

GWID/Birthdate (**not your name**): _____

Instructions

1. **Write your name on page 17.** Write your GWID or birthdate on all other pages. We subtract one point for exams without a name on page 17.
2. Answer all questions.
3. The exam has 100 points. Points for each section and points for each question are indicated on the exam.
4. Write legibly. Illegible exams cannot be graded.
5. Do your best to fit all your answers on the front side of the exam. If you need to use the back of a page, indicate that clearly.
6. Label all figures as needed.
7. Make sure you **explain** your answers as needed. When appropriate, explain any assumptions that you make to arrive at your answer. Explanations may yield partial credit.
8. Be concise.
9. The final page is intentionally left blank for extra work. If you do extra work on this page (or in any other non-standard location) that you would like to be counted, you must note it clearly near the question you are answering. Do not use extra paper.
10. You are allowed a dumb calculator and no other aids. Please leave everything else in your bag for the duration of the exam.

For marking purposes only

Part A _____

Part B _____

Part C _____

total _____

A. Ripped From the Headlines (10 points, 3 points for (a) and (b); 4 points for (c))

Read the article from the *Wall Street Journal* at the end of the exam.

1. Give two fixed cost components for glass manufacturers that are described in the article. Explain why they are fixed costs.

2. Give an example of sunk costs for glass firms mentioned in the article. Explain why these are sunk costs.

3. This article was written in 2015. What does the competitive market model tell us about (a) why glass prices are high now and (b) whether glass prices should stay high the long run? Explain your answer.

B. Short Answer Questions (5 points each, except for question 4 as noted. 42 points total)

1. Name a publicly provided good that is not exclusively a public good. Explain why the good is not exclusively a public good.

2. Give two examples of factors that could shift the demand curve for a particular market. For each factor, explain whether the curve shifts inward or outward and why.

3. Name a firm with market power and describe its source of market power.

4 (7 points). Imagine an insurance firm that has 100,000 identical customers, each with a $\frac{1}{2}$ percent likelihood of an accident in each period. This firm has to pay out \$20,000 in case of an accident, and charges consumers \$10 each period. Are these premiums actuarially fair? And is the insurer making positive profits, negative profits, or breaking even? Explain your answer.

5. Define a negative externality and give an example, being careful about to whom this is an externality. Explain why your example fits the definition.

6. Given an example of a moral hazard problem caused by insurance. Explain why it is a moral hazard problem.

7. Suppose that a perfectly competitive firm has a U-shaped marginal cost curve. Draw this curve and the associated average variable cost curve. Note on your picture for which values of Q the firm will produce and explain why the firm is willing to produce only at these values.

8. Suppose that the market for honeybees perfectly is competitive and is in equilibrium with 500 producers. Now suppose that the cost of producing honeybees falls (perhaps hives become cheaper). If the 500 honeybee producers do not increase production, what should happen to profits in the short and long run? In the long run, what happens to the number of firms in the market and the equilibrium price? Why?

C. Medium Answer Questions

(49 points, points as noted on each question)

1 (18 points total; 3 points each part) Market Power

Suppose that a firm with market power has a constant marginal cost of 50. It faces a market demand of $Q = 300 - 3P$.

(a) What does a firm with market power set equal to marginal cost to choose profit-maximizing quantity? Write the formula for this equality.

(b) Solve the equation you just wrote to find the market equilibrium quantity. Draw a picture that shows this quantity.

(c) What is the market equilibrium price? Add this to your picture from part (a).

(d) Define producer and consumer surplus, calculate their value in this case, and note their locations in your figure.

(e) Is there a deadweight loss? If so, why? And how large is it?

(f) Are consumers harmed by the presence of market power? Explain using the example of this problem.

2 (15 points, 3 each) Production

Suppose that a carmel wafer firm's long-run total cost curve is $TC = 10Q^2 + 6Q + 60$, and that the firm's marginal cost curve is $MC = 20Q + 6$.

(a) Define fixed cost, and find fixed cost for this firm.

(b) Define and find average variable cost in words and quantitatively for this question.

(c) Suppose that this is a perfectly competitive firm, and the market price is \$106. How much does the firm produce?

(d) Now that the firm knows how much it is going to produce (see part (c)), it needs to decide how much capital and how much labor to use. Suppose that the production function is $Q = \frac{1}{2}KL$, that the marginal product of capital is $MP_K = \frac{1}{2}L$, and the marginal product of labor is $MP_L = \frac{1}{2}K$. The firm faces a wage rate of 12.50 and a capital rental rate of 5. What is the firm's optimal choice for the quantity of labor? And the quantity of capital?

