Lesson 11: Transforming the Graph of the Sine Function

Classwork

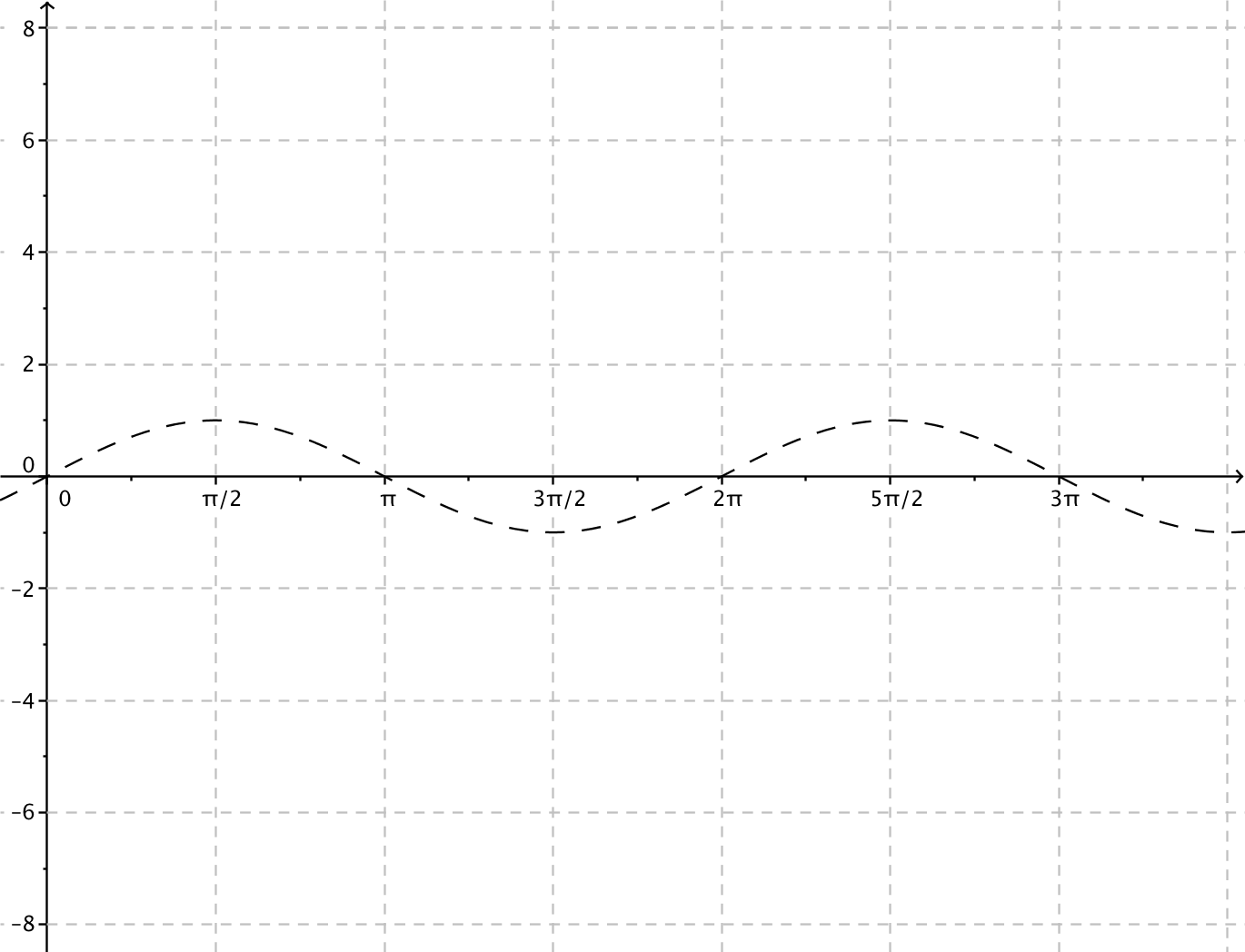
Opening Exercise

Explore your assigned parameter in the sinusoidal function . Select several different values for your assigned parameter and explore the effects of changing the parameter’s value on the graph of the function compared to the graph of . Record your observations in the table below. Include written descriptions and sketches of graphs.

|  |  |
| --- | --- |
| **-Team**  Suggested values: | **-Team**  Suggested values: |
| **-Team**  Suggested values: | **-Team**  Suggested values: |

