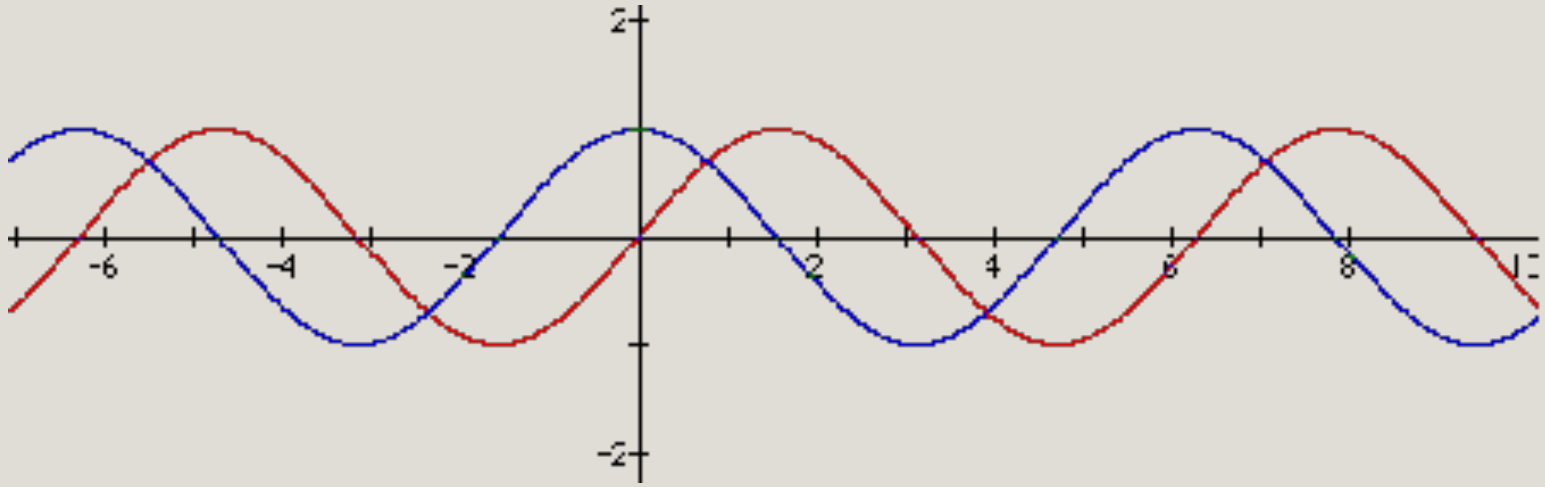
GRAPHING SINE & COSINE

ALGEBRA II

UNIT 2

DAY 1: REVIEW OF SINE & COSINE

- What is sine?
  - SOH = $\frac{Opposite}{Hypotenuse}$
- What is cosine?
  - CAH = $\frac{Adjacent}{Hypotenuse}$
- What is domain?
  - Of cosine? → (-∞, ∞)
  - Of sine? → (-∞, ∞)
- What is range?
  - Of cosine? → [-1, 1]
  - Of sine? → [-1, 1]



→Which line is cosine?

→Which line is sine?

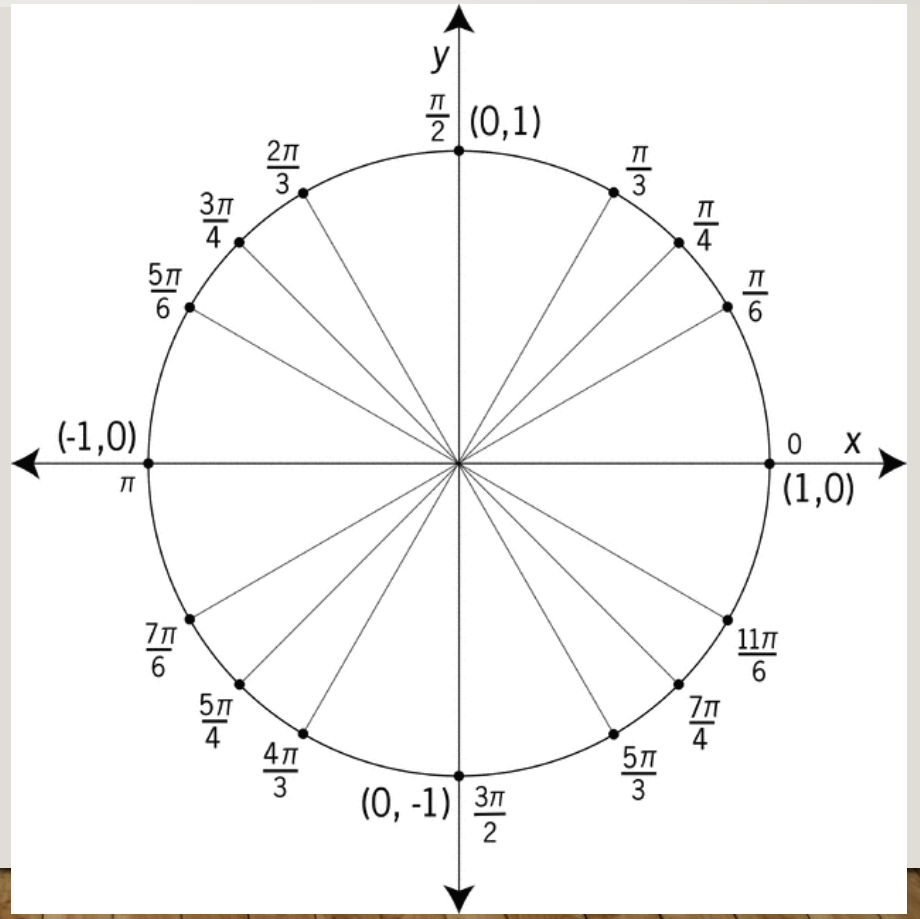
DAY 1: TERMINOLOGY

- By the end of the unit we will be able to solve equations such as:
  - $y = -3\cos(\frac{1}{2}(x - 4\pi))+5$
- $y = a\sin(bx-h) + k$
  - a = amplitude (vertical stretch/shrink)
  - b = horizontal stretch/shrink
  - h = horizontal shift
  - k = vertical shift (midline)

- **Amplitude**: the distance from the midline to the highest or lowest point of the graph
- **Horizontal Stretch**: making the period larger.
- **Horizontal Shrink:** making the period smaller.
- **Horizontal Shift**: moving the starting point of the function right or left.
- **Vertical Shift**: moving the midline of the function up or down.
- **Midline**: horizontal axis that is used as the reference line about which the graph of a trigonometric function oscillates.
- **Period**: one full cycle of the trig function.
- **Increment**: how far apart each of the 5 main points are.

