3b $\sin(2x) = \cos(2x)$

$\sin(2x) - \cos(2x) = 0$

$\sin(2x) - (1 - 2\sin^2 x) = 0$

$\sin(2x) - 1 + 2\sin^2 x = 0$

$2\sin^2 x + \sin(2x) - 1 = 0$

$2\sin^2 x + 2\sin x \cos x - 1 = 0$

$2\sin x(\sin x + \cos x) - 1$

3d. $\sin(4x) = \sin(2x)$

$$\frac{2\sin(2x)\cos(2x)}{\sin(2x)} = \frac{\sin(2x)}{\sin(2x)}$$

$$\cancel{4\sin x\cos x\cos(2x) = \sin(2x)}$$

$0 \le x \le \pi$

$0 \le 2x \le 2\pi$

$$2\cos(2x) = 1$$

$$\cos(2x) = \frac{1}{2}$$

$$2x = \frac{\pi}{3}, \frac{5\pi}{3}$$

$$x = \frac{\pi}{6}, \frac{5\pi}{6}$$

$$2\sin(2x)\cos(2x) - \sin(2x) = 0$$

$$\sin(2x)\left(\underbrace{2\cos(2x) - 1}\right) = 0$$

$$\sin(2x) = 0$$

$$2x = 0, \pi, 2\pi$$

$$x = 0, \frac{\pi}{2}, \pi$$

5d $\sin^2 x + 2\sin x\cos x + \cos^2 x = 1 + \sin 2x$

5d $\cos\theta + \sin\theta = \dfrac{1 - 2\sin^2\theta}{\cos\theta - \sin\theta}$ $\leftarrow$ $\cos(2\theta)$

$$\text{RHS} = \frac{\cos^2\theta - \sin^2\theta}{\cos\theta - \sin\theta} \qquad \cos(2\theta)$$

$$= \frac{\cancel{(\cos\theta - \sin\theta)}(\cos\theta + \sin\theta)}{\cancel{(\cos\theta - \sin\theta)}} \qquad \text{diff of squares}$$

$$= \cos\theta + \sin\theta$$

$$= \text{LHS} \checkmark$$