Section 5-2 Linear Combination Property

$$b\cos x + c\sin x = A\cos(x - D)$$

where

$$A = \sqrt{b^2 + c^2}$$

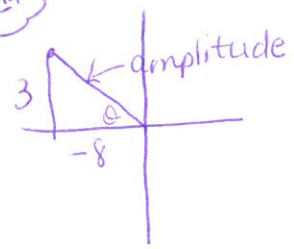
$$D = \arctan\frac{c}{b}$$

Write the linear combination of cosine and sine as a single cosine with a phase displacement.

1. $y = -8\cos\theta + 3\sin\theta$ *need to make a sketch to see the Quadrant (-8, 3)

1st put in calc

2nd



3rd

$3^2 + (-8)^2 = c^2$

$9 + 64 = c^2$

$\sqrt{73} = c$

$\tan\theta = -\frac{3}{8}$

$\theta = -20.55$

angle should be in 2nd quad, so must use an arctan value → $+180°$

$\theta = 159.44°$

$y = \sqrt{73}\cos(\theta - 159.44°)$

Graphically

FIRST Pt 1

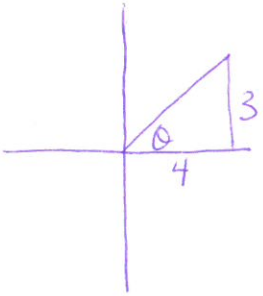
** Have students graph equation (in degrees) and write an equation for it using just cosine.

Algebraically

SECOND Pt 2

** Have them draw picture of it using the quadrants ∨ △. Can they figure out from picture where amp. + phase displacement (from pt 1) come from

2. $y = 4\cos\theta + 3\sin\theta$



$3^2 + 4^2 = c^2$

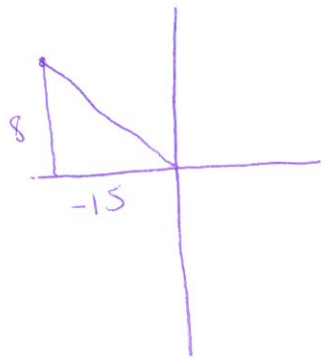
$9 + 16 = c^2$

$5 = c$

$\tan^{-1}\left(\frac{3}{4}\right) = 36.87°$

$y = 5\cos(\theta - 36.87°)$

3. $y = -15\cos\theta + 8\sin\theta$



$8^2 + (-15)^2 = c^2$

$17 = c$

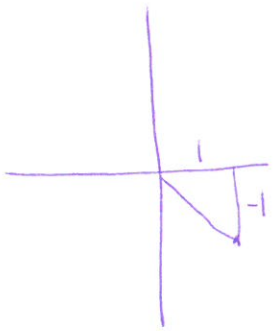
$\theta = \tan^{-1}\left(\frac{8}{-15}\right)$

$\theta = -28.07 + 180°$

$\theta = 151.93°$

$y = 17\cos(\theta - 151.93°)$

4. $y = |\cos\theta - |\sin\theta$



$1^2 + (-1)^2 = c^2$

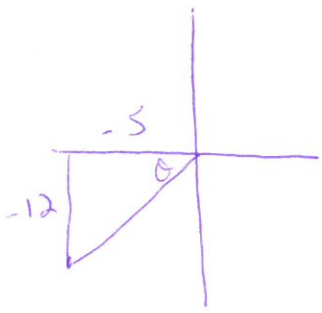
$c = \sqrt{2}$

$\theta = \tan^{-1}\left(\frac{-1}{1}\right)$

$\theta = -45°$

$y = \sqrt{2}\cos(\theta + 45°)$

5. $y = -5\cos x - 12\sin x$ *radian mode



$(-5)^2 + (-12)^2 = c^2$

$13 = c$

$x = \tan^{-1}\left(\frac{-12}{-5}\right)$

$x = 1.176 + \pi$

$x = 4.31$

$y = 13\cos(x - 4.31)$