(e) Suppose that the firm decides to use another unit of capital. What can you say about the value of the marginal product of this additional unit relative to the marginal product of the previous unit? Why?

3 (15 points; 3 points each part) Public Goods

Suppose that Cathy and Dina both enjoy falafel. Cathy's demand for falafel is $Q_C = 100 - \frac{1}{5}P$, while Dina's demand is $Q_D = 400 - 2P$.

(a) Draw Cathy's and Dina's demand curves, labeling intersection points for all curves.

(b) What is the market demand for falafel? Write an equation and draw a picture showing this demand, labeling all intercepts.

(c) If the marginal cost of falafel production is \$16 per ball in a competitive market (these are very very delicious falafel), how many falafel balls will Cathy and Dina consume in total?

(d) Now suppose instead that Cathy and Dina's demand curves are for smoke-free air. What is the market demand for smoke-free air? Write an equation and draw a picture showing this demand, labeling all intercepts.

(e) If Dina paid \$100 for 200 units of smoke-free air, would Cathy contribute any additional funds? Why or why not?

Name: _____

Blank – for extra work

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BUSINESS

Cost of Skyscraper Glass Hits Dizzying Heights

Earlier manufacturing cutbacks create delays, add to price tag as construction rebounds



A typical high-rise office tower can need hundreds of thousands of square feet of metal-framed glass panels. A Brookfield Property under construction in New York City. PHOTO: BEBETO MATTHEWS/ASSOCIATED PRESS

By **ROBBIE WHELAN**

Updated Sept. 8, 2015 10:42 a.m. ET

A shortage of glass is taking a toll on the nation's commercial building boom, adding millions of dollars to the cost of new skyscrapers and halting some projects midway through construction.

Demand is soaring for the metal-framed glass panels, or curtain wall, used to sheath skyscrapers. Those buildings need a lot of glass—hundreds of thousands of square feet for a typical high-rise office tower.

Glass manufacturers and fabricators can't keep up. Many glass makers mothballed their operations or went out of business in 2008 and 2009, during the recession, which hit the construction industry hard.

Now, however, apartment buildings are sprouting up at their brisk pace in decades, and new office towers are rising in major markets like Manhattan at the fastest rate since the early 1990s.

Restarting idled glass factories is a costly and time-consuming process, so property developers say the current shortage could last well into next year, if not longer.

In the meantime, builders are reporting that curtain-wall prices, which have risen more than 30% in the past 18 months, are setting records.

Glass accounts for roughly one-quarter of a construction project's budget, so the extra expense can add tens of millions of dollars to a building's cost, according to Brett Atkinson, executive vice president of Moss & Associates, a Florida-based company with 30 buildings under construction that require curtain wall.

Delays are also a problem: Several towers in San Francisco's trendy Rincon Hill neighborhood, home to some of the city's most expensive apartments, are standing bare while their builders wait for glass.

"Nowadays, the glass guys are dictating the timetables of a project to us, instead of the other way around," said Ralph Esposito, who oversees commercial construction by the New York office of Lend Lease Corp., one of the country's largest building contractors, with nearly 30 high-rise towers under way. "I don't think people had the leap of faith that the [real-estate] industry would be as strong as the run we're currently on."

The glass that ends up on the outside of an office building is manufactured in giant tanks in which sand is melted at temperatures north of 2,000 degrees Fahrenheit. Long ribbons of raw glass are floated down a river of molten metal. This "float glass" is then cut into pieces, customized to order, and the panels are



New Hudson Facades is a glass-making business that is an offshoot of real-estate developer Related Cos., which teamed up with a specialty-metal manufacturer so as to ensure a supply of glass panels. PHOTO: ROBBIE WHELAN/THE WALL STREET JOURNAL

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sent to contractors who fit them into metal frames to produce panels that meet the builder's specifications. A contractor typically installs the curtain wall on the side of a building.

Producers shut 11 out of 47 float-glass manufacturing plants in North America between 2007 and 2014, according to PPG Industries Inc., a Pittsburgh-based glass maker, as demand for glass of all kind—from building facades to auto windshields—sagged during the downturn. Building a new plant can cost hundreds of millions of dollars, PPG says, and restarting an idled line can take months because workers have to jackhammer thousands of pounds of hardened glass to remove it from melting tanks.

“Once you take one of those tanks out of commission, you can’t just turn it back on,” said Glenn Miner, director of construction for PPG’s flat-glass division. The downturn “affected all the suppliers in the marketplace. None of them were unscathed.”

As the glass shortage worsens, some developers are taking matters into their own hands. This summer, Related Cos., a large New York real-estate firm, got into the glass-panel manufacturing business. Teaming up with M. Cohen & Sons,