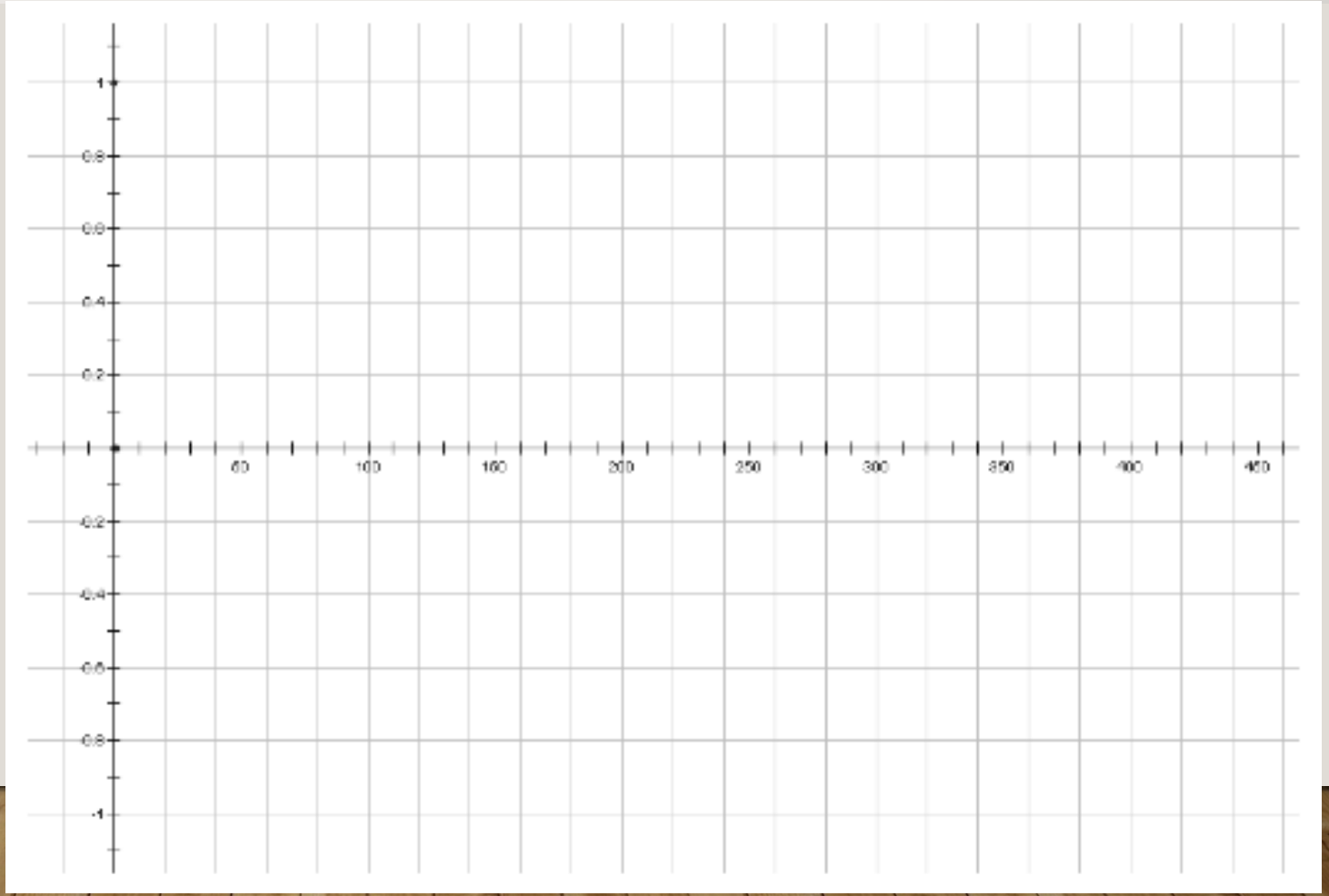
DAY 1: GRAPHING BY HAND

- Five main focus points
  - 0, 90°, 180°, 270°, and 360°
- Reference the unit circle



