# ECON 203
# Final

Be sure to show your work for all answers, even if the work is simple.

This exam will begin around 12:30 in V04, 12:35 in V02

1. *(5 points)* **Honor Statement:** Please read and sign the following statement:

   I promise that my answers to this test are based on my own work without reference to any notes, books, or the assistance of any other person. I will also not use a calculator or other electronic aid for calculation.

   Name and Surname: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   Student ID: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   Signature:

   _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

2. *(8 points)* Tariffs have been on my mind a lot lately. Using firm based analysis (*NOT the elasticity of demand and supply*) explain the maximum amount that a firm can absorb of a new tax like Trump's tariffs. How will it change as we move towards the long run? In the end, who will pay Trump's tariffs? Explain how—in theory—the tariffs could be a good idea in the long run.

3. *(8 points)* Since Ankara is in a valley surrounded by mountains, the air quality downtown sometimes becomes very bad. This is part of the reason Bilkent is located up in the hills, here the air is (fairly) fresh at all times. It has been proposed to put a tax on fuel in the county of Ankara (Buyuksehir) to curb this problem. Explain how this would *not* be Pareto improving. Be careful to discuss who would benefit and who would not from this tax.

4. *(6 points)* In general equilibrium, what important fact does the *decentralization theorem* tell us about command economies like Robinson Crusoe's? Explain. (**NOTE**: A *command economy* is defined as one that works without a market. Instead the government tells everyone what to produce and consume. Robinson Crusoe's economy is a command economy because he is both the sole producer and the only consumer.)

5. *(18 points)* In a given industry the Demand curve is $Q_d = 35 - \frac{1}{2}P_d$ and the supply curve is $Q_s = -25 + 2P_s$.

   (a) *(2 points)* What conditions determine an equilibrium in a market like this?

   (b) *(4 points)* Find the equilibrium price and quantity.

   (c) *(4 points)* The government now imposes a per-unit tax of $t = 10$. Find the equilibrium price sellers receive, the price demanders pay, and quantity in this market.

   (d) *(4 points)* Find the deadweight loss in this market with the tax, explaining how you derive it.

   (e) *(4 points)* Since there is deadweight loss in this market, would it be Pareto improving to remove the tax? Explain your reasoning.

6. *(19 points total)* Robinson Crusoe's preferences are $U(F, C) = \min(4F, C)$ and they have the production possibilities set of $F^2 + C^2 \leq 145$.

   (a) *(4 points)* Explain how we know that $C = F4$ in any Pareto efficient allocation in this economy. **Note:** You may use this even if you can not explain it.

   (b) *(2 points)* Explain why we can be sure that he will consume on the production possibilities frontier. **Note:** You may use this even if you can not explain it.

   (c) *(4 points)* Find the optimal amount of $F$ and $C$ to produce.

   (d) *(6 points)* Now he has discovered he can trade with the (very advanced) inhabitants of the next island. In their economy $p_f = 200$ and $p_c = 50$. Given this find out how much food and clothing he should produce.

(e) *(3 points) Without any further analysis* explain how we can be certain that Robinson Crusoe is better off if he trades with the next island.

7. *(28 points total)* The cost function is defined as the minimum over $(L, K)$ of $wL + rK$ such that $f(L, K) \geq q$. Note that $L \geq 0$, $K \geq 0$, $w > 0$, $r > 0$ and $q > 0$.

   (a) *(8 points)* Prove the envelope theorem. Let $L^*$ and $K^*$ be the optimal quantities of labor and capital, and assume that $L^* > 0$ and $K^* > 0$. You may also assume that $f(L, K)$ is twice continuously differentiable.

(b) *(8 points)* Prove that this function is non-decreasing in input prices using only algebra and the definition of the cost function.

(c) *(4 points)* Prove that this function is *strictly* increasing in $(w, r)$ using the envelope theorem when $L^* > 0$ and $K^* > 0$.

(d) *(8 points)* Prove that this function is non-decreasing in output using only algebra and the definition of the cost function. What does this tell us about marginal cost?

# ECON 203
# Final

Be sure to show your work for all answers, even if the work is simple.

This exam will begin around 12:30 in V04, 12:35 in V02

1. *(5 points)* **Honor Statement:** Please read and sign the following statement:

   I promise that my answers to this test are based on my own work without reference to any notes, books, or the assistance of any other person. I will also not use a calculator or other electronic aid for calculation.

