

Day 2: 5.1 – Graphs of Sine, Cosine, and Tangent Functions

Recall: last year, we graphed $y = \sin x$ & $y = \cos x$ in degrees. We will continue to explore graphs of trigonometric functions this year, but now in radians.

Recall the following definitions:

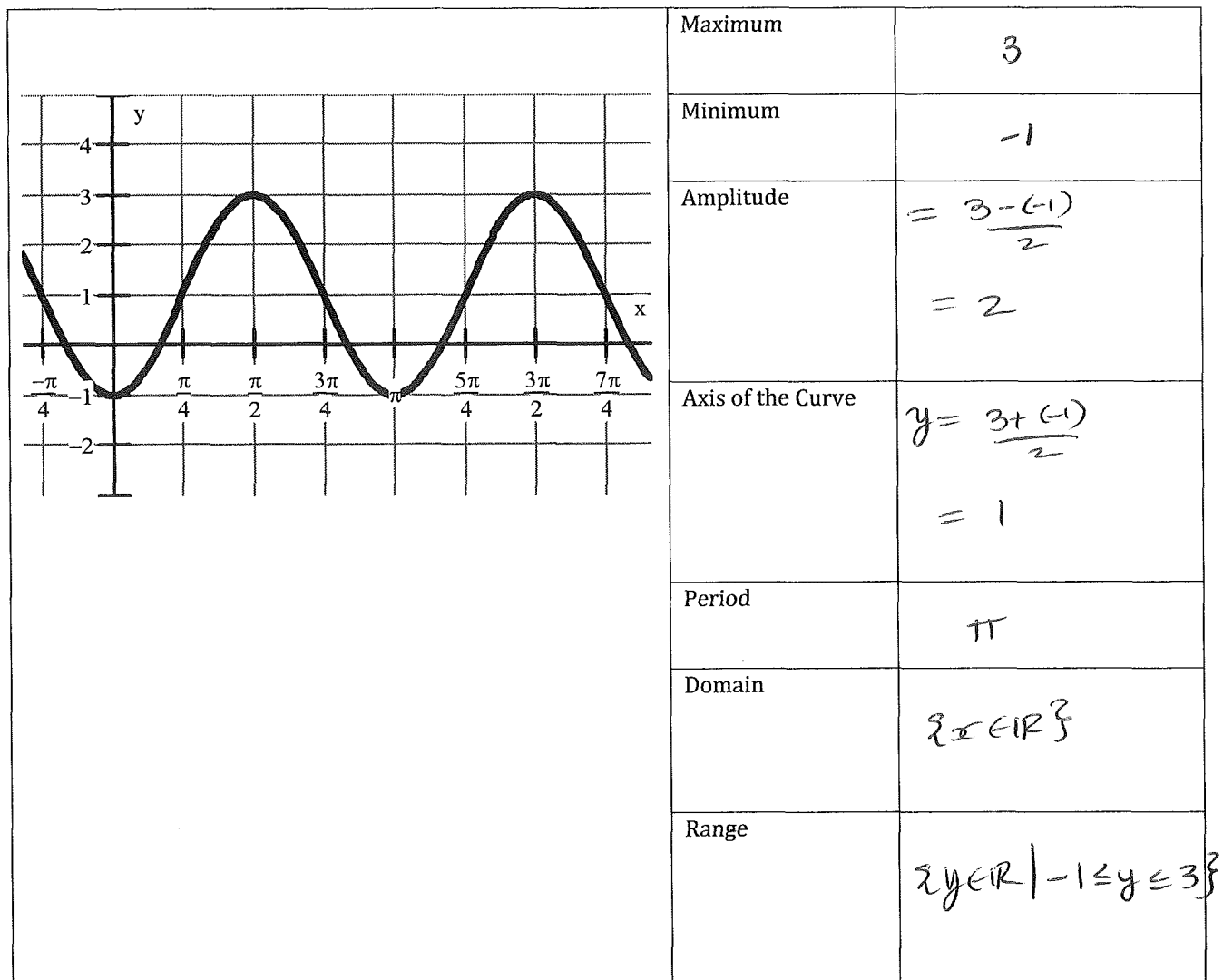
Periodic Functions - A function that repeats its' y-values in regular intervals