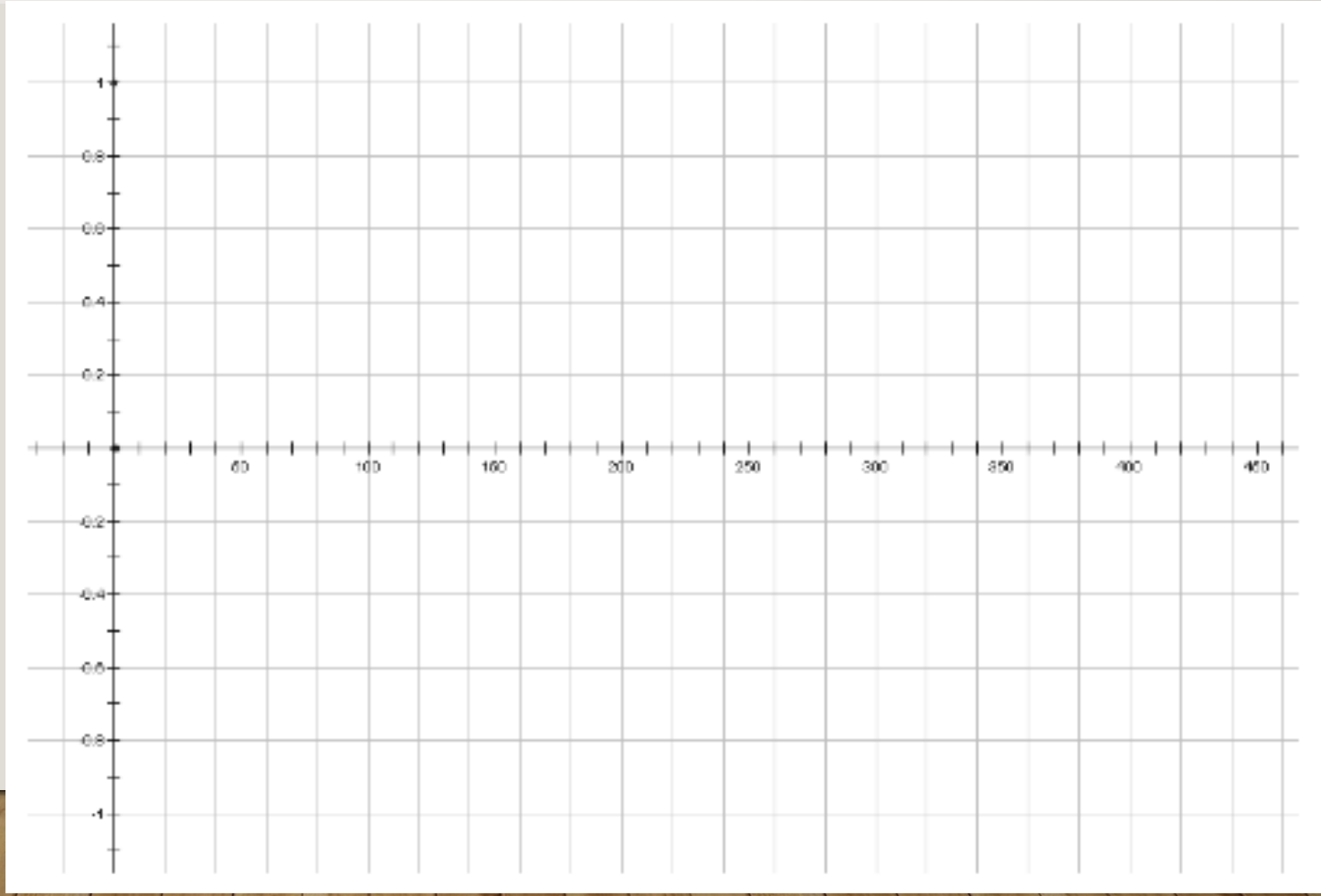
DAY 1: GRAPHING BY HAND

- **SINE PARENT GRAPH:**
- Five focus points:
  - 0 → 0
  - 90° → 1
  - 180° → 0
  - 270° → -1
  - 360° → 0
- Period = 2π
- Amplitude = 1
- Midline = x-axis or x = 0



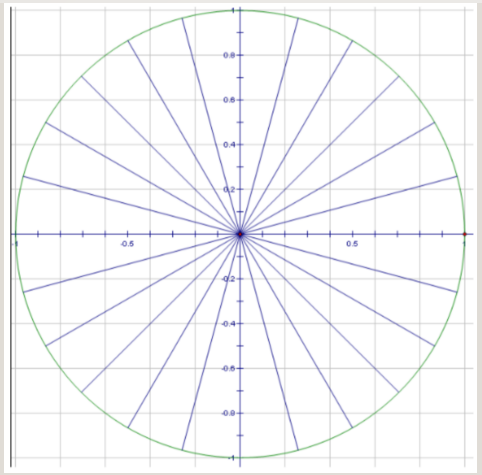
DAY 1: GRAPHING BY HAND

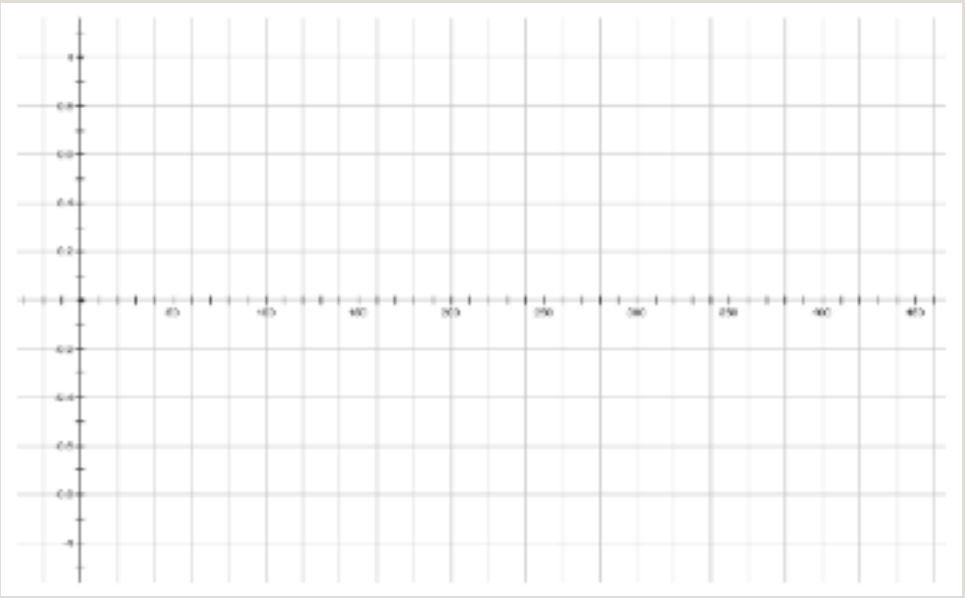
- **COSINE PARENT GRAPH:**
- Five focus points:
  - 0 → 1
  - 90° → 0
  - 180° → -1
  - 270° → 0
  - 360° → 1
- Period = 2π
- Amplitude = 1
- Midline = x-axis or x = 0