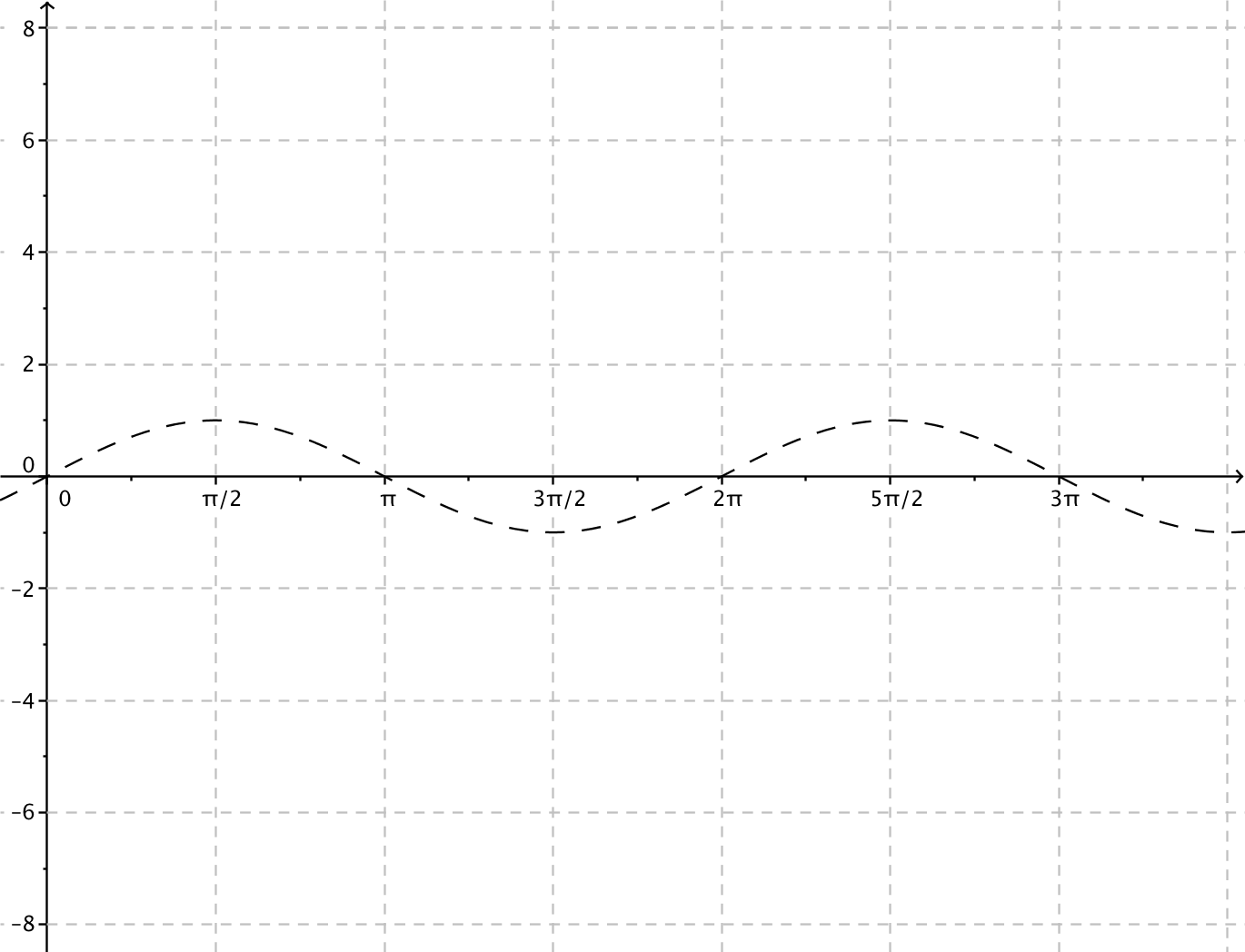
**Example**

