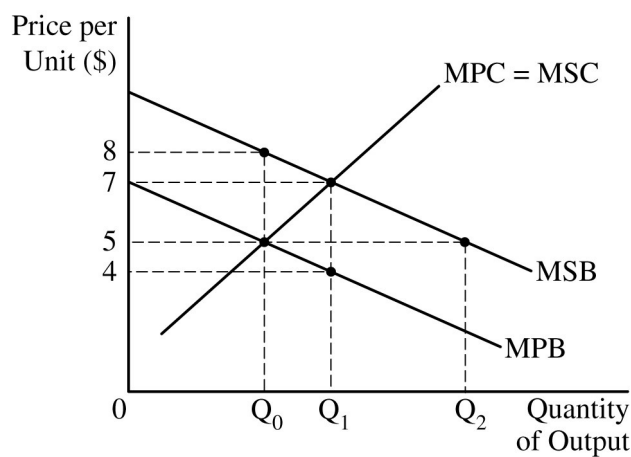1. A firm has a patent on a new carbon-capture technology, making it the only producer of that device. The firm is currently earning a positive economic profit and is producing the profit-maximizing level of output.

   (a) Draw a correctly labeled graph for the firm and show each of the following.

       (i) The quantity of carbon-capture devices produced by the firm, labeled Q_M
       (ii) The price charged by the firm, labeled P_M
       (iii) The area representing consumer surplus, shaded completely

   (b) The government is considering different options to regulate the firm.
       (i) Suppose the government is considering taxing the firm. Could using a per-unit tax change the firm's output to the socially optimal quantity? Explain.
       (ii) Instead, suppose the government imposes a price ceiling so that the firm produces the socially optimal quantity. On your graph in part (a), label the quantity and price after the price ceiling is imposed as Q_C and P_C.
       (iii) At the price and the quantity identified in part (b)(ii), is the firm earning positive economic profit? Explain.

   (c) Assume the government decides not to regulate the firm and instead the firm produces the quantity of output that maximizes total revenue.
       (i) If the firm now increases its output by one unit, would marginal revenue be positive, negative, or zero? Explain.
       (ii) Starting at the total-revenue-maximizing quantity, if the firm reduces the price by 10%, would the quantity demanded increase by less than 10%, by more than 10%, or by exactly 10% ?

   _____

   Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

GO ON TO THE NEXT PAGE.

2. Bueno is a firm that produces and sells guava, a type of fruit. The market for guava is perfectly competitive. The marginal private benefit (MPB), marginal private cost (MPC), marginal social benefit (MSB), and marginal social cost (MSC) curves are illustrated in the graph provided.
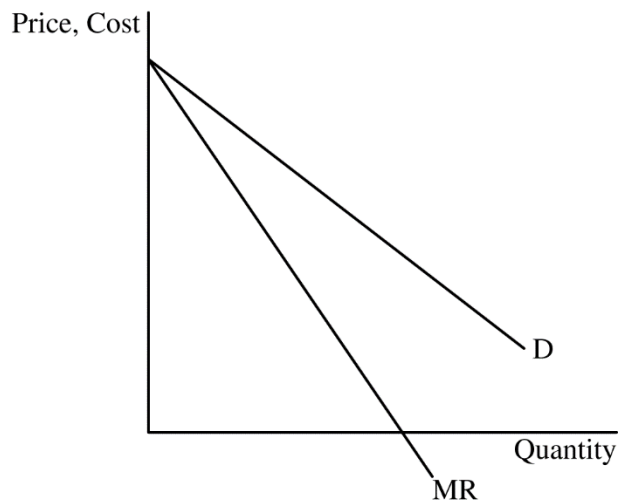

(a) Identify the kind of market failure represented by this graph.

(b) Using numbers from the graph, identify the marginal external benefit.

(c) Assume the guava market is in short-run equilibrium and Bueno hires workers in a perfectly competitive labor market at a wage of $20 per hour. The marginal product of the last worker hired was 6 units of guava per hour.

