Exponential Graphs Investigation

In this investigation students will investigate families of exponential functions.

**Tasks:**

1.(a) On the same set of axes, use a graphing package or graphics calculator to graph the following functions:

\[ y = 2^x \quad y = 3^x \quad y = 10^x \quad y = (1.3)^x \]

1.(b) The functions in 1.(a) are all members of the family \( y = b^x \).

(i) What effect does changing \( b \) values have on the shape of the graph?

(ii) What is the \( y \)-intercept of each graph?

(iii) What is the **horizontal asymptote** of each graph?

2.(a) On the same set of axes, use a graphing package or graphics calculator to graph the following functions:

\[ y = 2^x \quad y = 2^x + 1 \quad y = 2^x - 2 \]

2.(b) The functions in 2.(a) are all members of the family \( y = 2^x + d \) where \( d \) is a constant.

(i) What effect does changing \( d \) values have on the position of the graph?

(ii) What effect does changing \( d \) values have on the shape of the graph?

(iii) What is the **horizontal asymptote** of each graph?

(iv) What is the **horizontal asymptote** of \( y = 2^x + d \)?

2.(c) To graph \( y = 2^x + d \) from \( y = 2^x \) what translation is used?

3.(a) On the same set of axes, use a graphing package or graphics calculator to graph the following functions:

\[ y = 2^x \quad y = 2^{x-1} \quad y = 2^{x+2} \quad y = 2^{x-3} \]

3.(b) The functions in 3.(a) are all members of the family \( y = 2^{x-c} \).

(i) What effect does changing \( c \) values have on the position of the graph?

(ii) What effect does changing \( c \) values have on the shape of the graph?

(iii) What is the **horizontal asymptote** of each graph?

3.(c) To graph \( y = 2^{x-c} \) from \( y = 2^x \), what **transformation** is used?
4.(a) On the same set of axes, use a **graphing package** or **graphics calculator** to graph the functions \( y = 2^x \) and \( y = 2^{-x} \).

4.(b) (i) What is the \( y \)-intercept of each graph?

(ii) What is the **horizontal asymptote** of each graph?

(iii) What **translations** moves \( y = 2^x \) to \( y = 2^{-x} \)?

5.(a) On the same set of axes, use a **graphing package** or **graphics calculator** to graph the following functions:

(i) \( y = 2^x \quad y = 3 \times 2^x \quad y = \frac{1}{2} \times 2^x \)

(ii) \( y = -2^x \quad y = -3 \times 2^x \quad y = -\frac{1}{2} \times 2^x \)

5.(b) The functions in 5.(a) are all members of the family \( y = a \times 2^x \) where \( a \) is a constant. Comment on the effect on the graph when:

(i) \( a > 0 \)

(ii) \( a < 0 \)

5.(c) What is the **horizontal asymptote** of each graph?