

December 3

## Equations of Sine and Cosine

$$y = a \cdot \sin bx + d$$

amplitude =  $|a|$       period =  $\frac{2\pi}{b}$       vertical shift  
+d → up d units  
-d → down d units

\* Make it positive!

Determine amplitude, period, and vertical shift:

(Ex1)  $y = 6 \cos 10x - 8$

↑ a      ↑ b      ↑ d

amp =  $|6|$   
amp = 6

period =  $\frac{2\pi}{10}$   
period =  $\frac{\pi}{5}$

V.S. = down 8

(Ex2)  $y = -1 \cos \frac{1}{3}x + 4$

↑ a      ↑ b      ↑ d

amp =  $|-1|$   
amp = 1

period =  $\frac{2\pi}{\frac{1}{3}}$   
period =  $6\pi$

V.S. = up 4

Ex3  $y = -\frac{8}{3} \sin \frac{7}{6}x + 0$

amp =  $\left| -\frac{8}{3} \right|$

amp =  $\frac{8}{3}$

period =  $\frac{2\pi}{\frac{7}{6}}$

period =  $\frac{12\pi}{7}$

v.s. = none

Ex4 Write a cosine function with amplitude 7, period  $\frac{\pi}{11}$ , and vertical shift up 2.

amp =  $|a|$

$7 = |a|$

$a = 7 \text{ or } -7$

period =  $\frac{2\pi}{b}$

$\frac{\pi}{11} = \frac{2\pi}{b}$

$\pi \cdot b = 11 \cdot 2\pi$

$\frac{\pi b}{\pi} = \frac{22\pi}{\pi}$

$b = 22$

v.s. = up 2

$d = +2$

$y = 7 \cos 22x + 2$

$y = -7 \cos 22x + 2$

(Ex 5) Write a sine function with amplitude 150, period  $160\pi$ , and vertical shift down 1001.

$$\text{amp} = |a|$$

$$150 = |a|$$

$$a = 150 \text{ or } -150$$

$$\text{period} = \frac{2\pi}{b}$$

$$\frac{160\pi}{1} = \frac{2\pi}{b}$$

$$160\pi \cdot b = 1 \cdot 2\pi$$

$$\frac{160\pi b = 2\pi}{\frac{160\pi}{160\pi}} = \frac{2\pi}{160\pi}$$

$$b = \frac{1}{80}$$

$$\text{v.s.} = \text{down } 1001$$

$$d = -1001$$

$$y = 150 \sin \frac{1}{80} X - 1001$$
$$y = -150 \sin \frac{1}{80} X - 1001$$