    (i) Calculate the change in Bueno's profit per hour from the last worker hired. Show your work.
    (ii) Suppose that the government decides to provide a per-unit subsidy to consumers who buy guava. How would the per-unit subsidy affect Bueno's marginal revenue product curve? Explain.

(d) Instead of hiring workers in a perfectly competitive labor market, assume Bueno hires workers in a monopsony labor market. Will the number of workers hired increase, decrease, or stay the same? Explain.
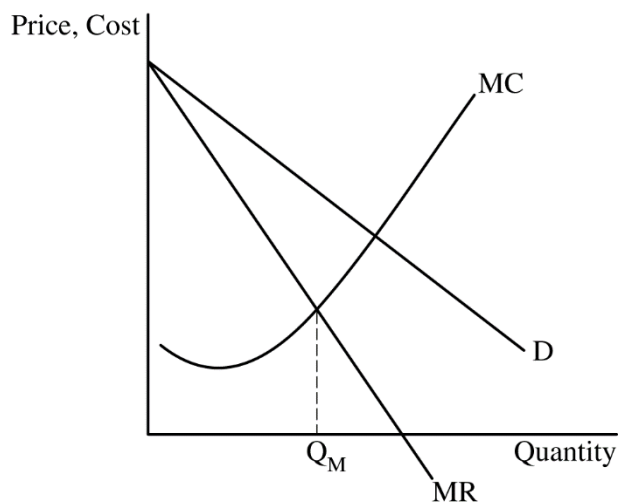
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Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

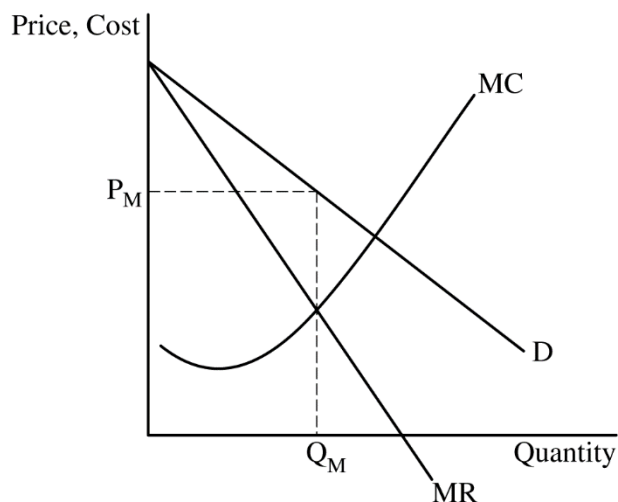## Question 1: Long   10 points

(a) Draw a correctly labeled graph for a monopoly showing downward-sloping   **1 point**
demand (D) and marginal revenue (MR) curves with the MR curve below the
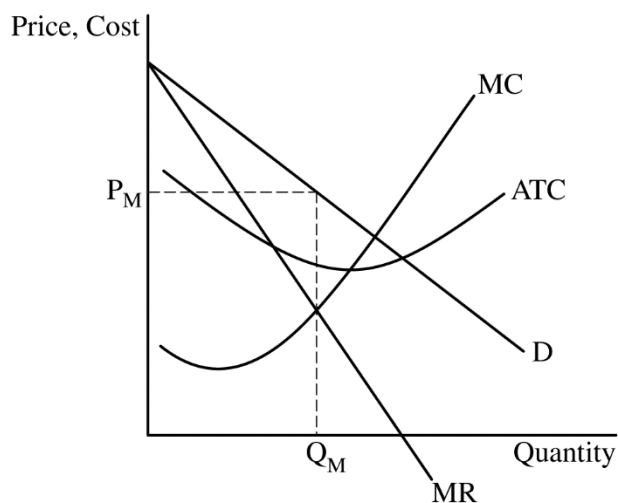demand curve.

For the second point, the graph must show the marginal cost (MC) curve and the   **1 point**
profit-maximizing quantity, labeled Q_M, where MR=MC.