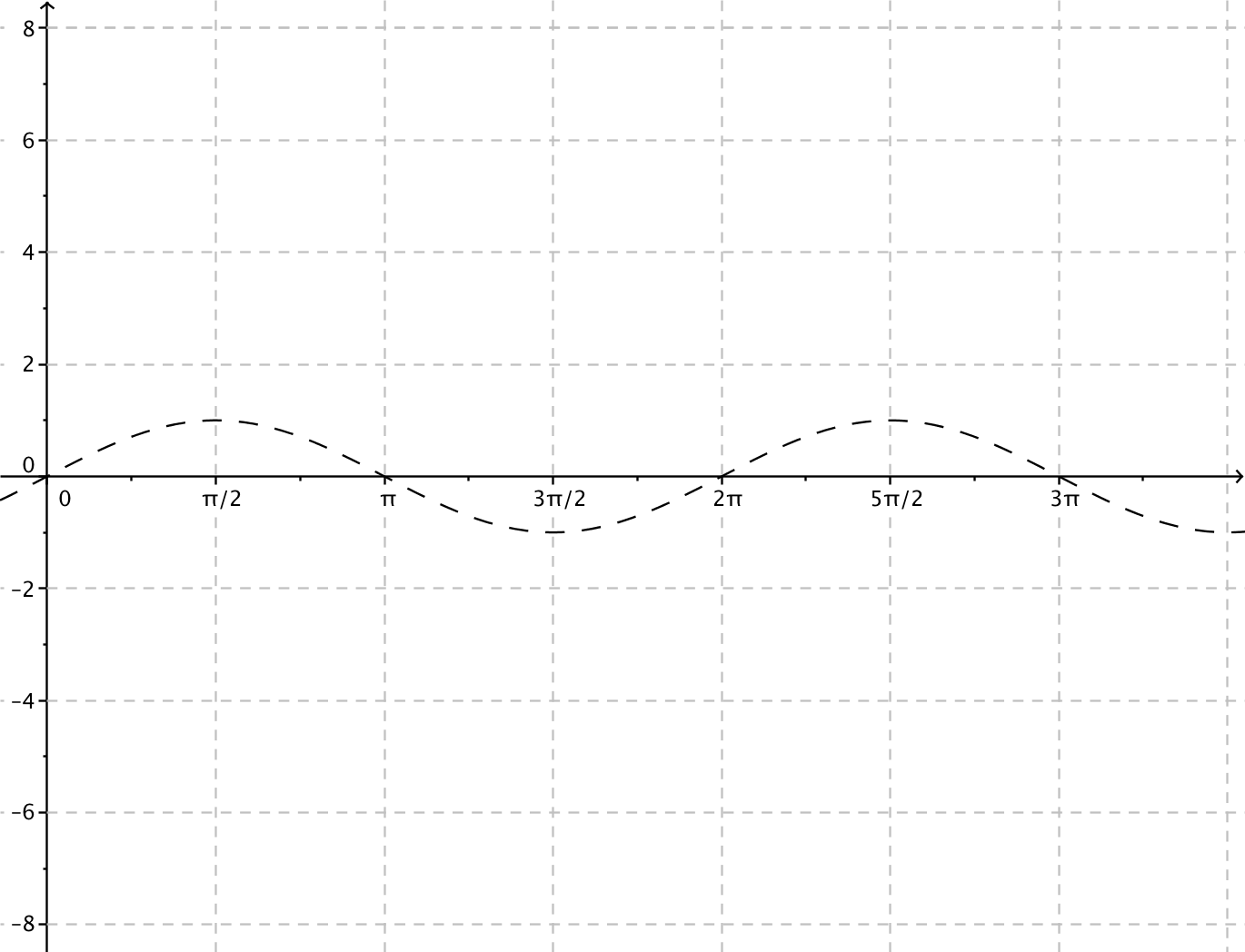
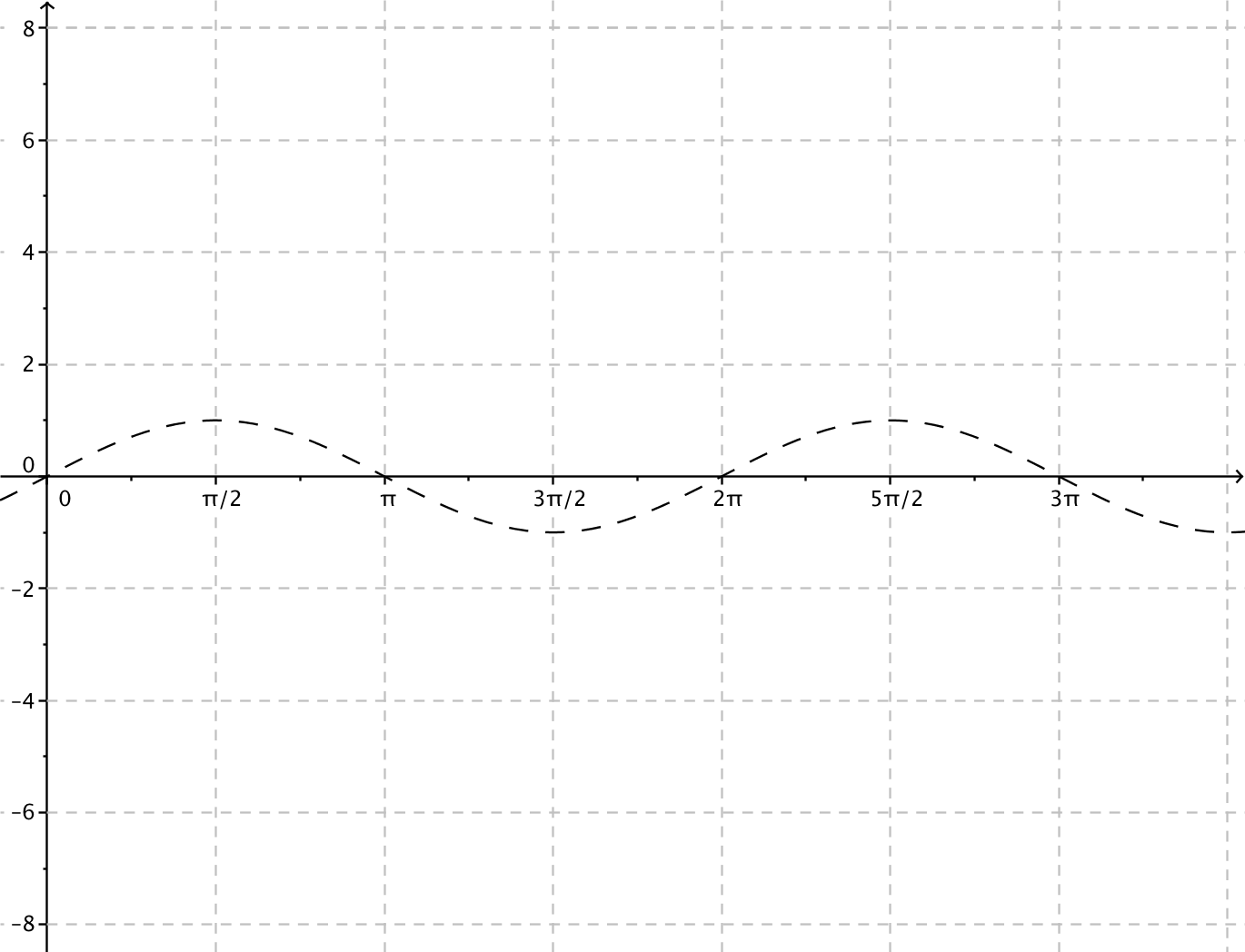