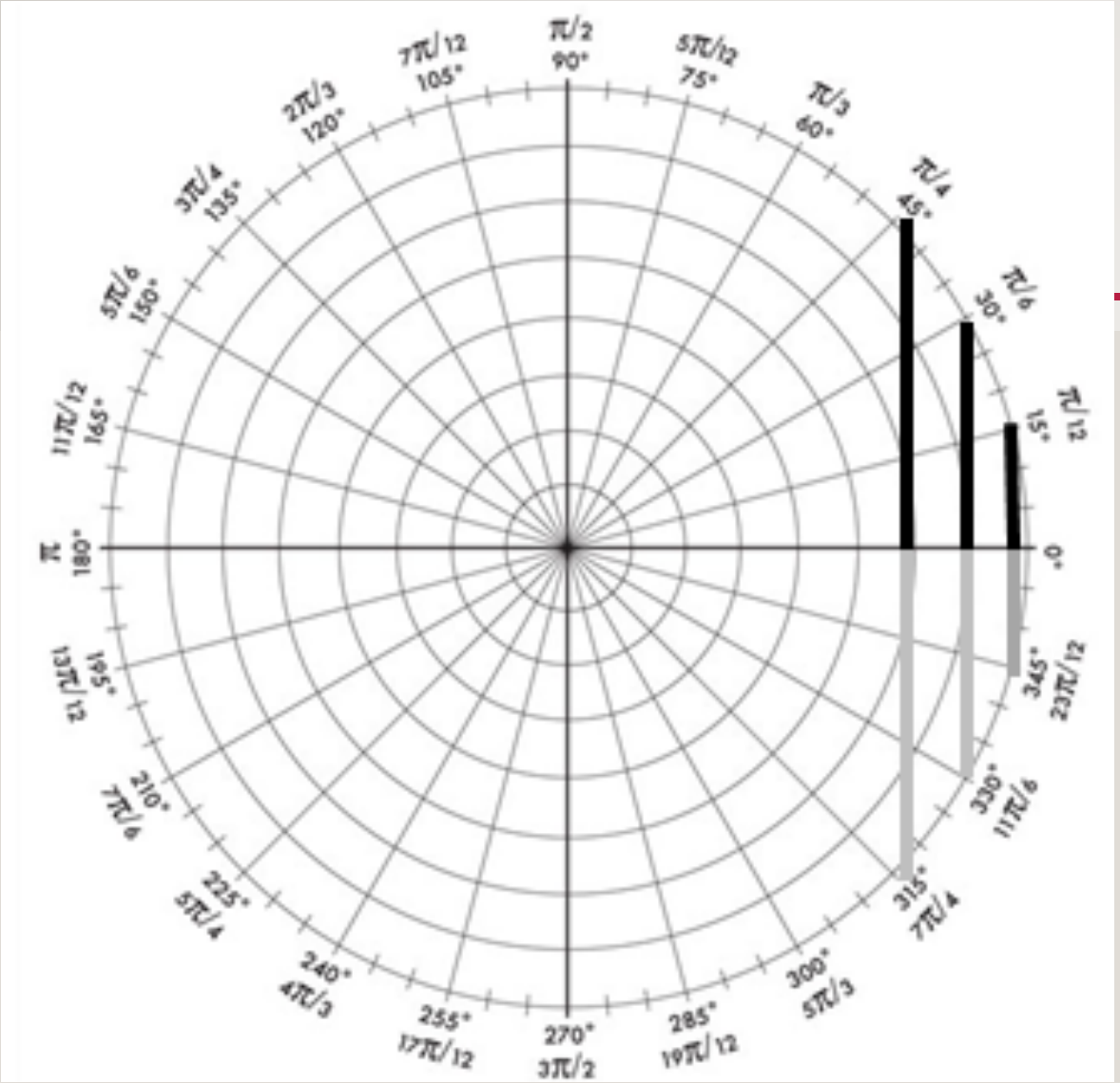


DAY 2: SPAGHETTI LAB

- Groups of 2
  - Partner 1: Sine
  - Partner 2: Cosine
- Each partner needs:
  - Unit Circle
  - Rectangle Graph
  - 8 Pieces of Spaghetti
  - Glue

