

① $\sin^3 x + \sin x \cos^2 x$
 Factor out GCF = $\sin x$!
 $\sin x (\sin^2 x + \cos^2 x)$
 Pyth.! $\sin^2 x + \cos^2 x = 1$
 $\sin x (1) = \boxed{\sin x}$

② $\cos x - \cos^3 x$
 Factor out GCF = $\cos x$!
 $\cos x (1 - \cos^2 x)$
 Pyth.! $\sin^2 x + \cos^2 x = 1$
 $\sin^2 x = 1 - \cos^2 x$
 $\cos x (\sin^2 x)$

③ $\frac{1 + \tan^2 x}{\csc^2 x}$ ← Pyth!
 $\tan^2 x + 1 = \boxed{\sec^2 x}$
 $\frac{\sec^2 x}{\csc^2 x} \xrightarrow{\text{Reciprocal ID}} \frac{1}{\cos^2 x} \cdot \frac{1}{\frac{1}{\sin^2 x}}$
 KCF!
 $\frac{1}{\cos^2 x} \cdot \frac{\sin^2 x}{1}$
 $\frac{\sin^2 x}{\cos^2 x} \xrightarrow{\text{Quot. ID}} \boxed{\tan^2 x}$

④ $\sin x \cos x \tan x \sec x \csc x$
 Rewrite in terms of $\sin x$ & $\cos x$!
 $\frac{\sin x}{1} \cdot \frac{\cos x}{1} \cdot \frac{\sin x}{\cos x} \cdot \frac{1}{\cos x} \cdot \frac{1}{\sin x}$
 $\frac{\sin x}{\cos x} \xrightarrow{\text{Quot. ID}} \boxed{\tan x}$

⑤ $\frac{(\sec x + 1)(\sec x - 1)}{\sin^2 x}$
 BOX or FOIL!
 $\frac{\sec^2 x - 1}{\sin^2 x}$ ← Pyth!
 $\tan^2 x + 1 = \sec^2 x$
 $\tan^2 x = \sec^2 x - 1$
 $\frac{\tan^2 x}{\sin^2 x} \xrightarrow{\text{Quot. ID}} \frac{\sin^2 x}{\cos^2 x} \cdot \frac{1}{\frac{1}{\sin^2 x}} = \frac{1}{\cos^2 x}$
 $\boxed{\sec^2 x}$ ← Rec. ID!

⑥ $\sin^2 x + \sin^2 x \tan^2 x$
 Factor out GCF = $\sin^2 x$!
 $\sin^2 x (1 + \tan^2 x)$
 Pyth.! $\tan^2 x + 1 = \boxed{\sec^2 x}$
 $\sin^2 x (\sec^2 x)$
 $\frac{\sin^2 x}{1} \cdot \frac{1}{\cos^2 x} \xrightarrow{\text{Reciprocal ID}}$
 $\frac{\sin^2 x}{\cos^2 x} = \boxed{\tan^2 x}$

⑦ $\frac{\tan(\pi/2 - x) \csc x}{\csc^2 x}$
 cofunction ID!
 $(\cot x) \csc x = \frac{\cot x}{\csc x}$
 $\frac{\cos x}{\sin x} \cdot \frac{\sin x}{1} = \boxed{\cos x}$

⑧ $\sin x (\tan x + \cot x)$
 Distribute $\sin x$!
 $\sin x \tan x + \sin x \cot x$
 ALL $\sin x$ & $\cos x$!
 $\frac{\sin x}{1} \cdot \frac{\sin x}{\cos x} + \frac{\sin x}{1} \cdot \frac{\cos x}{\sin x}$
 $\frac{\sin^2 x}{\cos x} + \frac{\cos x}{1}$ ← Criss-Cross Applesauce!
 Pyth.! $\frac{\sin^2 x + \cos^2 x}{\cos x} = \frac{1}{\cos x} = \boxed{\sec x}$

⑨ $\frac{\sin^2 x + \cos^2 x}{\cos^2 x}$ ← Pyth.
 $\frac{1}{\cos^2 x} = \boxed{\sec^2 x}$
 Reciprocal

⑩ $\cos x \csc x$
 $\frac{\cos x}{1} \cdot \frac{1}{\sin x}$
 $= \frac{\cos x}{\sin x} = \boxed{\cot x}$
 Quotient ID

$$\textcircled{11} \frac{\tan x}{\sin x} = \frac{\overset{\text{Quot.}}{\cancel{\sin x}} \cdot \overset{K}{\cancel{\cos x}} \cdot \overset{C}{1} \cdot \overset{F}{\cancel{\sin x}}}{\sin x} = \frac{1}{\cos x} = \boxed{\sec x}$$

$$\textcircled{12} \frac{\tan x \csc x}{\sec x} = \tan x \cdot \csc x \cdot \overset{\text{Reciprocal}}{\cancel{\cos x}} = \frac{\cancel{\sin x}}{\cancel{\cos x}} \cdot \frac{1}{\cancel{\sin x}} \cdot \frac{\cancel{\cos x}}{1} = \boxed{1}$$

$$\textcircled{13} \frac{1}{\sin^2 x} - \frac{\cos^2 x}{\sin^2 x} = \frac{1 - \cos^2 x}{\sin^2 x} = \frac{\sin^2 x}{\sin^2 x} = \boxed{1}$$

$$\textcircled{14} \frac{\cos^2 x}{1 + \sin x} \stackrel{\text{Pyth.}}{=} \frac{1 - \sin^2 x}{1 + \sin x} = \frac{\overset{\text{Diff. of Squares}}{(1 + \sin x)(1 - \sin x)}}{1 + \sin x} = \boxed{1 - \sin x}$$

$$\textcircled{15} \frac{\csc x}{1 + \cot^2 x} = \frac{\csc x}{\csc^2 x} = \frac{1}{\csc x} = \boxed{\sin x}$$

$$\textcircled{16} \sin^2 x \cos^2 x + \sin^4 x = \sin^2 x (\cos^2 x + \sin^2 x) = \boxed{\sin^2 x (1)}$$

$$\textcircled{17} \sin x + \cos x \tan x = \sin x + \cancel{\cos x} \cdot \frac{\sin x}{\cancel{\cos x}} = \boxed{2 \sin x}$$