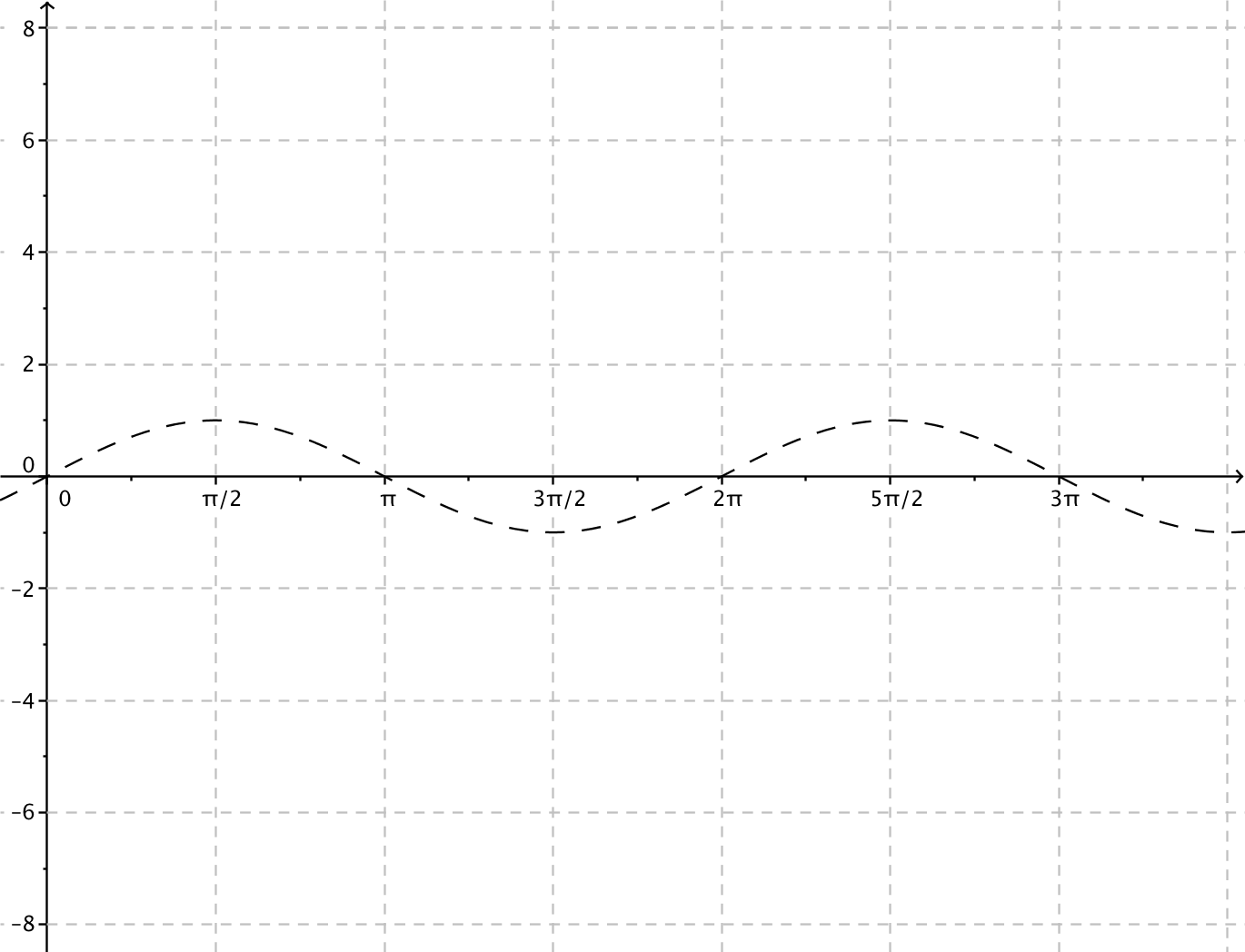
