2. Consider the following two-objective optimization problem:

$$\text{Minimize } f_1(x) = x_1^2 + x_2^2$$
$$\text{Minimize } f_2(x) = (x_1 - 1)^2 + x_2^2$$
$$-2 \le x_1 \le 2,$$
$$2 \le x_2 \le 2.$$

By using the preference-based procedure, calculate the optimum solutions for each of the following three weight vectors: (i) $\mathbf{w}^{(1)} = (1, 0)^T$, (ii) $\mathbf{w}^{(2)} = (0.5, 0.5)^T$, (iii) $\mathbf{w}^{(3)} = (0, 1)^T$.

3. In problem 2, write the optimum solution vector $\mathbf{x}$ as a function of the chosen weight vector $\mathbf{w}$ (where $w_1 + w_2 = 1$).

7. Using an ideal multi-objective optimization algorithm, explain how the following multi-objective optimization problem can be solved to find multiple Pareto-optimal solutions:

$$\text{Minimize} \quad f_1(x_1, x_2) = (x_1 - 2)^2 + (x_2 - 1)^2,$$
$$\text{Minimize} \quad f_2(x_1, x_2) = 9x_1 - (x_2 - 1)^2.$$

If the user prefers a solution with the smallest absolute value of $f_2$, which is the preferred Pareto-optimal solution?