Ch. 5.2 Practice Examples: ← This is 5.2 HW + add #3+5 p250

Combining ALL Transformations $y = a\sin b(x-c)+d$ **and** $y = a\cos b(x-c)+d$

STEPS:

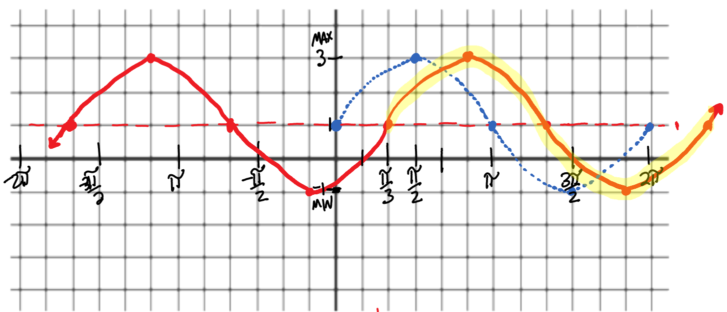
1. Determine the amplitude, vertical displacement, period and phase shift
2. Adjust the scale on the *x*-axis according to the period and phase shift (make the number of squares for one period the same as the common denominator)
3. Adjust the scale on the *y*-axis according to the amplitude and vertical displacement (use the Max and Min)
4. Graph base function
5. Graph the Period > Amplitude > Phase Shift > Vertical Displacement in order.

$(-2\pi \le \theta \le 2\pi)$

1) $y = 2\sin\left(x - \frac{\pi}{3}\right) + 1$

amplitude = 2
period = 2π or 360°
phaseshift = $\frac{\pi}{3}$ (right)
verticaldisplacement = 1

MAX = 3
1 ↑+2 ↓−2
MIN = −1

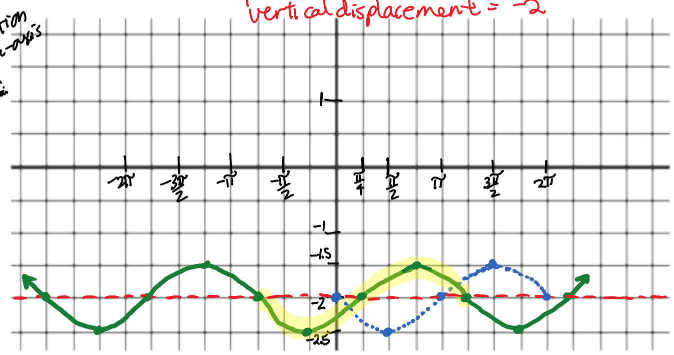


2) $y = -\frac{1}{2}\sin\left(x + \frac{3\pi}{4}\right) - 2$

reflection over x-axis

amplitude = $\frac{1}{2}$
period = 2π
phaseshift = $-\frac{3\pi}{4}$ or $\frac{3\pi}{4}$ left
verticaldisplacement = −2