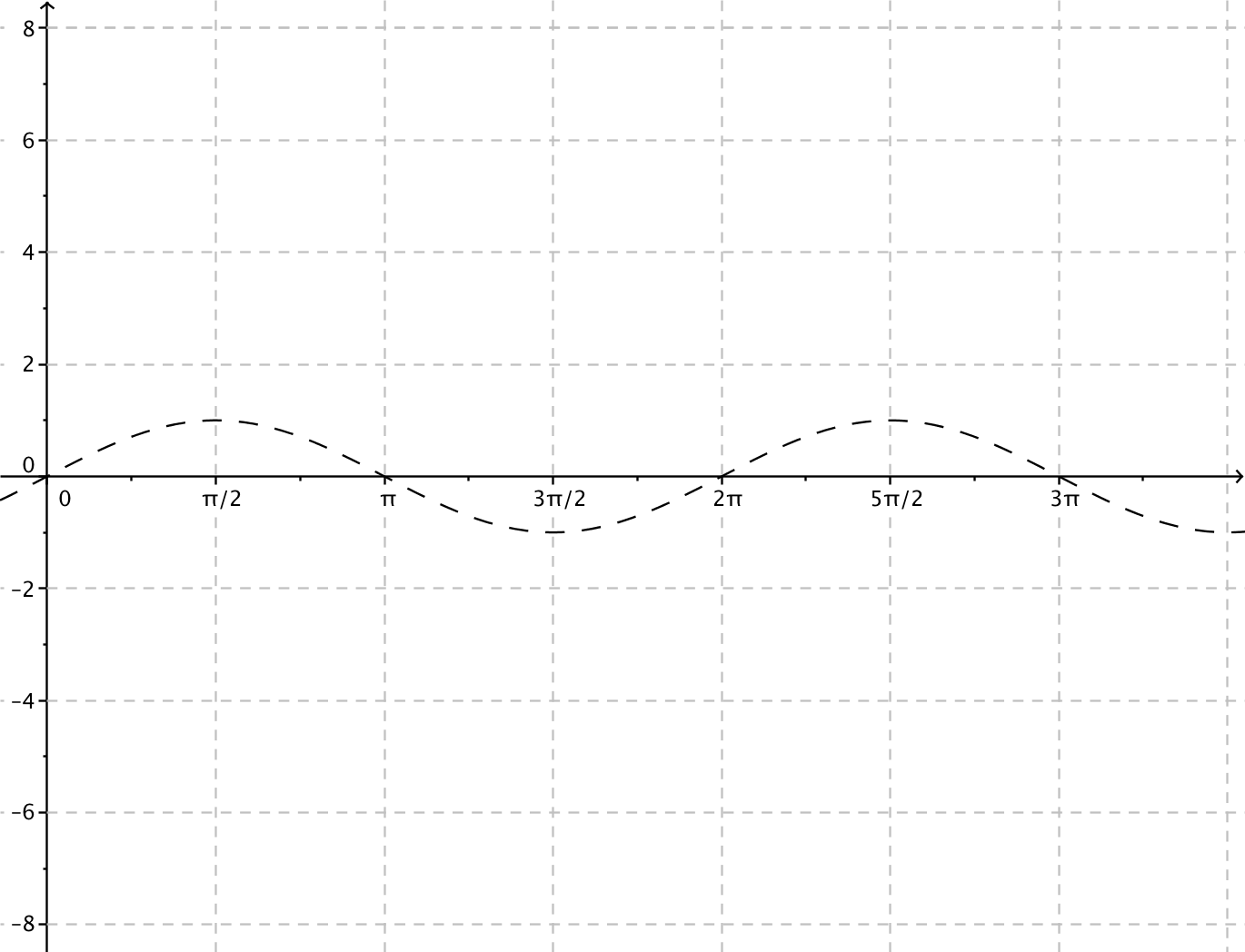
Graph the following function:

