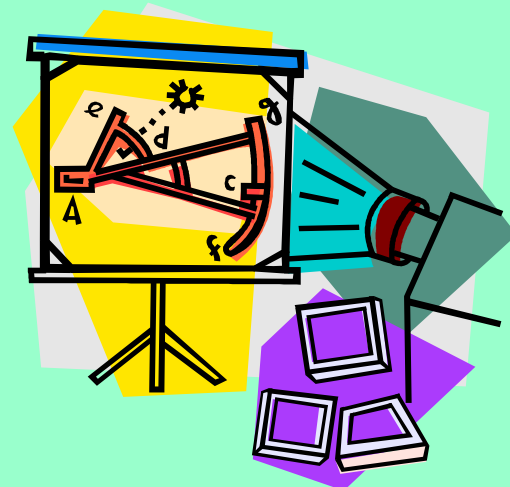


4.

Solving Equations



Example 1

Solve $2\cos x + 1.5\sin x = 1.25$

Solution:

1. You can choose which expansion to use to simplify left hand side.
2. Compare coefficients of $\sin x$ and $\cos x$ for this expansion and original.
3. Use these facts to find which quadrant a will lie in.

$$k > 0, \quad 0 \leq x \leq 360$$

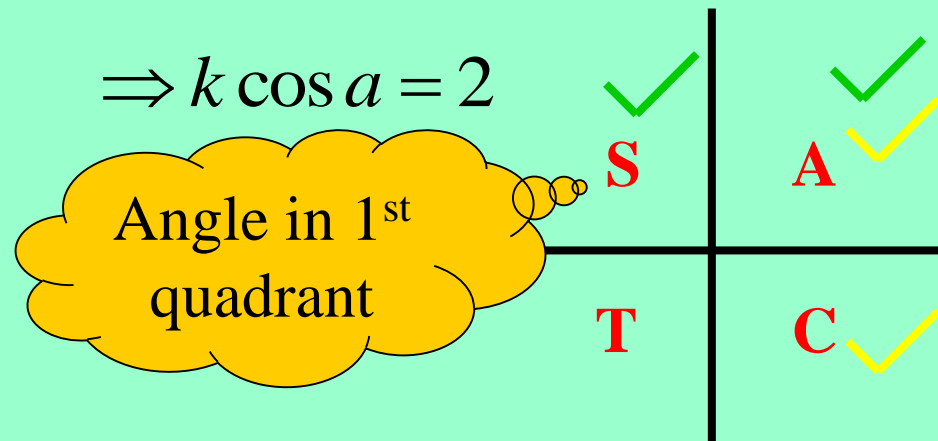
$$k \cos(x - a)$$

$$= k(\cos x \cos a + \sin x \sin a)$$

$$= k \cos x \cos a + k \sin x \sin a$$
$$2\cos x + 1.5\sin x$$

$$\Rightarrow k \sin a = 1.5$$

$$\Rightarrow k \cos a = 2$$



Example 1

Solve $2 \cos x + 1.5 \sin x = 1.25$

Solution:

4. Find k

5. Find a

$$k > 0, \quad 0 \leq x \leq 360$$

$$\begin{aligned} k &= \sqrt{a^2 + b^2} \\ &= \sqrt{(2)^2 + (1.5)^2} \\ &= \sqrt{6.25} = 2.5 \end{aligned}$$

$$\tan a = \frac{k \sin a}{k \cos a} = \frac{1.5}{2}$$

$$\Rightarrow a = \tan^{-1} \left(\frac{1.5}{2} \right)$$

$$\Rightarrow a = 36.9^\circ$$

Example 1

Solve $2\cos x + 1.5\sin x = 1.25$

$k > 0, 0 \leq x \leq 360$

Solution:

6. Re-write equation using wave function form.

7. Solve equation

$$k = 2.5 \quad a = 36.9^\circ$$

$$2\cos x + 1.5\sin x = 1.25$$

$$\Rightarrow 2.5\cos(x - 36.9^\circ) = 1.25$$

$$\Rightarrow \cos(x - 36.9^\circ) = \frac{1.25}{2.5}$$

$$\Rightarrow (x - 36.9^\circ) = \cos^{-1}\left(\frac{1.25}{2.5}\right)$$

$$\Rightarrow (x - 36.9^\circ) = 60^\circ \text{ or } 300^\circ$$

$$\Rightarrow x = 96.9^\circ \text{ or } 336.9^\circ$$

Heinemann, p.309, EX 16H, Q1