P = 300, \quad R = 4\% = 0.04, \quad X = 4, \quad \text{Interest} = 300(1.04)^4 = \$360.96
\]

**Utica bank and trust: 5% compounded biannually**

\[
P = 300, \quad R = 5\% = 0.05, \quad X = 2, \quad \text{Interest} = 300(1.05)^8 = \$365.82
\]

**Chieftain Credit Union: 5% compounded quarterly**

\[
P = 300, \quad R = 5\% = 0.05, \quad X = 4, \quad \text{Interest} = 300(1.0125)^{16} = \$365.97
\]

**Bank of Byron: 4.8% compounded monthly**

\[
P = 300, \quad \frac{R}{12} = 0.4\% = 0.004, \quad X = 4, \quad \text{Interest} = 300(1.004)^{48} = \$363.36
\]
8. Solve for x:

A. \(5^x = 25^x\)
\[5^x = (5^2)^x\]
\[x = 2\]

B. \(3^{2x} = 9^4\)
\[3^{2x} = (3^2)^4\]
\[2x = 8\]
\[x = 4\]

C. \(4^x = 2^6\)
\[(2^2)^x = 2^6\]
\[2x = 6\]
\[x = 3\]

D. \(2^x = 16\)
\[2^x = 2^4\]
\[x = 4\]

9. Solve for x: (no decimals!)

A. \(3^{5x - 2} = 27^{4x + 3}\)
\[
\begin{align*}
3^{5x-2} & = (3^3)^{4x+3} \\
3x-2 & = 3(4x+3) \\
5x-2 & = 12x+9 \\
-7x & = -11 \\
x & = \frac{11}{7}
\end{align*}
\]

B. \(2^{6x} = 32^{5x-1}\)
\[
\begin{align*}
2^{6x} & = (2^5)^{5x-1} \\
6x & = 5(5x-1) \\
6x & = 25x - 5 \\
19x & = 5 \\
x & = \frac{5}{19}
\end{align*}
\]

10. Label each situation as exponential growth, exponential decay, or linear:

A. \(y = 7(0.1)^x\)  decay

B. \(y = 7x + 1\)  linear

C. \(y = 0.1(7)^x\)  growth

D. Increase the number of sit ups done each day by 5 linear

E. Increase the number of miles run each week by 10% growth

F.

<table>
<thead>
<tr>
<th>x</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>.125</td>
<td>.25</td>
<td>.5</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

growth

G.

<table>
<thead>
<tr>
<th>x</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>7.8</td>
<td>6.25</td>
<td>5</td>
<td>4</td>
<td>3.2</td>
</tr>
</tbody>
</table>

decline
6. graph \( y = 2(0.4)^x \)

<table>
<thead>
<tr>
<th>x</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>12.5</td>
<td>5</td>
<td>2.8</td>
<td>.32</td>
<td></td>
</tr>
</tbody>
</table>

What is the domain? \( \mathbb{R} \)

What is the range? \( 0 < y < \infty \)

What is the asymptote? \( y \)-axis

Growth or decay? Decay \( (b = 0.4) \)

For the following problems, consider the fact that your purchases were made the exact day that the item came out.

7. A. You build a new home for $125,000. It increases in value each year by approximately 2%. You use the equation \( y = 125000(1.02)^x \) to keep track of the value of your home.

What is the domain of the situation? \( 0 \leq x < \infty \) \( \{0, \infty\} \)

What is the range of the situation? \( 125000 \leq y < \infty \) \( \{125000, \infty\} \)

B. You buy the Xbox 1 for your brother. It cost $300. It loses around 7% of its value each year. You use the function \( y = 300(0.93)^x \) to keep track of its value.

What is the domain of the situation? \( 0 \leq x < \infty \) \( \{0, \infty\} \)

What is the range of the situation? \( 0 \leq y \leq 300 \) \( \{0, 300\} \)

C. Consider the function \( y = 2(3)^x \). There are no constraints on the graph.

What is the domain of the graph? \( \mathbb{R} \)

What is the range of the graph? \( 0 < y < \infty \)
13. 

\[ y - \text{intercept } \frac{1}{a}, \quad x - \text{intercept } \text{none} \]

growth or decay? \( \text{decay} \)

\[ y = 5, \ x = -a \quad y = 10, \ x = -2.5 \]

14. A certain kind of bacteria in a lab culture triples in number every 30 minutes. Suppose a culture started with 21 bacteria cells.

A. Write an equation: \( y = 21(3)^{x/30} \)

B. How many bacteria will there be in 2 hours? \( 21(3)^{4} \times 170 \) \( 2 \) \( \text{h} = 120 \text{ min} \)

C. How many bacteria were there 1 hour ago? \( 21(3)^{2} = 2.3 \) \( 1 \text{h} = 60 \text{ min} \)

15. The half-life of mystery substance 123 is 2 hours. You have 50 mg of mystery substance 123.

A. Write an equation: \( y = 50 \left( \frac{1}{2} \right)^{x/2} \)

B. How many mg of mystery substance 123 is there in 6 hours? \( 50 \left( \frac{1}{2} \right)^{3} = 6.25 \)

C. How many mg of mystery substance 123 is there in 15 hours? \( 50 \left( \frac{1}{2} \right)^{7.5} = 2.8 \)
11. Evaluate \( f(x) = 4^x \) for the domain \( \{-3, -2, -1, 0, 1, 2, 3\} \) No decimals!

\[
\begin{align*}
4^{-3} &= \frac{1}{4^3} = \frac{1}{64} \\
4^{-2} &= \frac{1}{4^2} = \frac{1}{16} \\
4^{-1} &= \frac{1}{4} \\
4^0 &= 1 \\
4^1 &= 4 \\
4^2 &= 16 \\
4^3 &= 64
\end{align*}
\]

12. \( g(x) \) is linear and \( h(x) \) is exponential. Write a rule for each function.