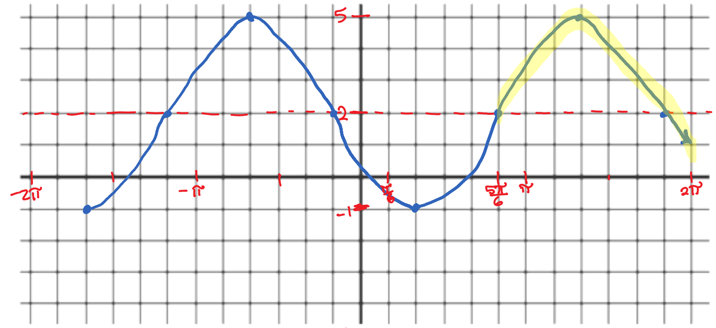
MAX = −1.5
−2 → ↑+0.5 ↓−0.5
MIN = −2.5



equation of Midline is $y = -2$

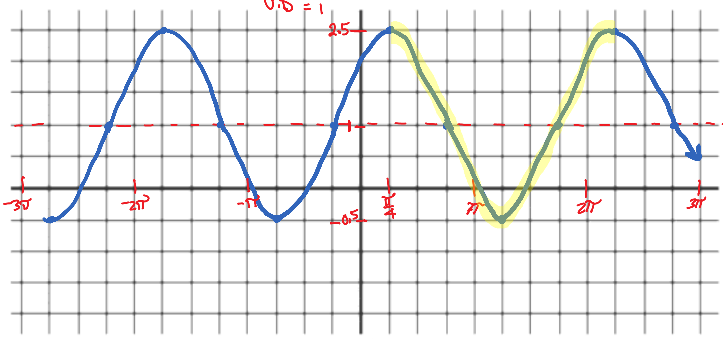
3) $y = 3\sin\left(x - \frac{5\pi}{6}\right) + 2$

amplitude = 3
period = 2π → 12 squares = 2π ∴ 3 squares for every $\frac{1}{4}$ of cycle.
phase shift = $\frac{5\pi}{6}$
vert. disp. = 2



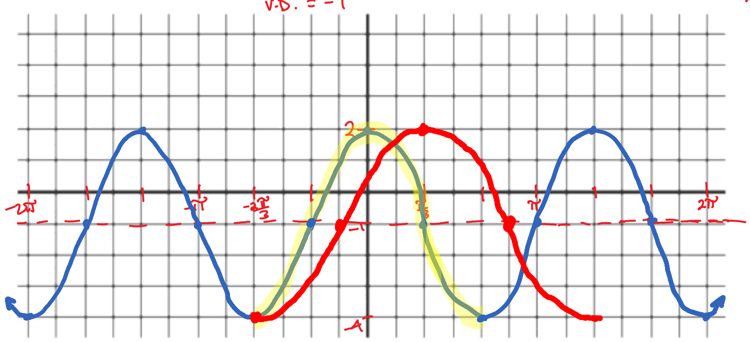
4) $y = \frac{3}{2}\cos\left(x - \frac{\pi}{4}\right) + 1$

$a = \frac{3}{2}$ (1.5)
$p = 2\pi$ → 8 squares for 2π ∴ every 2 squares is $\frac{1}{4}$ of cycle.
P.S = $\frac{\pi}{4}$
V.D = 1



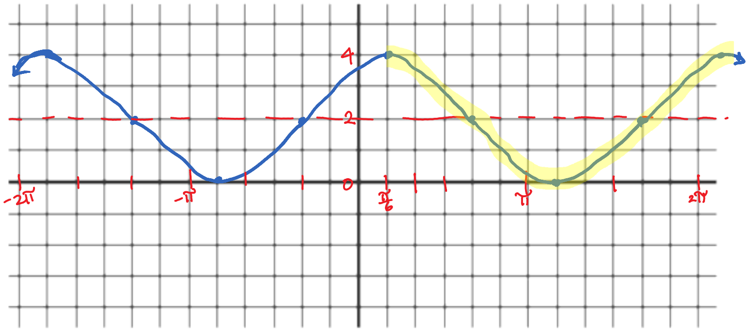
5) $y = -3\cos\left(x + \frac{2\pi}{3}\right) - 1$

$a = 3$ + reflection ∴ start at a minimum
$p = 2\pi$ → 2π = 12 squares ∴ every 3 squares is $\frac{1}{4}$ cycle.
P.S. = $-\frac{2\pi}{3}$
V.D. = −1



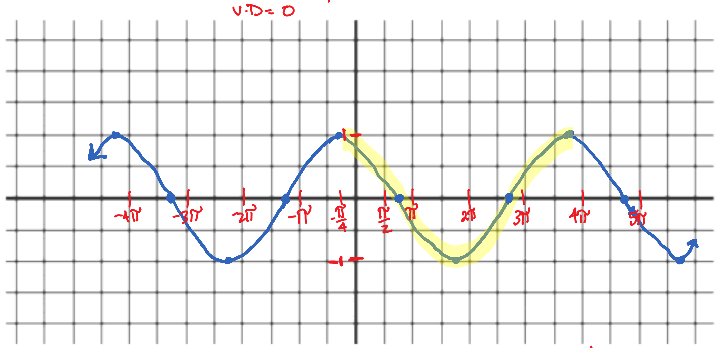
6) $y = 2\cos\left(x - \frac{\pi}{6}\right) + 2$

