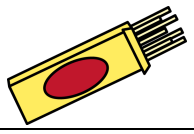
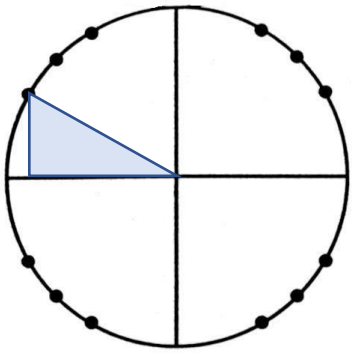


Spaghetti Waves

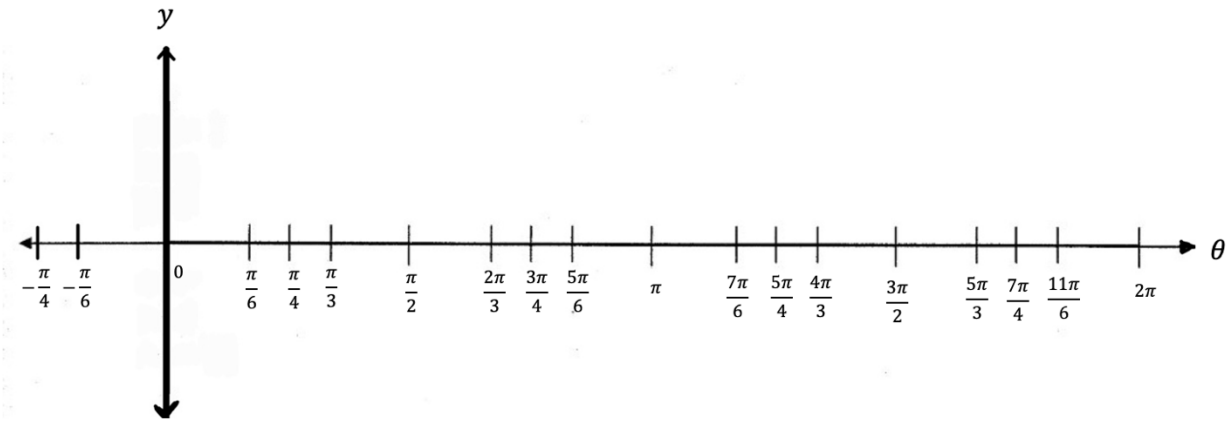
The unit circle shows us how the sine and cosine ratios change as our angle increases. Today we're going to look at the sine and cosine as functions that input angles and output ratios and graph them!

1. We used special right triangles to find coordinates for points on the unit circle. How can we use the unit circle to find the sine of any angle? How can we use the unit circle to find the cosine of any angle?



2. We'll start by looking at the function $y = \sin\theta$.
   a. What is the independent (input) variable? What is the dependent (output) variable?

   b. For each input, use the raw spaghetti to measure the length of the side associated with the sine ratio on the unit circle. Break the spaghetti to match this length. Then glue this length onto the graph at the corresponding angle, perpendicular to the x-axis. (Hint: If the sine value is negative, where should you glue the piece of spaghetti?)



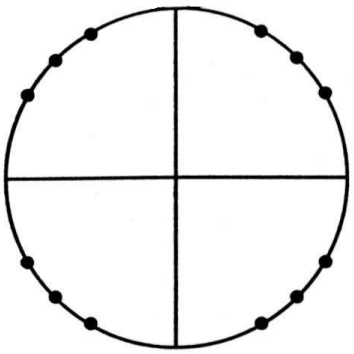
3. Label the exact value on the y-axis where each piece of spaghetti ends.
4. Use your pencil to make a smooth curve that connects the ends of the spaghetti. What do you notice about the shape of the curve? Why does this happen?

