Quadratic equations with parameters

1. In the equations below analyze the number of solutions to x with respect to the parameters used.
   (a) $2x^2 + px + 1 = 0$.
   (b) $x^2 + 3x + b = 0$.
   (c) $-x^2 + kx + (k-3) = 0$.
   (d) $x^2 + px + p = 0$.
   (e) $ax^2 - 2x + 1 = 0$.
   (f) $px^2 + px - 3 = 0$.
   (g) $mx^2 - x + m = 0$.

2. Find the tangent line
   (a) to $y = -2x^2 + 1$ at $x = 1$,
   (b) to $y = 4x^2 - x$ at $x = -2$,
   (c) to $y = x^2 - x + 1$ at $x = 3$,
   (d) to $y = 2x^2 + 4x + 5$ at $x = -1$,

3. For each function below find, exactly,
   - the domain,
   - the equations of the asymptotes,
   - the roots and the y-intercept
   - the range and the coordinates of any turning points.

   Sketch the graphs, indicating your findings.
   (a) $y = x + \dfrac{5}{x}$.
   (b) $y = 2x - 1 - \dfrac{1}{x-1}$.
   (c) $y = \dfrac{x^2 + x + 4}{x + 1}$.
   (d) $y = \dfrac{-2x^2 + 3}{2x - 1}$.
   (e) $y = \dfrac{(x+1)^2}{x}$.
   (f) $y = \dfrac{-2x^2 + 4x - 2}{x + 1}$.
   (g) $y = \dfrac{x}{4x^2 + 1}$.
   (h) $y = \dfrac{x + 1}{x^2 + x + 4}$.
   (i) $y = \dfrac{1 - 2x}{(x + 2)^2}$.
   (j) $y = \dfrac{2x + 1}{x^2 - 6x + 9}$.
   (k) $y = \dfrac{x}{1 - x^2}$.
   (l) $y = \dfrac{x - 1}{x^2 + x}$.
   (m) $y = \dfrac{x^2 + x + 1}{x^2 - x + 1}$.

(n) $y = \dfrac{2x^2 + 1}{(x-1)^2}$.

(o) $y = \dfrac{2x^2 + 1}{x^2 - 1}$.