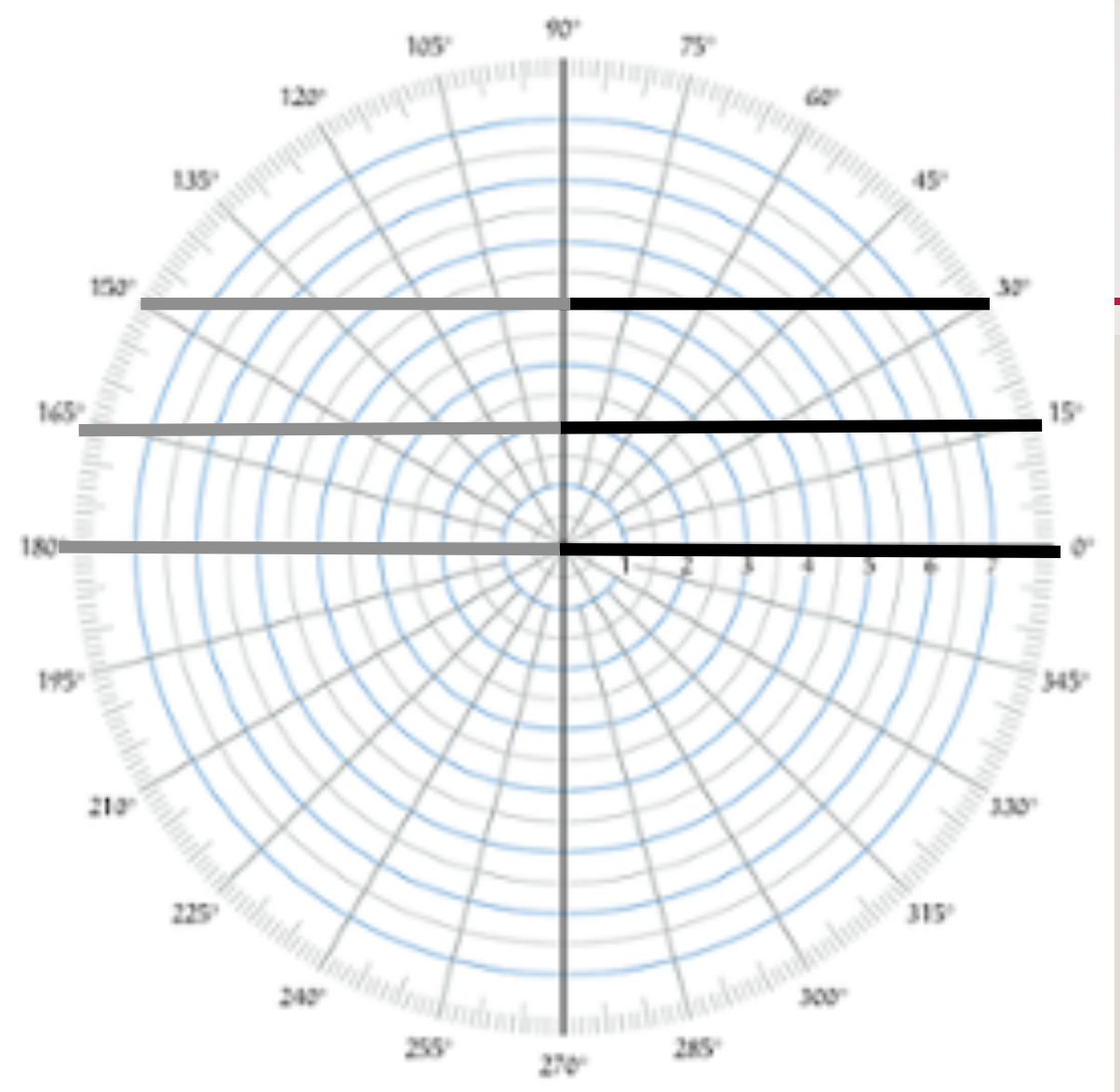






DAY 2: SPAGHETTI LAB

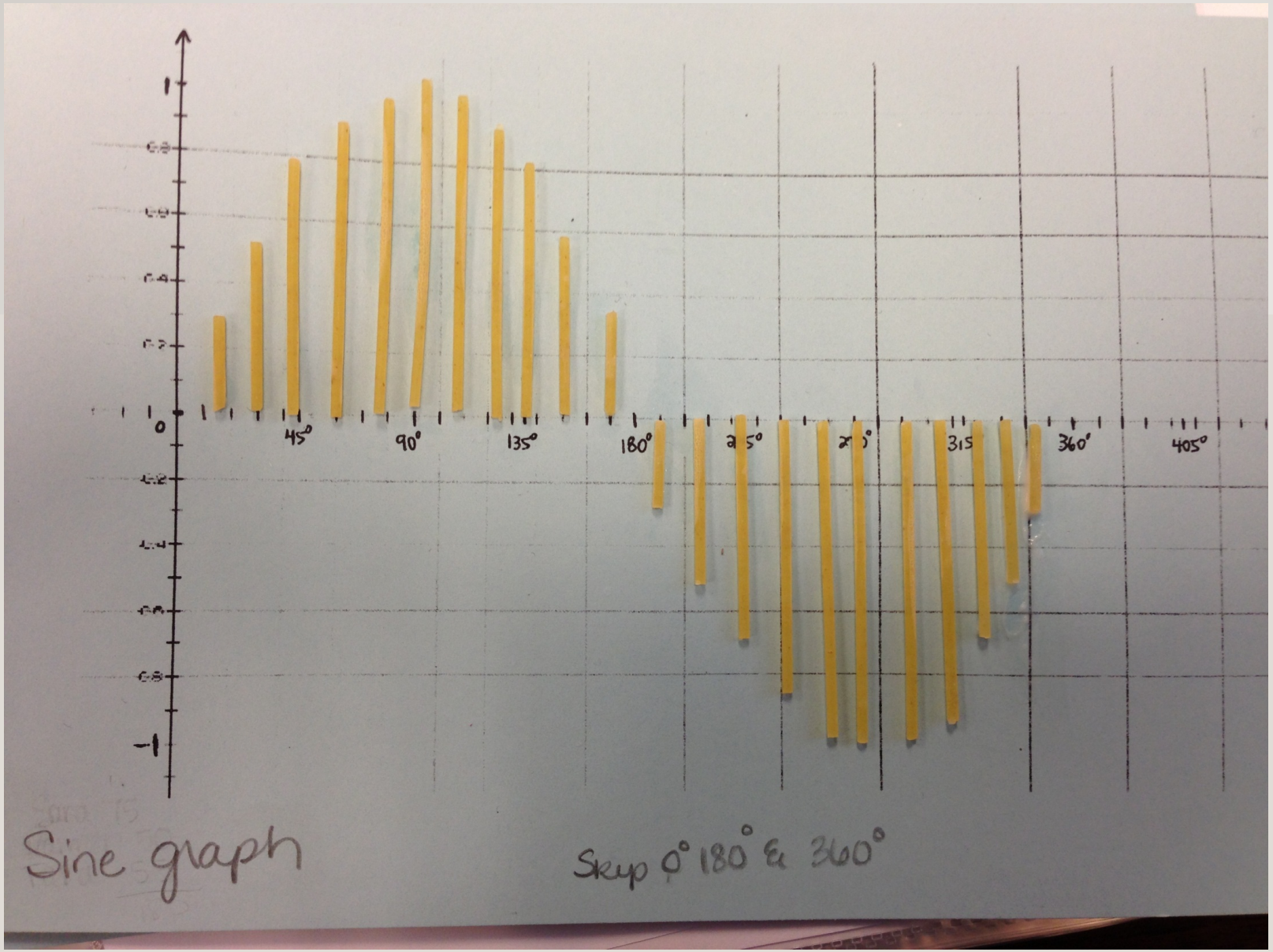
- **Sine Partner:**
  - On your circular graph, draw a perpendicular line segment from each angle measurement to the **x-axis**.
  - Lay spaghetti down and carefully break at the same length of each line (every 15°) all the way around the unit circle (360°).
  - Glue each spaghetti piece to the corresponding angle on the rectangle graph.