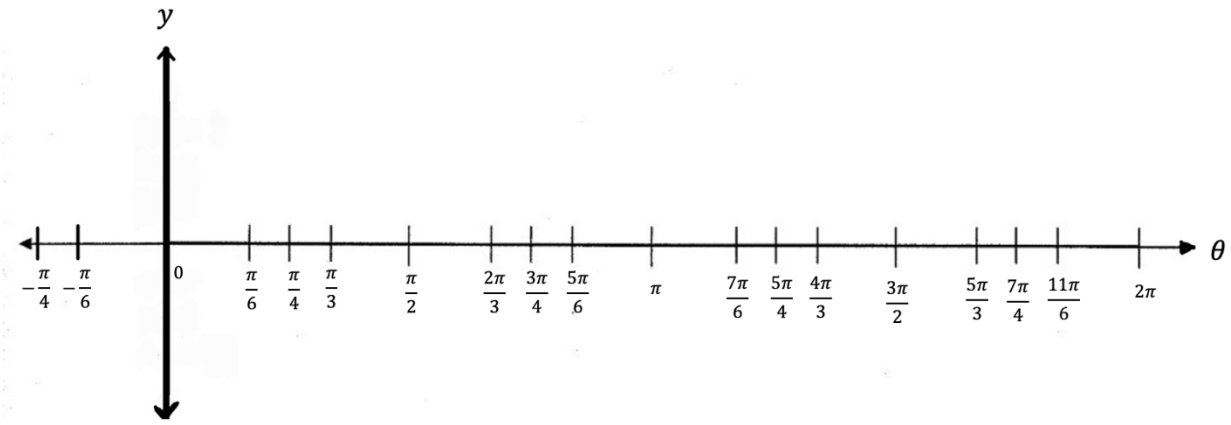
5. What is the highest and lowest point on your graph?

6. How long does it take until the graph starts repeating?

7. Now we'll look at the function $y = \cos\theta$.
   a. What is the independent variable? What is the dependent variable?

   b. For each input, use the raw spaghetti to measure the length of the side associated with the cosine ratio on the unit circle. Break the spaghetti to match this length. Then glue this length onto the graph at the corresponding angle, perpendicular to the x-axis.



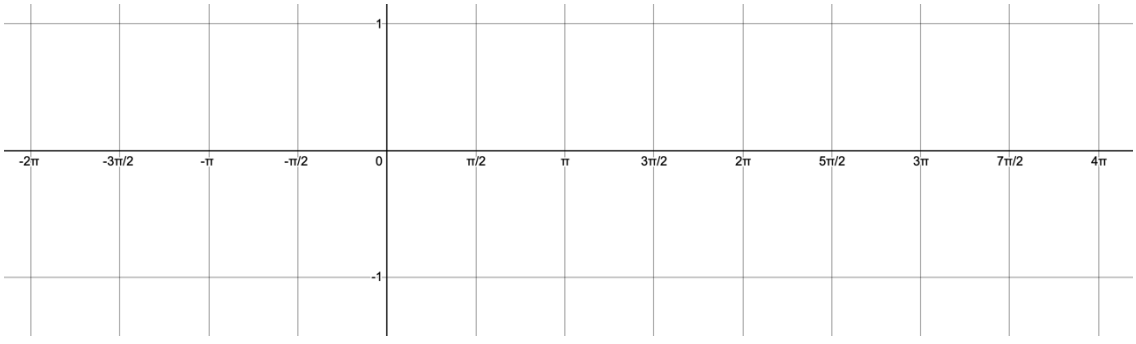


8. Label the exact value on the y-axis where each piece of spaghetti ends.
9. Draw the smooth curve that goes through the ends of the spaghetti.
10. What is the highest and lowest point on your graph?

11. How long does it take until the graph starts repeating?

12. What do the graphs of the sine and cosine functions have in common? How are they different?

13. Sketch $y = \cos\theta$ for $-2\pi \leq \theta \leq 4\pi$.



Lesson 6.5 – Graphs of Sine and Cosine

QuickNotes

Check Your Understanding

1. Explain why the range of both the sine and cosine function is $[-1,1]$.

2. How many full cycles of $f(\theta) = \sin\theta$ can be graphed on the interval $[-2\pi, 4\pi]$?

3. Is $y = \cos\theta$ an even function, an odd function, or neither? How do you know?

4. Is $y = \sin\theta$ an even function, an odd function, or neither? How do you know?

5. Determine if each statement is true or false about the function $f(x) = \cos x$.

   _____ $f(x) = f(-x)$

   _____ The graph of f has a y-intercept of 1.

   _____ The graph of f is concave down over its entire domain.

   _____ The x-axis represents the cosine ratio.

   _____ $f(146\pi) = 1$

   _____ f is undefined for $x < 0$