1. Find all the values of $x$ between $-3$ and $2$ for which $\sec \frac{\pi}{4} \sec^2 (2x - 2) = -\tan \frac{5\pi}{3}$

2. Find all the angles between $0^\circ$ and $180^\circ$ for the equation $\cos 3x = -11 \cos^2 x$.

3. Solve the equation $\cos^2 \theta + 3 \sin \theta \cos \theta = -1$ for $0^\circ \leq \theta \leq 180^\circ$

4. a) Given that $\cos 2x = a + b$ and $\sin 2x = a - b$. Show that $a^2 + b^2 = \frac{1}{2}$.
   b) Find a function that has the following graph

   ![Graph Image]

   y
   4
   -2
   0
   \(\pi/2\)
   x

5. Prove that $\sin^4 A + \cos^4 A = \frac{1}{4} (3 + \cos 4A)$.
   (Hint: Square ($\sin^2 A + \cos^2 A$) to help proof above equation)

6. $ABC$ is a triangle where $\tan \left(\frac{\angle A}{2}\right) = \frac{1}{2}$.
   i) Show that $\tan \angle A = \frac{4}{3}$
   ii) Find the exact values of $\sin(\angle B + \angle C)$ and $\cos(\angle B + \angle C)$
   (Hint: $\angle A + \angle B + \angle C = 180^\circ$)

7. The depth of water, $y$ meters, at a particular coast, $t$ hours after 12 am is given by:
   \[ y = 4 + 3 \sin \left(\frac{\pi}{6} t\right), \text{ where } 0 \leq t \leq 24 \]
   i) State the amplitude of $y$
   ii) What are the depths of water at high tide and low tide?
   iii) At what times of the day will low tide occur?

8. a) Prove the identity $\frac{\sin(A+B)}{\sin(A-B)} = \frac{\tan A + \tan B}{\tan A - \tan B}$
   b) Prove the identity $\sin^3 x + \cos^3 x = (\sin x + \cos x)(1 - \sin x \cos x)$
9.  i) Prove the identity \( \sin 2x - \tan x = \tan x \cos 2x \).

   ii) Hence, without using a calculator, find the value of \( \tan(67.5^\circ) \).

10. In the diagram above, \( \triangle ABC \) is a triangle such that \( \angle BAD = \angle DBC = \theta^\circ \), \( AB = 5 \text{ m} \) and \( AC = 10 \text{ m} \).

   i) Find \( BC \) (Leave your answer in surd form)

   ii) Show that \( BD = 5 \sin \theta^\circ \)

   iii) Show that \( BD = 5\sqrt{5} \cos \theta^\circ \)

   iv) Hence, show that \( 2BD = 10 \cos(\theta^\circ - 24.1^\circ) \)