# Graphs of Parent Functions

*In this section we are introduced to the sine and cosine functions and the exponential and logarithmic functions.*

## Basic learning objectives

These are the tasks you should be able to perform with reasonable fluency **when you arrive at our next class meeting**. Important new vocabulary words are indicated *in italics*.

- Know the basic shapes of each of the *parent functions* $y = sin(x)$, $y = cos(x)$, $y = log(x)$, and $y = 10^x$.
- Be familiar with the constant $e \approx 2.718281828$.
- Know the basic characteristics of each parent function, and be able to plot them by hand.

## Advanced learning objectives

In addition to mastering the basic objectives, here are the tasks you should be able to perform **after class, with practice**:

- Be able to evaluate logarithmic expressions.
- Know how to solve equations graphically.
- Be able to find a parent function to match data.

We start off by learning about two wave functions called the *sine* and *cosine* functions. In a trigonometry class you would learn a great deal about these functions. In this class we will just learn some of their important characteristics, and we will use them for some limited applications.

Open up `https://www.desmos.com/calculator/ubhracbupf` in a separate window. Watch the video at _____

Note that you can select which functions to display by toggling the circle to the left of each function. Each of the functions plotted in this applet are called *parent functions* because they are basic building blocks out of which a wide variety of functions can be built.[1]

**Question 1** *Which of the parent functions below go through the origin?*

***Solution***

(a) $y = x$ ✓

(b) $y = x^2$ ✓

(c) $y = x^3$ ✓

(d) $y = |x|$ ✓

(e) $y = \sqrt{x}$ ✓

[1] YouTube link: `https://www.youtube.com/watch?v=BXLQDhPi6-k`

(f) $y = \dfrac{1}{x}$

***Hint:*** *Plot each function individually by toggling the circle to the left of each function. Look to see which curve includes the point* $(0, 0)$.

***Hint:*** *You can try plugging* $x = 0$ *into each expression to see if the output is* $y = 0$.

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**Question 2** *Which of the parent functions below go through the point* $(1, 1)$*?*

***Solution***

(a) $y = x$ ✓

(b) $y = x^2$ ✓

(c) $y = x^3$ ✓

(d) $y = |x|$ ✓

(e) $y = \sqrt{x}$ ✓

(f) $y = \dfrac{1}{x}$ ✓

***Hint:*** *Just look at the graphs.*

***Hint:*** *You can try plugging* $x = 1$ *into each expression to see if the output is* $y = 1$.

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Recall that the domain of a function is the set of input values (or the set of $x$-values).

**Question 3** *Which of the parent functions below has as its domain the interval* $(-\infty, \infty)$*?*

***Solution***

(a) $y = x$ ✓

(b) $y = x^2$ ✓

(c) $y = x^3$ ✓

(d) $y = |x|$ ✓

(e) $y = \sqrt{x}$

(f) $y = \dfrac{1}{x}$

***Hint:*** *You aren't allowed to take square roots of negatives (when working with real numbers) or to divide by zero.*

***Hint:*** *As each curve travels from left to right are there any holes or gaps?*

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**Question 4** *Which of the parent functions below has a graph with a jagged corner?*

***Solution***

(a) $y = x$

(b) $y = x^2$

(c) $y = x^3$

(d) $y = |x|$ ✓

(e) $y = \sqrt{x}$

(f) $y = \dfrac{1}{x}$

**Question 5** *Which of the parent functions below has some negative $y$-values as its ouput?*

***Solution***

(a) $y = x$ ✓

(b) $y = x^2$

(c) $y = x^3$ ✓

(d) $y = |x|$

(e) $y = \sqrt{x}$

(f) $y = \dfrac{1}{x}$ ✓

***Hint:*** *Which curves drop below the $x$-axis?*