Amplitude - Half the distance between the minimum and maximum values

Axis of the Curve - Horizontal line halfway between minimum and maximum values

Period - Horizontal length of one cycle

EX 1- State the following key properties for the periodic function below:



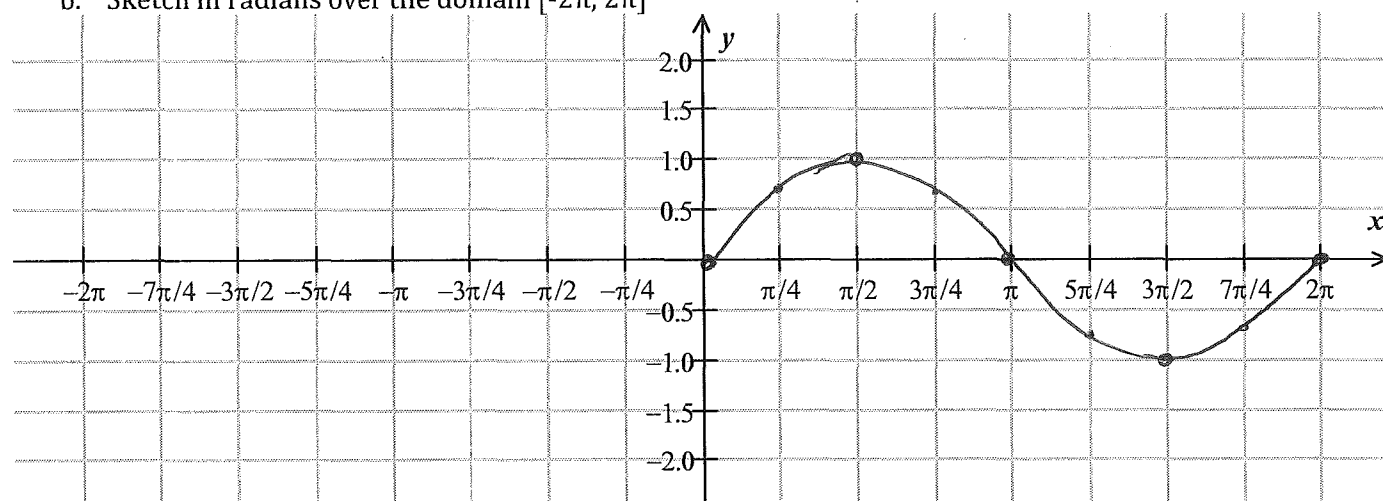
EX 2- Graph of $y = \sin x$

a. Fill in the table of values below. You can use the unit circle to help.

- The highlighted columns will be the 5 key points we use for graphing the function.

| | | | | | | | | |
|----------|----------------------|----------------------|-----------------------|------------|-----------------------|-----------------------|-----------------------|-------------|
| $\sin 0$ | $\sin \frac{\pi}{4}$ | $\sin \frac{\pi}{2}$ | $\sin \frac{3\pi}{4}$ | $\sin \pi$ | $\sin \frac{5\pi}{4}$ | $\sin \frac{3\pi}{2}$ | $\sin \frac{7\pi}{4}$ | $\sin 2\pi$ |
| 0 | 0.71 | 1 | 0.71 | 0 | -0.71 | -1 | -0.71 | 0 |

b. Sketch in radians over the domain $[-2\pi, 2\pi]$



c. State the key properties for $y = \sin x$ (in radians).

| | | |
|---|------------------------|--|
| Amplitude | Axis of the Curve | Period |
| 1 | $y = 0$ | 2π |
| x-intercepts | Domain | Range |
| $0, \pi, 2\pi, \dots$ $x = k\pi, k \in \mathbb{Z}$ | $\{x \in \mathbb{R}\}$ | $\{y \in \mathbb{R} \mid -1 \leq y \leq 1\}$ |