For the third point, the graph must show the profit-maximizing price, labeled P_M, from the demand curve at Q_M. **1 point**
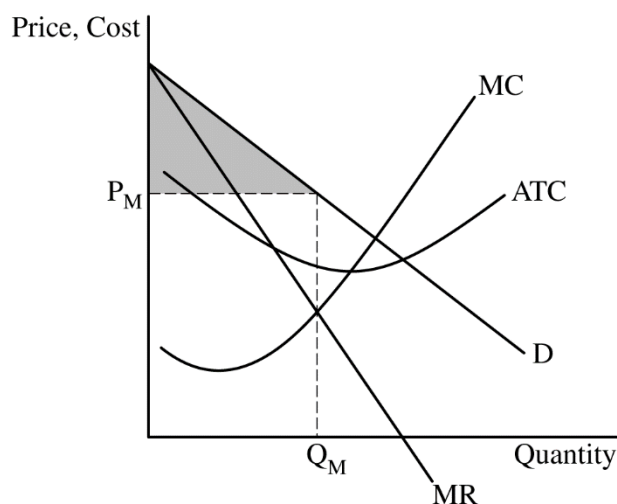
Price, Cost

MC

P_M

D

Q_M Quantity

MR

For the fourth point, the graph must show the average total cost (ATC) curve below the demand curve at Q_M and show the MC curve passing through the minimum point of the ATC curve. **1 point**

Price, Cost

MC

P_M

ATC

D

Q_M Quantity

MR

For the fifth point, the graph must show a completely shaded area of the consumer surplus.	**1 point**

Price, Cost

MC

P_M

ATC

D

Q_M

Quantity

MR

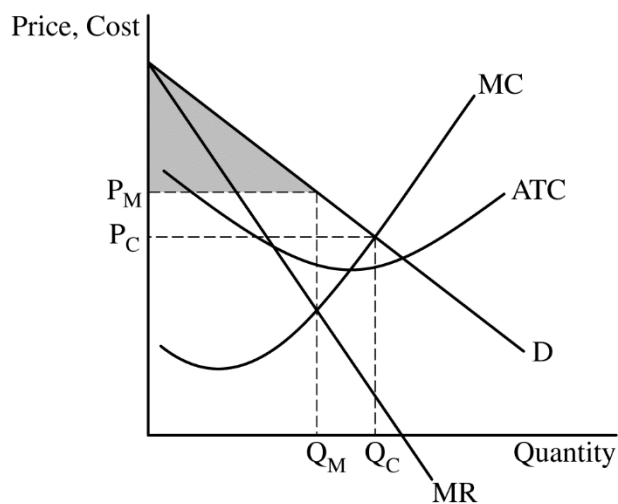|		
	Total for part (a)	**5 points**
(b)(i) State no and explain that a per-unit tax would shift the MC curve upward and intersect the MR curve at a lower quantity, which decreases the firm's profit-maximizing quantity, not increases it to the socially optimal quantity where MC=D.		**1 point**
(ii) On your graph from part (a), show the socially optimal quantity labeled as Q_C and the price ceiling labeled as P_C at MC=D.		**1 point**

Price, Cost

MC

P_M
P_C

ATC

D

Q_M Q_C

Quantity

MR

(iii)	State that the firm is earning positive economic profit and explain that ATC is less than P_C at Q_C, as shown.	**1 point**
	Scoring Note: The answer should be consistent with the position of the ATC curve with respect to the demand curve at Q_C on the graph drawn in part (b)(ii). The firm will not earn positive economic profit if the ATC curve is drawn such that $ATC > P_C$ or $ATC = P_C$ at Q_C.	
	Total for part (b)	**3 points**
(c) (i)	State that marginal revenue will be negative and explain that after total revenue is maximized, TR decreases since the firm moves onto the inelastic portion of the demand curve.	**1 point**
(ii)	State that the percentage increase in quantity demanded will be less than 10%.	**1 point**
	Total for part (c)	**2 points**
	Total for question 1	**10 points**