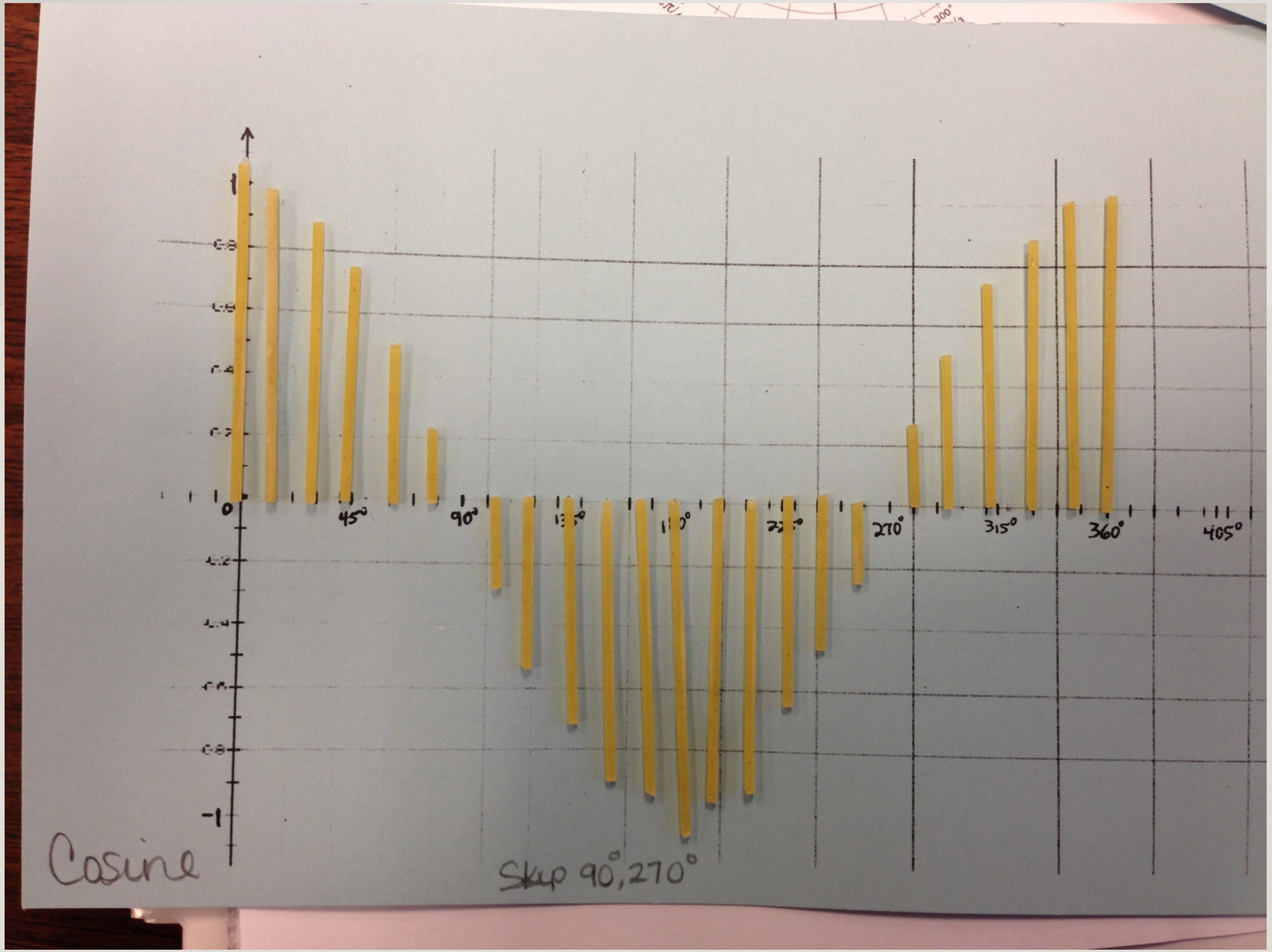
DAY 2: SPAGHETTI LAB

- **Cosine Partner:**
  - On your circular graph, draw a perpendicular line segment from each angle measurement to the **y-axis**.
  - Lay spaghetti down and carefully break at the same length of each line (every 15°) all the way around the unit circle (360°).
  - Glue each spaghetti piece to the corresponding angle on the rectangle graph.

