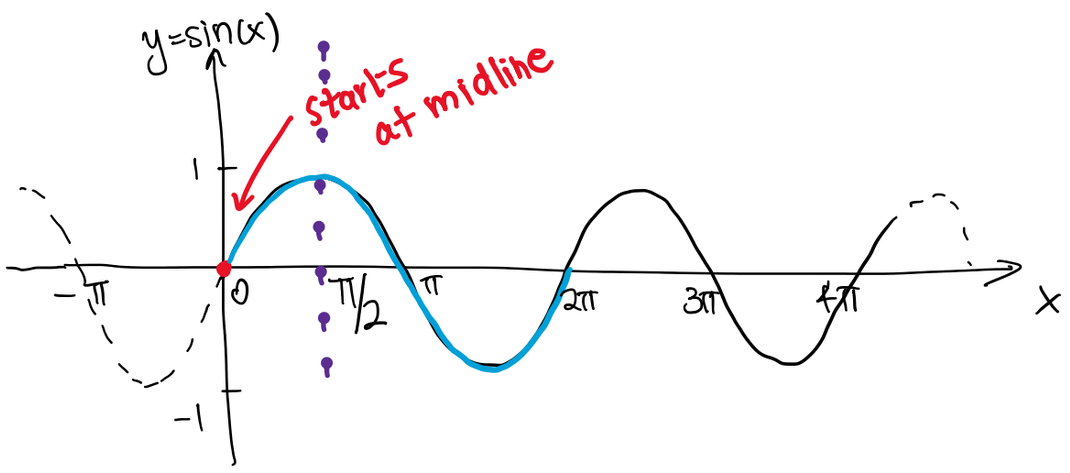
Graphs of sine and cosine (sec. 7.4)

Tuesday, November 17, 2020 12:36 AM

Sine function



period = 2π

amplitude = $\frac{max-min}{2} = \frac{1-(-1)}{2} = \frac{2}{2} = 1$

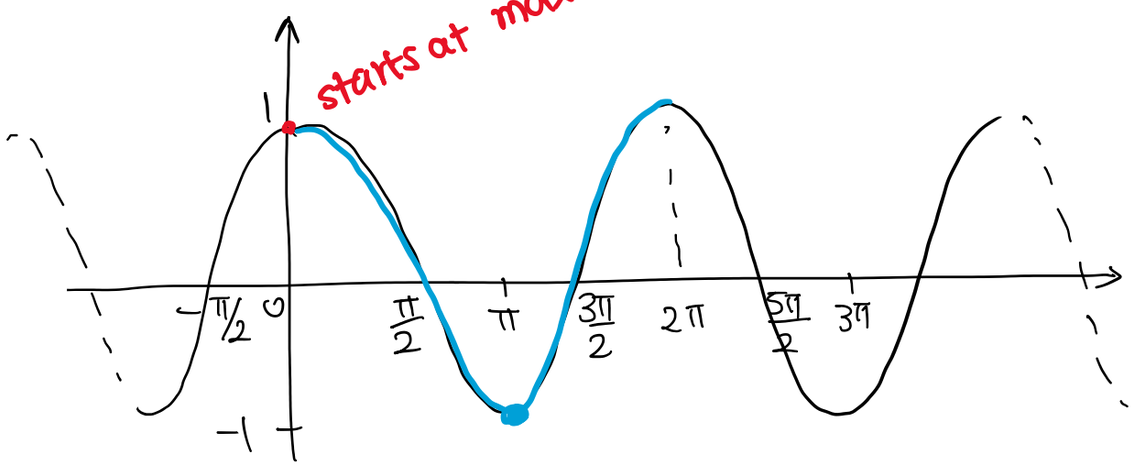
midline = $y = \frac{max+min}{2} = \frac{1+(-1)}{2} = 0$

range : $-1 \le y \le 1$

domain : $-\infty < x < \infty$

odd function : $\sin(x) = -\sin(-x)$

Cosine function



period = 2π

amplitude = 1

midline = $y = 0$

range : $-1 \le y \le 1$

domain : $-\infty < x < \infty$

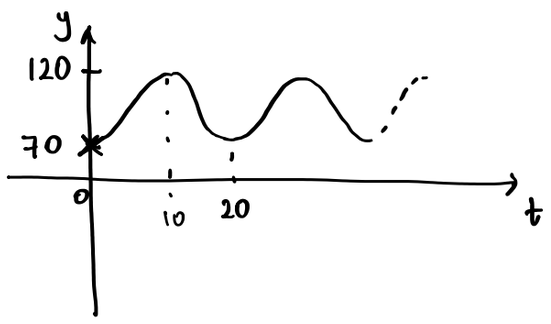
even function : $\cos(x) = \cos(-x)$

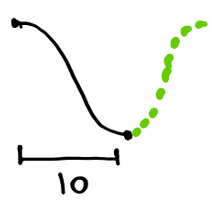
Note : $\sin\left(x + \frac{\pi}{2}\right) = \cos(x)$

EXTRA!

4. [14 points] The noise level of the sound of a fire alarm at a factory oscillates between a maximum of 120 decibels to a minimum of 70 decibels. It takes the alarm 10 seconds to go from its maximum to its minimum noise level. Let $y = f(t)$ be the noise level of the sound of the alarm (in decibels) t seconds after it is activated. Suppose that $f(t)$ is a **sinusoidal** function and that $f(0) = 70$.

a. [6 points] Find the period, the amplitude, the midline and formula of the function $y = f(t)$. Include units.



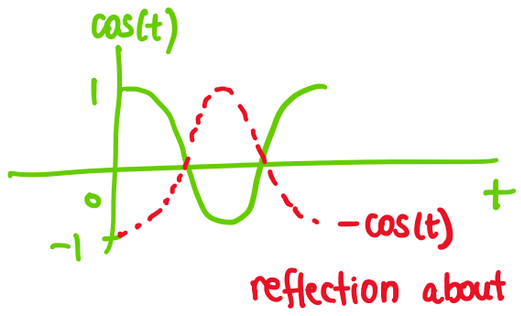


amplitude = $\frac{max-min}{2} = \frac{120-70}{2} = \frac{50}{2}$

$= 25$

midline = $y = \frac{max+min}{2} = \frac{120+70}{2} = \frac{190}{2}$

$= 95$



Period= 20 seconds

Amplitude= 25 decibels

Midline: $y = 95$ (decibels)

$f(t) = -25\cos\left(\frac{\pi}{10}t\right) + 95$.

$f(0) = -25\cos\left(\frac{\pi}{10}\cdot 0\right) + 95$

$= -25\cos(0) + 95$

$= -25 + 95$

$= 70$ ✓

General function : $y = A\cos(B(t-h)) + k$ (factored form)

amplitude, midline, horizontal shift

$\frac{2\pi}{B}$ = new period

$\Rightarrow B = \frac{2\pi}{\text{new period}}$

$B = \frac{2\pi}{20} = \frac{\pi}{10}$

$f(10) = -25\cos\left(\frac{\pi}{10}\cdot 10\right) + 95$

$= -25\cos(\pi) + 95$

$= -25(-1) + 95$

$= 25 + 95$

$= 120$ ✓