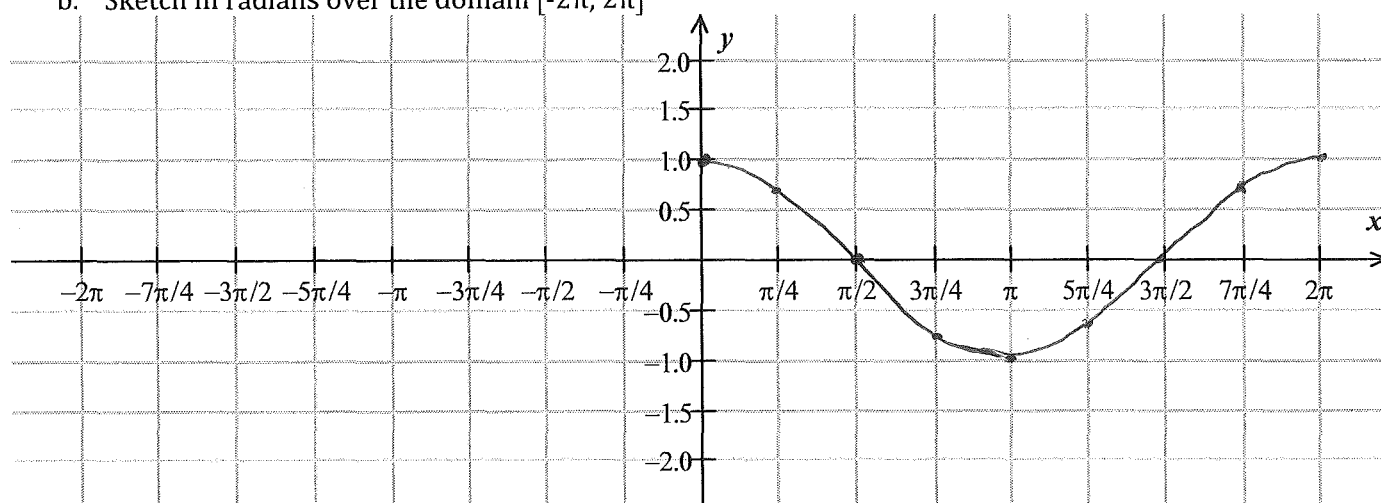
→ You may use the formula $t_n = a + (n-1)d$ from grade 11.

EX 3- Graph of $y = \cos x$

- a. Fill in the table of values below. You can use the unit circle to help.
- The highlighted columns will be the 5 key points we use for graphing the function.

| $\cos 0$ | $\cos \frac{\pi}{4}$ | $\cos \frac{\pi}{2}$ | $\cos \frac{3\pi}{4}$ | $\cos \pi$ | $\cos \frac{5\pi}{4}$ | $\cos \frac{3\pi}{2}$ | $\cos \frac{7\pi}{4}$ | $\cos 2\pi$ |
|----------|----------------------|----------------------|-----------------------|------------|-----------------------|-----------------------|-----------------------|-------------|
| 1 | 0.71 | 0 | -0.71 | -1 | -0.71 | 0 | 0.71 | 1 |

- b. Sketch in radians over the domain $[-2\pi, 2\pi]$



- c. State the key properties for $y = \cos x$ (in radians).

| Amplitude | Axis of the Curve | Period |
|--|------------------------|--|
| 1 | $y = 0$ | 2π rad |
| x-intercepts | Domain | Range |
| $\frac{\pi}{2}, \frac{3\pi}{2}, \dots$ | $\{x \in \mathbb{R}\}$ | $\{y \in \mathbb{R} \mid -1 \leq y \leq 1\}$ |

