1. Consider \( f(x) = -4x^2 + x - 1 \).
   (a) Find \( f'(x) \).
   (b) Find the point on the graph \( y = f(x) \) where \( f'(x) = 0 \).
   (c) Find \( f''(x) \).
   (d) Using your result from part c) explain why the graph of \( y = f(x) \) is concave down.

2. Find the equation of the line tangent to the graph of \( f \) at \((\pi, 0)\), where \( f \) is given by
   \[ f(x) = x^3 \sin(2x) \].

3. Consider \( f(x) = e^{2x}(x + 2) \).
   (a) Find the derivative of \( f(x) \).
   (b) For which values of \( x \) is \( f'(x) \) strictly positive?
   (c) For which values of \( x \) is \( f'(x) \) strictly negative?
   (d) Using your results from parts b) and c) give the interval on which \( f(x) \) is increasing.

4. Find all the local maximum, local minimum and inflection points of \( f(x) = e^{-x^2/2} \) and hence sketch \( y = f(x) \) showing all the points you’ve found.

5. The number, \( N \), of people who have heard a rumor spread by mass media at time, \( t \), in days, is modelled by
   \[ N(t) = \frac{a}{1 + be^{-kt}} \].
   (a) If 50 people have heard the rumour initially and 300,000 people hear the rumour eventually, find \( a \) and \( b \).
   (b) If the rumour is initially spreading at the rate of 500 people per day, find \( k \).