$a = 2$
$P = 2\pi \rightarrow$ 12 squares $= 2\pi$ $\therefore$ every 3 squares $= \frac{1}{4}$ cycle.
$P.S. = \frac{\pi}{6}$
$V.D = 2$



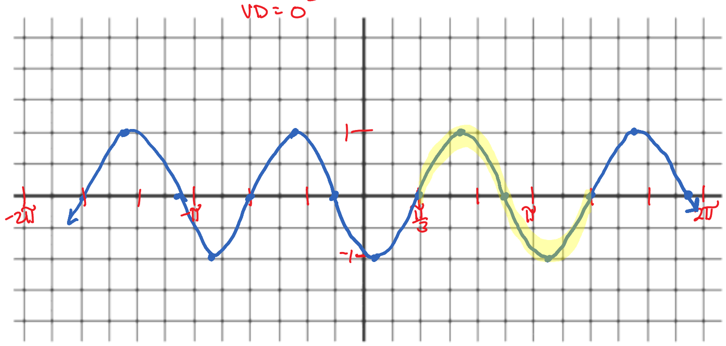
7) $y = \cos\frac{1}{2}\left(\theta + \frac{\pi}{4}\right)$

$a = 1$
$P = 2\pi \times \frac{2}{1} = 4\pi \rightarrow$ 8 squares $= 4\pi$ $\therefore$ every 2 squares is $\frac{1}{4}$ cycle
$P.S. = -\frac{\pi}{4}$
$V.D = 0$



8) $y = \sin 2\left(\theta - \frac{\pi}{3}\right)$

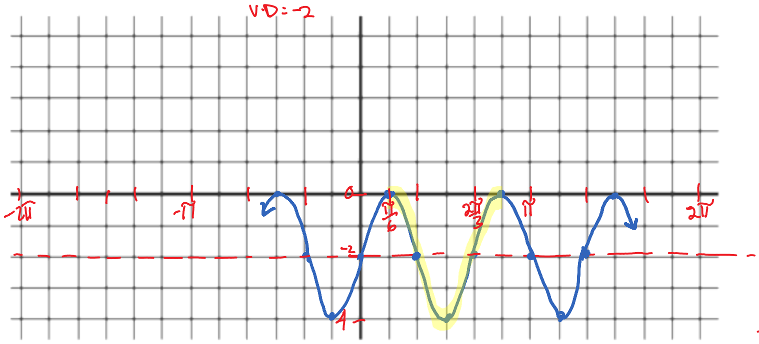
$a = 1$
$P = \frac{2\pi}{2} = \pi \rightarrow$ 6 squares $= \pi$ $\therefore$ every 1.5 squares is $\frac{1}{4}$ cycle.
$P.S. = \frac{\pi}{3}$
$VD = 0$