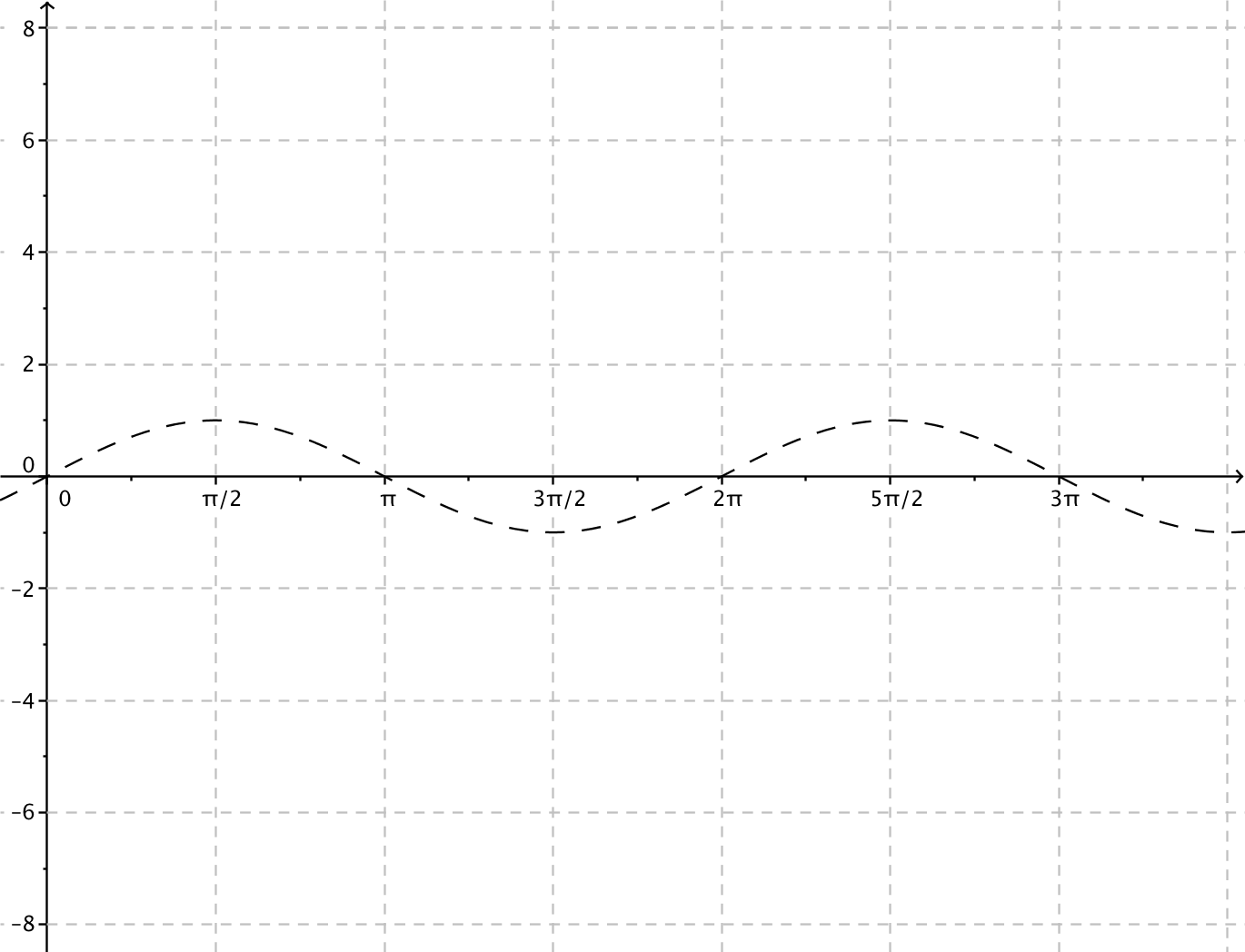


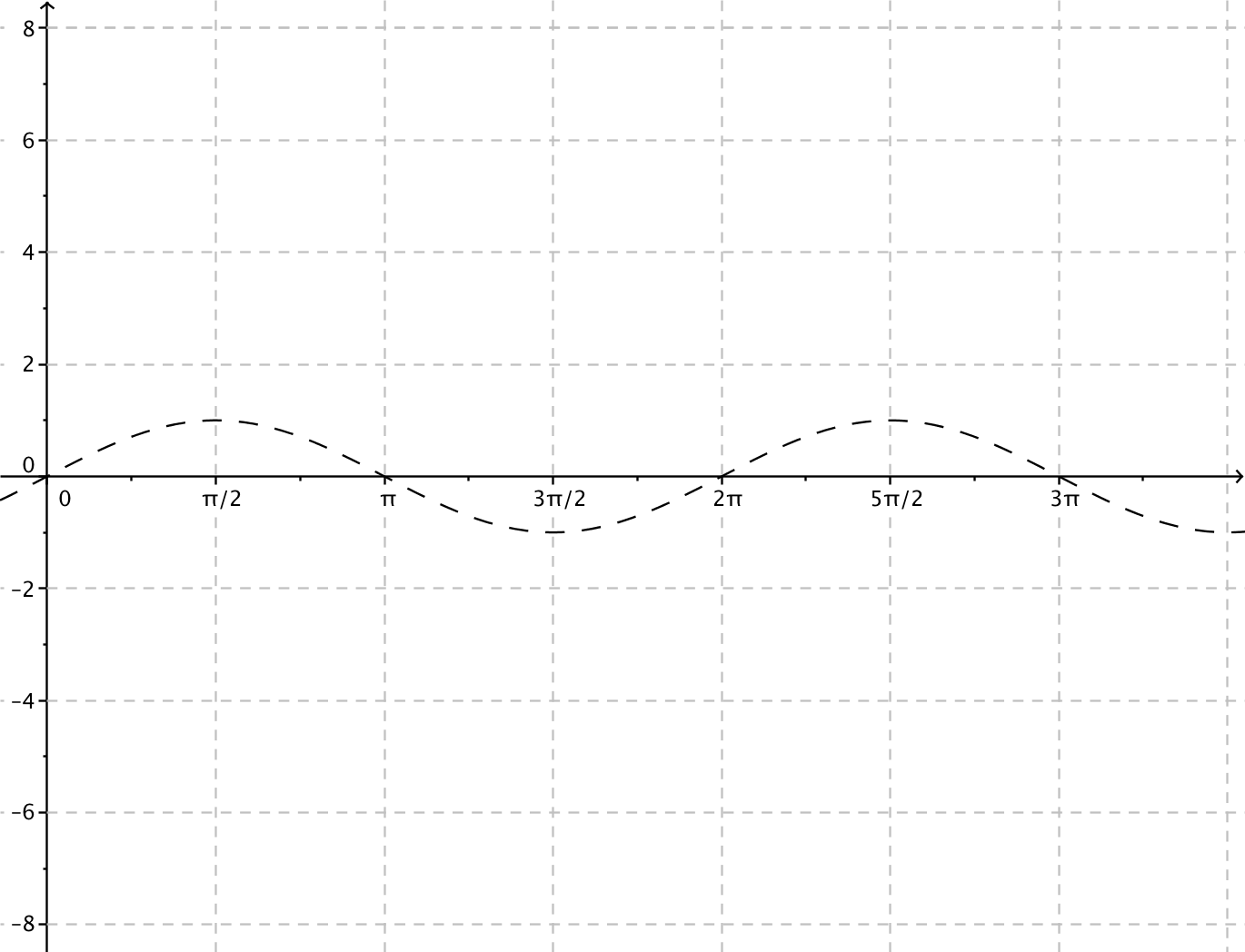
**Exercise**

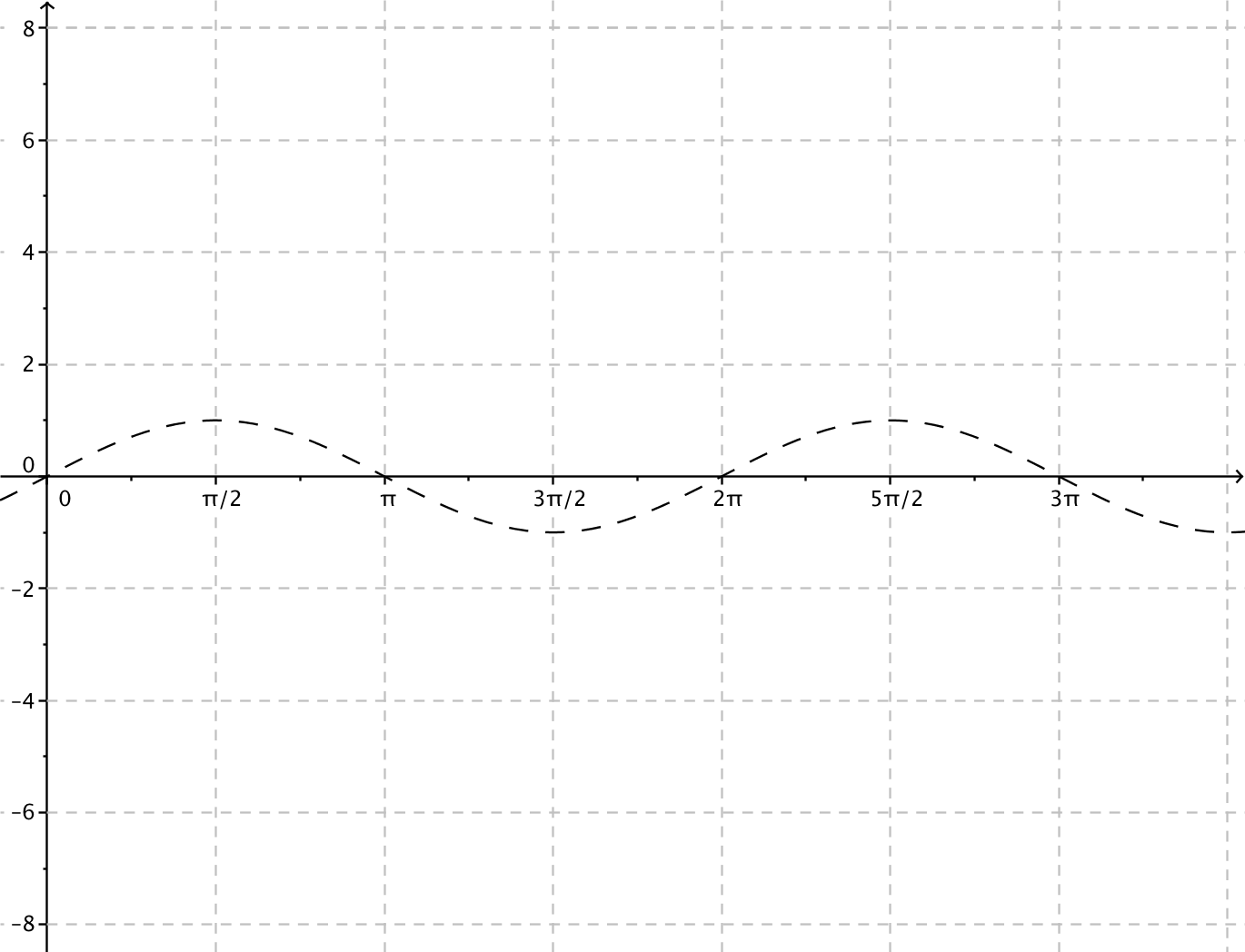
For each function, indicate the amplitude, frequency, period, phase shift, vertical translation, and equation of the midline. Graph the function together with a graph of the sine function on the same axes. Graph at least one full period of each function.



* 1. 
  2. 
  3. 
  4. 



* 1. 



Problem Set

Lesson Summary

In this lesson, we investigated the effects of the parameters , , , and on the graph of the function

.

* The graph of is the **midline**. The value of determines the vertical translation of the graph compared to the graph of the sine function. If , then the graph shifts units upwards. If , then the graph shifts units downward.
* The **amplitude** of the function is ; the vertical distance from a maximum point to the midline of the graph is .
