1. (9 points) Let $f(x) = \sqrt{3}\cos x + \sin x + 1$, where $x \in \mathbb{R}$.
   (a) (3 points) Write $f(x)$ in the form $R\sin(x+\alpha)+1$, where $R > 0$ and $\alpha \in (-\frac{\pi}{2}, \frac{\pi}{2})$.
   (b) (1 point) State the range of f.
   (c) (2 points) Sketch the graph of f.
   (d) (3 points) Solve the equation $f(x) = -1$.

2. (18 points)
   (a) (2 points) Sketch the graph of $f(x) = \sec x$ for $x \in [0, \frac{\pi}{2}) \cup (\frac{\pi}{2}, \pi]$.
   (b) (3 points) Write down:
      i. the coordinates of the maximum and minimum points of the graph,
      ii. the equation of the asymptote of the graph,
      iii. the range of $f(x)$.
   (c) (2 points) On a separate diagram sketch the graph of $f^{-1}(x) = arc\sec(x)$.
   (d) (1 point) Write down the domain of $arc\sec(x)$.
   (e) (5 points) Assume $x > 1$.
      i. Use an appropriate right triangle to show that
      $$\sin(arc\sec(x)) = \frac{\sqrt{x^2 - 1}}{x}$$
      ii. Find similar expressions for $\cos(arc\sec(x))$ and $\tan(arc\sec(x))$.
   (f) (3 points) Calculate the exact value of
   $$\tan(arc\sec(2) + arc\sec(3))$$
   (g) (2 points) Find the exact value of
   $$\tan(arc\sec(-2) + arc\sec(-3))$$

3. (5 points) If $\alpha \in (\pi, \frac{3\pi}{2})$ and $\cos\alpha = -\frac{2}{5}$, find the value of:
   (a) $\sin 2\alpha$,
   (b) $\tan 3\alpha$.