9) $y = 2\cos 3\left(\theta - \frac{\pi}{6}\right) - 2$

$a = 2$
$P = \frac{2\pi}{3}$
$P.S. = \frac{\pi}{6}$
$V.D. = -2$

$\frac{2\pi}{3} = 4$ squares $\therefore$ every square $= \frac{1}{4}$ cycle



10) $y = -\frac{1}{2}\sin\left(\frac{1}{2}\theta + \frac{\pi}{4}\right) + 1$

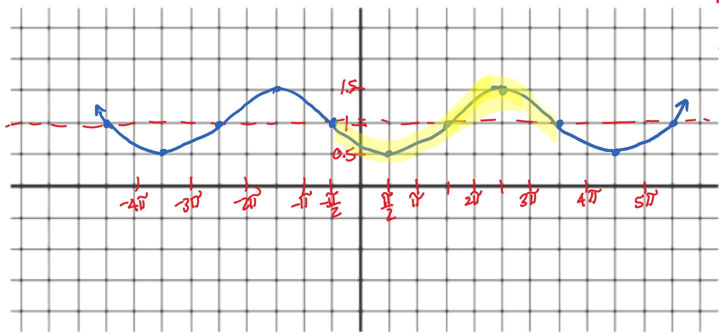
FACTOR $\rightarrow \div \frac{1}{2}$ out of $\frac{\pi}{4}$ $\rightarrow y = -\frac{1}{2}\sin\frac{1}{2}\left(\theta + \frac{\pi}{2}\right) + 1$

$\frac{\frac{\pi}{4}}{\frac{1}{2}} \Rightarrow \frac{\pi}{4} \times \frac{2}{1} = \frac{\pi}{2}$

$a = \frac{1}{2}$ & reflection $\therefore$ midpoint + down

$P = 2\pi \times \frac{2}{1} = 4\pi$
$P.S. = -\frac{\pi}{2}$
$V.D. = 1$

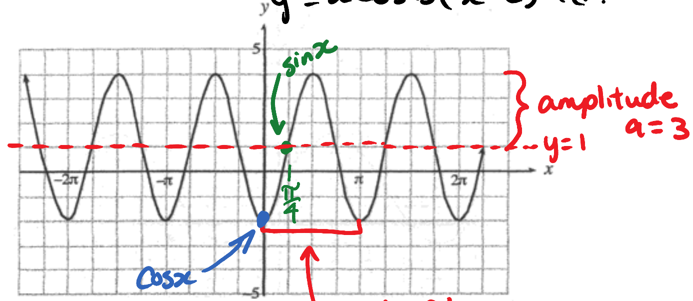
$4\pi = 8$ squares $\therefore$ every 2 squares $= \frac{1}{4}$ cycle.



11. Given the graphs below, determine a possible equation for each function.

a)

$y = a\sin b(x - c) + d$
$y = a\cos b(x - c) + d.$

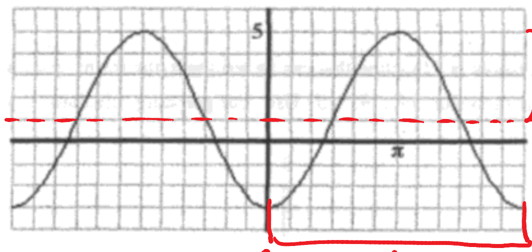


$y = -3\cos 2x + 1$
$y = 3\sin 2\left(x - \frac{\pi}{4}\right) + 1$

$bP = \frac{2\pi}{b} \Rightarrow b = \frac{2\pi}{P} = \frac{2\pi}{\pi} = 2$

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

b)



$a = 4$

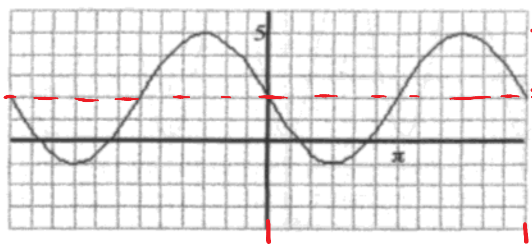
$VD = 1$

P.S. $= 0$ for $-\cos$

$2\pi \rightarrow b = 1$

$\boxed{y = -4\cos x + 1}$

c)



$a = 3$

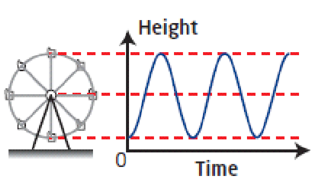
$VD = 2$

P.S. $= 0$ for $-\sin$

period $= 2\pi$ $\therefore b = 1$

$\boxed{y = -3\sin x + 2}$

19. A Ferris wheel with a radius of 10 m rotates once every 60 s. Passengers get on board at a point 2 m above the ground at the bottom of the Ferris wheel. A sketch for the first 150 s is shown.



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