\( g(x) = 1.5x + 9 \)

\( h(x) = 3(1.5)^x \)

<table>
<thead>
<tr>
<th>( x )</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>( g(x) )</td>
<td>9</td>
<td>10.5</td>
<td>12</td>
<td>13.5</td>
<td>15</td>
<td>16.5</td>
<td>18</td>
</tr>
<tr>
<td>( h(x) )</td>
<td>3</td>
<td>4.5</td>
<td>6.75</td>
<td>10.125</td>
<td>15.1875</td>
<td>22.78125</td>
<td>34.171885</td>
</tr>
</tbody>
</table>

\[
\frac{4.5}{3} = 1.5
\]
23. rewrite with a single exponent:

A. \[ 4x^2y^6z^8 \]
\[ 2^2x^2(y^3)^2(z^4)^2 \]
\[ = (2xy^{3}z^{4})^2 \]

B. \[ 125x^6y^{15}z^3 \]
\[ 5^3(x^2)^3 (y^5)^3 z^3 \]
\[ = (5x^2y^{5}z)^3 \]

24. identify the coefficient, base, and exponent:

<table>
<thead>
<tr>
<th></th>
<th>A. 50(2)^x</th>
<th>B. 9x^3</th>
<th>C. -2(0.5)^4</th>
</tr>
</thead>
<tbody>
<tr>
<td>coeff</td>
<td>50</td>
<td>9</td>
<td>-2</td>
</tr>
<tr>
<td>base</td>
<td>2</td>
<td>x</td>
<td>.5</td>
</tr>
<tr>
<td>exp</td>
<td>X</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

25. \[ (5x^4)^2(2x^5)^3 \]
\[ 25x^8(8x^{15}) \]
\[ \frac{1200x^{23}}{\text{a00x}^{23}} \]

26. \( m^x \)

27. \( m^x(m^y) \)

28. \( \frac{m^x}{m^y} \)
16. A town has 200 people and it is growing by 24% each year.  
A. write an equation: \( y = 200(1.24)^x \)  
B. How many people will there be in 6 years? 787  
C. How many people will there be in 15 years? 5039  
D. How many people were there 3 years ago? 105  

17. A town has 500 people but is losing 5% of its population each year.  
A. write an equation: \( y = 500(0.95)^x \)  
B. How many people will there be in 6 years? 368  
C. How many people will there be in 15 years? 232  
D. How many people were there 3 years ago? 583  

18. \( y = 40(1.09)^x \)  
Is this growth or decay? Growth  
What is the growth/decay factor? 1.09  
What is the percent of increase or decrease? 9.0%  

19. \( y = 20(0.77)^x \)  
Is this growth or decay? Decay  
What is the growth/decay factor? 0.77  
What is the percent of increase or decrease? 23.2%  

20. \( (3x)^0 \)  
21. \( \frac{9x^4y}{12x^2y^2} = \frac{3x^2}{4y} \)  
22. \( (5a^4bc^6d^9)^2 = 25a^8b^2c^{12}d^{18} \)
29. You get to choose between two allowance plans, but you may change the plan at any time.

Plan #1: $6 each week

Plan #2: $0.25 for the first week, and it will double each additional week.

You will not be spending any of the money!

\[ a_5(2) \times 1 \]

A. How much will you receive at the end of the 5th week under

\begin{align*}
\text{Plan #1} & \quad \$60 \\
\text{Plan #2} & \quad \$4 \\
\end{align*}

B. How much total will you have received at the end of the 5th week under

\begin{align*}
\text{Plan #1} & \quad \$30 \\
\text{Plan #2} & \quad \$7.75 \\
\end{align*}

C. When should you switch plans? Week 8 $63.75 w/ plan #2 v. only $48 with plan #1 (total)

<table>
<thead>
<tr>
<th>Week</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25.75</td>
</tr>
<tr>
<td>2</td>
<td>1.75</td>
</tr>
<tr>
<td>3</td>
<td>3.75</td>
</tr>
<tr>
<td>4</td>
<td>7.5</td>
</tr>
<tr>
<td>5</td>
<td>15.75</td>
</tr>
<tr>
<td>6</td>
<td>31.75</td>
</tr>
<tr>
<td>7</td>
<td>63.75</td>
</tr>
<tr>
<td>8</td>
<td>121</td>
</tr>
</tbody>
</table>

| Plan 1 total | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 |
30. graph \( f(x) = -\pi(3)^x \)

<table>
<thead>
<tr>
<th></th>
<th>(-2)</th>
<th>(-1)</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(y)</td>
<td>(-.09)</td>
<td>(-.3)</td>
<td>(-.8)</td>
<td>(-2.4)</td>
<td>(-7.2)</td>
</tr>
</tbody>
</table>

What is the domain? \( \mathbb{R} \)
What is the range? \( y\)-axis
What is the asymptote? \( y\)-axis
Growth or decay? growth

[Graph showing the graph of \( f(x) = -\pi(3)^x \)]