In general: $x = \frac{\pi}{2} + k\pi, k \in \mathbb{Z}$

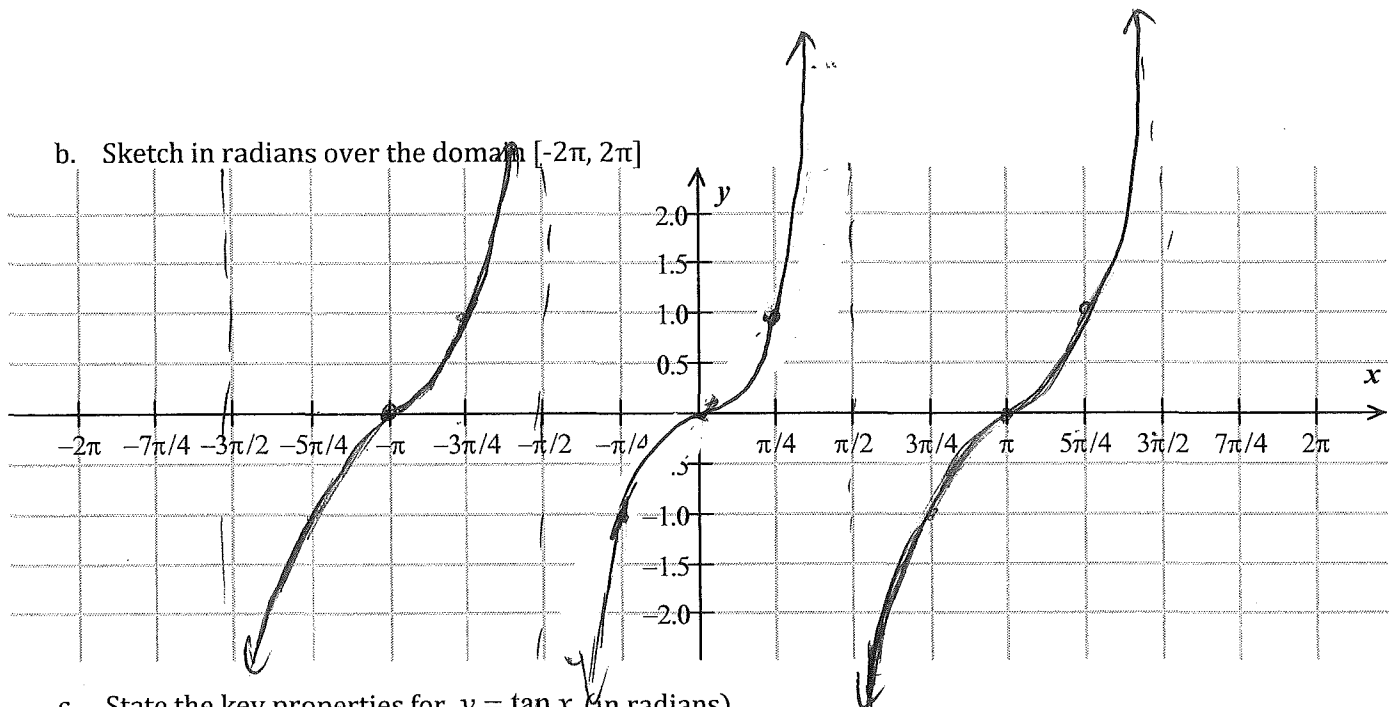
EX 4- Graph of $y = \tan x$

a. Fill in the table of values below. Remember, $\tan x = \frac{\sin x}{\cos x}$

| | | | | | | | | |
|----------|----------------------|----------------------|-----------------------|------------|-----------------------|-----------------------|-----------------------|-------------|
| $\tan 0$ | $\tan \frac{\pi}{4}$ | $\tan \frac{\pi}{2}$ | $\tan \frac{3\pi}{4}$ | $\tan \pi$ | $\tan \frac{5\pi}{4}$ | $\tan \frac{3\pi}{2}$ | $\tan \frac{7\pi}{4}$ | $\tan 2\pi$ |
| 0 | 1 | undefined VA | -1 | 0 | 1 | undefined VA | -1 | 0 |

What is happening at undefined values of x ?

b. Sketch in radians over the domain $[-2\pi, 2\pi]$



c. State the key properties for $y = \tan x$ (in radians).

| | | |
|---|---------------|---|
| Amplitude | Period | x-intercepts |
| NA | π radians | $x=0, \pi, 2\pi, \dots$ $\hookrightarrow x = k\pi, k \in \mathbb{Z}$ |
| Domain | | Range |
| $\{x \in \mathbb{R} \mid x \neq \frac{\pi}{2} + k\pi, k \in \mathbb{Z}\}$ | | $\{y \in \mathbb{R}\}$ |