

PC Notes Unit 5 Section 4.5 Graphs of Sine and Cosine Functions

Complete Unit 5 Activity 4

Identify the key points for every sine graph and every cosine graph.

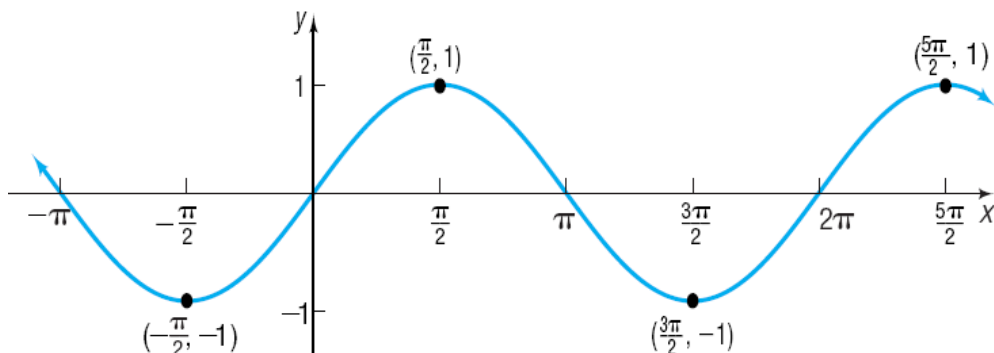
Key points: Zeros (x-intercepts) and max and min locations

Every graph you draw will need only 5 key points representing the four quadrants or sections of the graph. After you can sketch a basic sine and cosine graph, we will apply the same types of transformations that were discussed in section 1-4 of Unit 1.

Properties of the Sine Function

1. The domain is the set of all real numbers.
2. The range consists of all real numbers from -1 to 1 , inclusive.
3. The sine function is an odd function, as the symmetry of the graph with respect to the origin indicates.
4. The sine function is periodic, with period 2π .
5. The x -intercepts are $\dots, -2\pi, -\pi, 0, \pi, 2\pi, 3\pi, \dots$; the y -intercept is 0 .
6. The maximum value is 1 and occurs at $x = \dots, -\frac{3\pi}{2}, \frac{\pi}{2}, \frac{5\pi}{2}, \frac{9\pi}{2}, \dots$;
the minimum value is -1 and occurs at $x = \dots, -\frac{\pi}{2}, \frac{3\pi}{2}, \frac{7\pi}{2}, \frac{11\pi}{2}, \dots$

$$y = \sin x$$

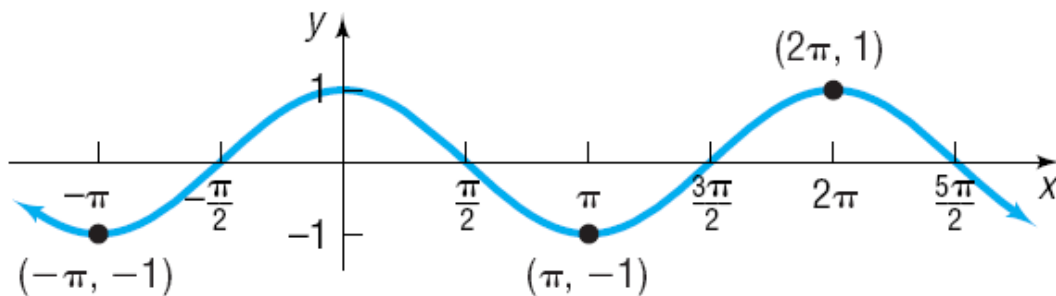


Note: Over the interval $[0, 2\pi]$, the sine wave crosses the x -axis three times at the 1st, 3rd and 5th marks. It reaches its max at the 2nd and min at the 4th. **These are the key points**

Properties of the Cosine Function

1. The domain is the set of all real numbers.
2. The range consists of all real numbers from -1 to 1 , inclusive.
3. The cosine function is an even function, as the symmetry of the graph with respect to the y -axis indicates.
4. The cosine function is periodic, with period 2π .
5. The x -intercepts are $\dots, -\frac{3\pi}{2}, -\frac{\pi}{2}, \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \dots$; the y -intercept is 1 .
6. The maximum value is 1 and occurs at $x = \dots, -2\pi, 0, 2\pi, 4\pi, 6\pi, \dots$; the minimum value is -1 and occurs at $x = \dots, -\pi, \pi, 3\pi, 5\pi, \dots$

$$y = \cos x$$



Note: Over the interval $[0, 2\pi]$, the cosine wave crosses the x -axis twice at the 2nd and 4th marks. It has a max at the 1st and 5th and min at the 3rd. **These are the key points.**

For the parent graphs $y = \sin x$ and $y = \cos x$

- Domain = $(-\infty, \infty)$ (angle measurements)
- Range $[-1, 1]$ (function values)
- Period $T = 2\pi$ (time to complete one cycle)
- Key points to graph: maximums, minimums, x -intercepts (zeros)

Graphing Using Transformations:

$$y = a \sin b(x - c) + d \quad \text{and} \quad y = a \cos b(x - c) + d$$

- $|a|$ = amplitude (distance from midline to max / min)
- $T = \frac{2\pi}{b} = \text{period}$ (time for one complete cycle)
- $\frac{\text{period}}{4}$ = interval between key points (dbm) (add to starting point
to find next angle, continue adding to get each new angle (marks))
- **Vertical translation: d units up if $d > 0$**
 $|d|$ units down if $d < 0$ (new midline)
- **If there is a negative sign in front of a, the graph is reflected over the midline.**
- **We will graph using transformations of key points.**