* The **phase shift** is . The value of determines the horizontal translation of the graph from the graph of the sine function. If , the graph is translated units to the right, and if the graph is translated units to the left.
* The **frequency** of the function is , and the period is . The **period** is the vertical distance between two consecutive maximal points on the graph of the function.

These parameters affect the graph of similarly.

1. For each function, indicate the amplitude, frequency, period, phase shift, horizontal, and vertical translations, and equation of the midline. Graph the function together with a graph of the sine function on the same axes. Graph at least one full period of each function. No calculators allowed.
   1. (Hint: First, rewrite the function in the form )
2. For each function, indicate the amplitude, frequency, period, phase shift, horizontal, and vertical translations, and equation of the midline. Graph the function together with a graph of the sine function on the same axes. Graph at least one full period of each function. No calculators allowed.
   1. (Hint: First, rewrite the function in the form )
3. For each problem, sketch the graph of the pairs of indicated functions on the same set of axes without using a calculator or other graphing technology.
   1. ,
   2. ,
   3. ,
   4. ,
   5. ,
   6. ,
   7. ,
   8. ,

Extension Problems

1. Show that if the graphs of the functions and are the same, then and differ by an integer multiple of the period.
2. Show that if and differ by an integer multiple of the period, then the graphs of and are the same graph.
3. Find the -intercepts of the graph of the function in terms of the period , where .