SINE



COSINE



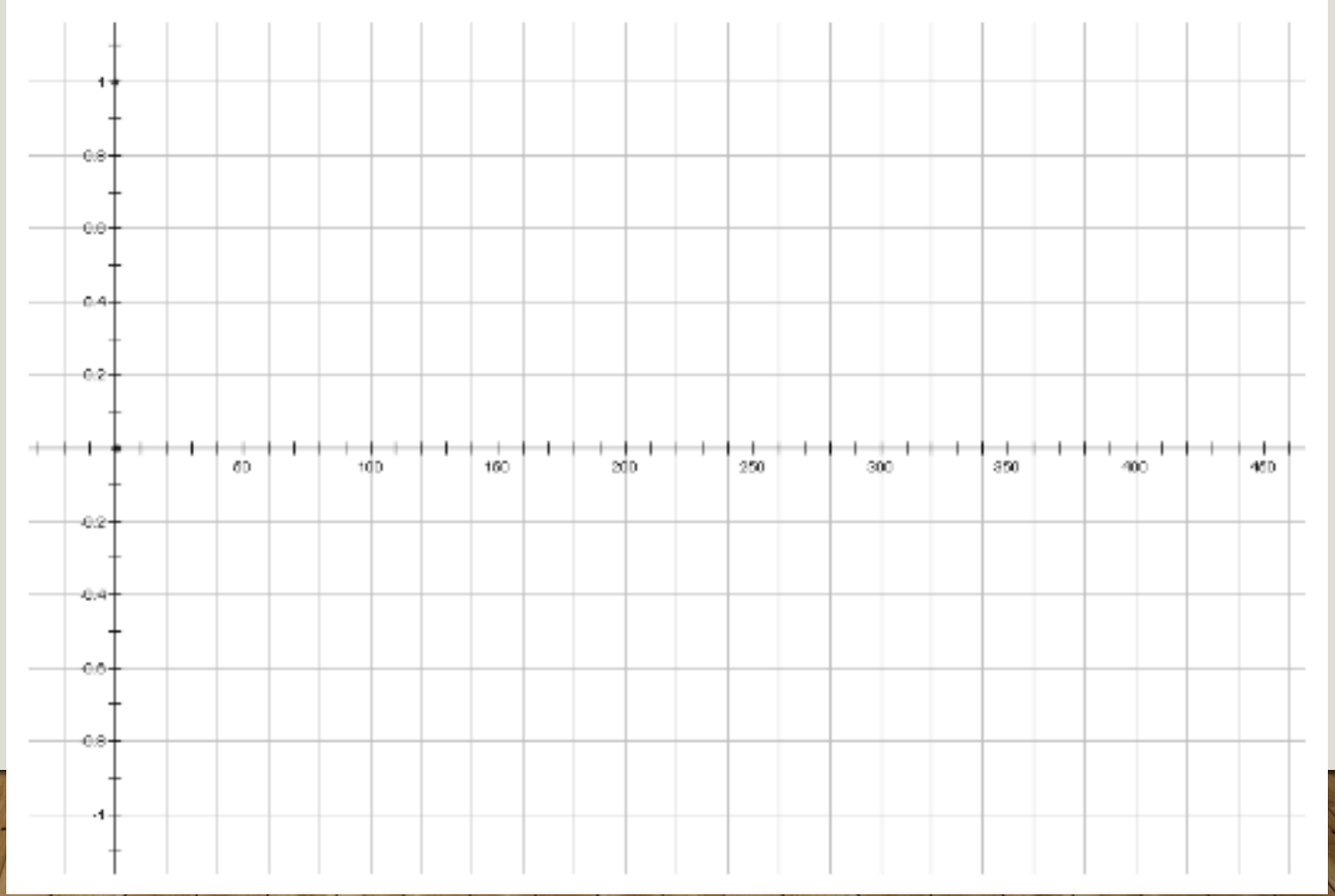
DAY 3: AMPLITUDE & PERIODS

- **AMPLITUDE**
  - Definition: the distance from the midline to the highest or lowest point of the graph
- y = asin(bx-h) + k
  - a = amplitude (vertical stretch/shrink)
- To find the amplitude, take the absolute value of a.
  - $|a|$

- **PERIOD**
  - Definition: one full cycle of the trig function.
  - y = asin(bx-h) + k
    - b = horizontal shrink/stretch
  - To find the period, divide 2π by b.
    - $\frac{2\pi}{b}$
- **INCREMENT**
  - Definition: how far apart each of the 5 main points are.
  - To find the increment, divide the period by 4.
    - $\frac{Period}{4}$

DAY 3: AMPLITUDE & PERIODS

- Examples:
  - $y = 3\cos(x)$
  - $y = 8\sin(x)$
  - $y = \frac{1}{2}\sin(x)$
  - $y = \sin(\frac{1}{2}x)$
  - $y = 4\cos(2x)$



DAY 4: QUIZ

- Quizziz.com
  - Join a game. Teacher info in notes.
- Students will play my quiz first.
- Must have piece of paper with scratch work to turn in.
- The quiz is not timed but will be graded.
  - Will get points for score as well as scratch work.
- When finished with my quiz, play two other Graphing Sine & Cosine quizzes.
- After that, if time is left, you may play whatever quiz you would like.

