(1) Fitness facilities often offer exercise classes (like Zumba and BodyPump classes) for an extra fee. This question considers the market for such exercise classes. Let Q = the number of people in a class and p = the price of (fee charged for) a class. Assume that the market is perfectly competitive. Assume also that the Demand curve for a spot in a class is relatively elastic and that the marginal cost to the facility of having one more person attend a class is constant and equal to $3.

(A) **[5 points]** Suppose that the market is in equilibrium. Using the information given above, depict the equilibrium class size (Q) and fee in the following graph. Be sure to identify the equilibrium class size and fee clearly.

(B) [5 points] Now, suppose that a highly contagious and deadly virus is introduced into the population, resulting in easy transmission of the virus between people who are close to each other. As more people are in a given space, the likelihood of being exposed to the virus increases and the marginal (externality) costs (for example, due to sickness, and not being able to work) associated with transmission increase significantly. Suppose that Figure 1 at the end of this test identifies how these marginal costs change as the number of people in a class (Q) increases.

Using the information given above, identify (in the graph below) the efficient class size (the efficient Q) and the class size we would observe in markets (the equilibrium size identified in part (A)). Discuss whether the class size we would observe in markets is efficient and, if it is not efficient, clearly identify the deadweight loss associated with the class size not being efficient.

(C) **[5 points]** Identify a policy which would allow us to achieve the efficient class size (efficient Q) identified in part (B). Explain, in words and show in the graph below, how the policy you have identified gets us to the efficient level of Q. Be sure to provide the details necessary to show that the policy achieves the efficient level of Q.

(2) The importance of vaccinations to the functioning of economies around the world has become apparent this year. While the United States (which has vaccinated a substantial portion of its population against Covid-19) is opening up its economy, many other countries (which have not been able to vaccinate their populations) are imposing greater restrictions on their populations. Society at large benefits from a person who has been vaccinated against a virus like Covid-19 because people with whom the person has come in contact will, with high probability, not catch the virus. In other words, a vaccination creates positive externalities.

This question concerns the market for vaccines. For your answer, let Q represent number of vaccines and p represent the price of a vaccine.

Figure 2 at the end of this test identifies hypothetical private demand (D_1), private (societal) supply (S_1), and Marginal Social Benefits (MSB) curves for a vaccine market.

(A) [5 points] Using Figure 2, explain why we would expect an inefficient number of vaccines to be sold in the vaccine market, and (ii) identify the deadweight loss associated with that inefficiency. (Your answer must include identifying the efficient level of output.)

(B) [5 points] Suppose that the government decides on a public policy which makes vaccines available to everyone for free. Using Figure 2 as a point of reference, explain why the governmental policy will not achieve the efficient level of vaccinations.

(C) [5 points] Identify a policy (or program) which would produce an efficient level of output in the vaccine market. In the graph below and using words, show how the policy achieves the efficient level of output.

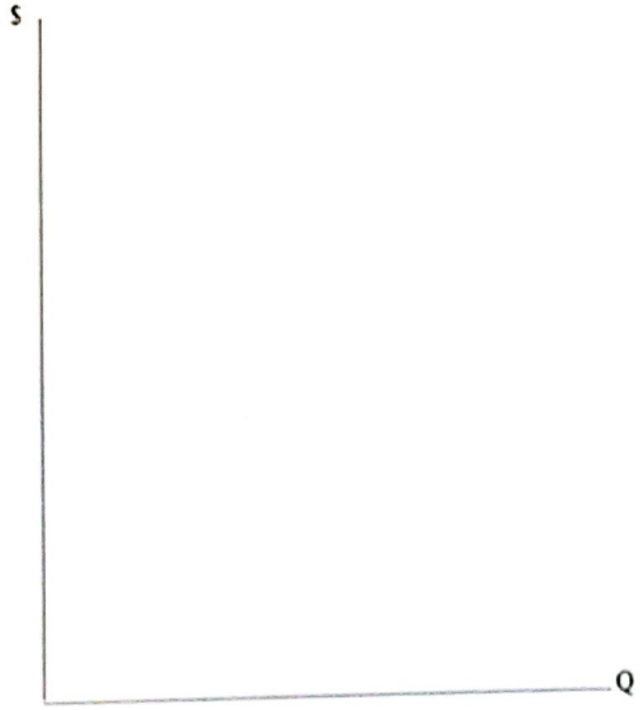

Figure 1

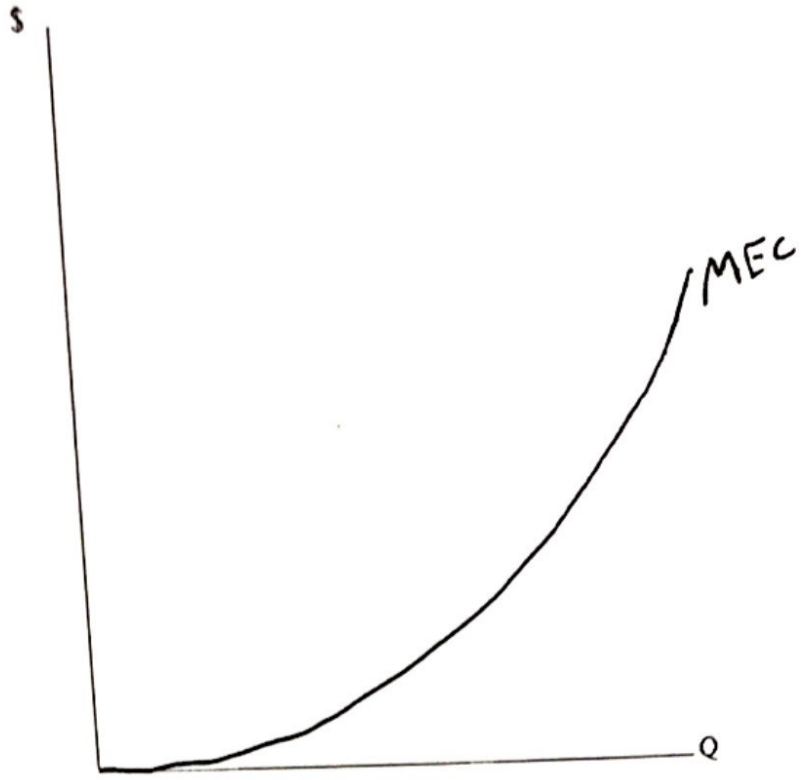

Figure 2