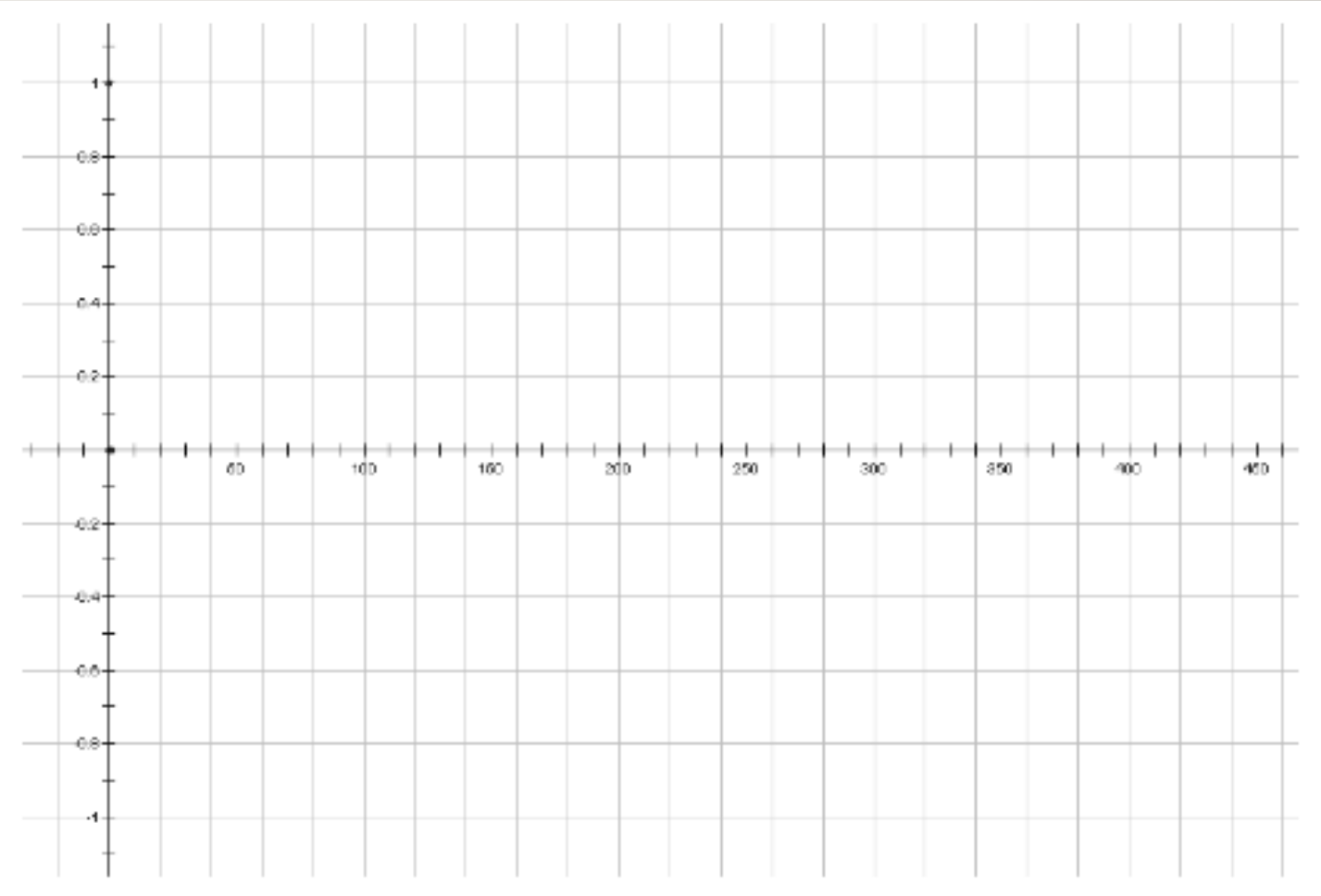
DAY 5: VERTICAL SHIFTS

- **Definition:**
  - moving the midline of the function up or down.
- Midline: horizontal axis that is used as the reference line about which the graph of a trigonometric function oscillates.
- Range?
  - Since we are moving the midline, range is affected.
  - Take the original ranged with the amplitude included and either add or subtract the k value from both the lowest point and the highest point.

- $y = a\sin(bx-h) + k$
  - k = vertical shift (midline)
- If $y = a\sin(bx-h) + k$
  - Shift parent graph up k units.
- If $y = a\sin(bx-h) - k$
  - Shift parent graph down k units.

DAY 5:VERTICAL SHIFTS

- Examples:
  - $y = \cos(x) - 3$
  - $y = \sin(x) + 7$
  - $y = \frac{1}{2}\sin(x) + 2$
  - $y = \sin(8x) - 5$
  - $y = 2\cos(\frac{1}{2}x) + 4$



DAY 6: HORIZONTAL SHIFTS

- Definition: moving the starting point of the function right or left.
- Domain?
  - Since the domain is always $(-\infty, \infty)$, a horizontal shift does not affect the domain.

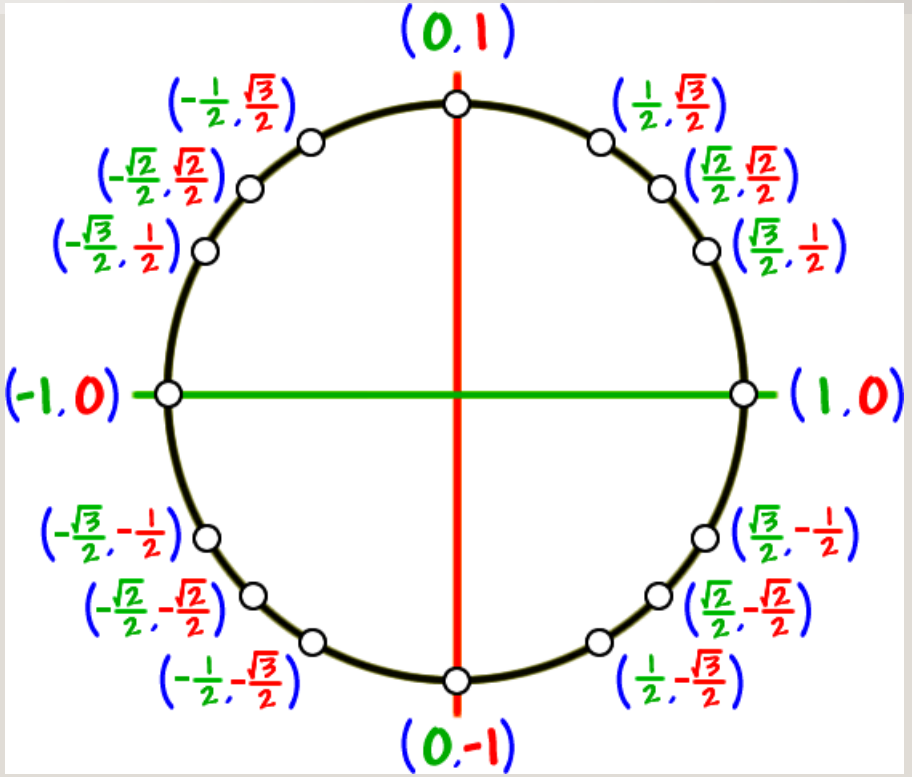
- $y = a\sin(bx-h) + k$
  - h = horizontal shift
- If $y = a\sin(bx-h) + k$
  - Shift the parent graph to the **right** h units.
- If $y = a\sin(bx+h) + k$
  - Shift the parent graph to the **left** h units.

DAY 6: HORIZONTAL SHIFTS

- Examples:
  - $y = \cos(x - \pi)$
  - $y = \sin(x + 2\pi)$
  - $y = \frac{1}{2}\sin(x - \pi) + 2$
  - $y = \sin(4x - \frac{\pi}{2}) - 1$
  - $y = 2\cos(\frac{1}{2}x + \pi) + 3$

DAY 7: PYTHAGOREAN IDENTITY

- What is it?
  - $sin^2(\theta) + cos^2(\theta) = 1$
- Proof:
- $x^2 + y^2 = r^2$ → equation of a circle
- $x^2 + y^2 = 1^2$ → radius of unit circle is 1
- $x^2 + y^2 = 1$ → calculation
- $cos^2(\theta) + sin^2(\theta) = 1$ → substitution
- $sin^2(\theta) + cos^2(\theta) = 1$ → commutative property of addition



DAY 7: PYTHAGOREAN IDENTITY

$$\frac{\sin^2\theta}{\sin^2\theta} + \frac{\cos^2\theta}{\sin^2\theta} = \frac{1}{\sin^2\theta}$$

$$1 + \cot^2\theta = \csc^2\theta$$

(You can also remember that the "co" guys go together!)

$$\frac{\sin^2\theta}{\cos^2\theta} + \frac{\cos^2\theta}{\cos^2\theta} = \frac{1}{\cos^2\theta}$$

$$\tan^2\theta + 1 = \sec^2\theta$$

We can also use the Pythagorean Identity to derive the other identities.