   Name and Surname: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   Student ID: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   Signature:

   _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

2. *(8 points)* Tariffs have been on my mind a lot lately. Using firm based analysis (*NOT the elasticity of demand and supply*) explain the maximum amount that a firm can absorb of a new tax like Trump's tariffs. How will it change as we move towards the long run? In the end, who will pay Trump's tariffs? Explain how—in theory—the tariffs could be a good idea in the long run.

3. *(8 points)* Since Ankara is in a valley surrounded by mountains, the air quality downtown sometimes becomes very bad. This is part of the reason Bilkent is located up in the hills, here the air is (fairly) fresh at all times. It has been proposed to put a tax on fuel in the county of Ankara (Buyuksehir) to curb this problem. Explain how this would *not* be Pareto improving. Be careful to discuss who would benefit and who would not from this tax.

4. *(6 points)* In general equilibrium, what important fact does the *decentralization theorem* tell us about command economies like Robinson Crusoe's? Explain. (**NOTE**: A *command economy* is defined as one that works without a market. Instead the government tells everyone what to produce and consume. Robinson Crusoe's economy is a command economy because he is both the sole producer and the only consumer.)

5. *(18 points)* In a given industry the Demand curve is $Q_d = 30 - \frac{1}{2}P_d$ and the supply curve is $Q_s = -10 + 2P_s$.

   (a) *(2 points)* What conditions determine an equilibrium in a market like this?

   (b) *(4 points)* Find the equilibrium price and quantity.

   (c) *(4 points)* The government now imposes a per-unit tax of $t = 5$. Find the equilibrium price sellers receive, the price demanders pay, and quantity in this market.

   (d) *(4 points)* Find the deadweight loss in this market with the tax, explaining how you derive it.

   (e) *(4 points)* Since there is deadweight loss in this market, would it be Pareto improving to remove the tax? Explain your reasoning.

6. *(19 points total)* Robinson Crusoe's preferences are $U(F, C) = \min(3F, 2C)$ and they have the production possibilities set of $F^2 + C^2 \leq 85$.

   (a) *(4 points)* Explain how we know that $C = F\frac{3}{2}$ in any Pareto efficient allocation in this economy. **Note:** You may use this even if you can not explain it.

   (b) *(2 points)* Explain why we can be sure that he will consume on the production possibilities frontier. **Note:** You may use this even if you can not explain it.

   (c) *(4 points)* Find the optimal amount of $F$ and $C$ to produce.

   (d) *(6 points)* Now he has discovered he can trade with the (very advanced) inhabitants of the next island. In their economy $p_f = 3$ and $p_c = 2$. Given this find out how much food and clothing he should produce.

(e) *(3 points) Without any further analysis* explain how we can be certain that Robinson Crusoe is better off if he trades with the next island.

7. *(28 points total)* The cost function is defined as the minimum over $(L, K)$ of $wL + rK$ such that $f(L, K) \geq q$. Note that $L \geq 0$, $K \geq 0$, $w > 0$, $r > 0$ and $q > 0$.

   (a) *(8 points)* Prove the envelope theorem. Let $L^*$ and $K^*$ be the optimal quantities of labor and capital, and assume that $L^* > 0$ and $K^* > 0$. You may also assume that $f(L, K)$ is twice continuously differentiable.

(b) *(8 points)* Prove that this function is non-decreasing in input prices using only algebra and the definition of the cost function.

(c) *(4 points)* Prove that this function is *strictly* increasing in $(w, r)$ using the envelope theorem when $L^* > 0$ and $K^* > 0$.

(d) *(8 points)* Prove that this function is non-decreasing in output using only algebra and the definition of the cost function. What does this tell us about marginal cost?

# ECON 203
# Final

Be sure to show your work for all answers, even if the work is simple.

This exam will begin around 12:30 in V04, 12:35 in V02

1. *(5 points)* **Honor Statement:** Please read and sign the following statement:

   I promise that my answers to this test are based on my own work without reference to any notes, books, or the assistance of any other person. I will also not use a calculator or other electronic aid for calculation.

   Name and Surname: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   Student ID: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   Signature:

   _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

2. *(8 points)* Tariffs have been on my mind a lot lately. Using firm based analysis (*NOT the elasticity of demand and supply*) explain the maximum amount that a firm can absorb of a new tax like Trump's tariffs. How will it change as we move towards the long run? In the end, who will pay Trump's tariffs? Explain how—in theory—the tariffs could be a good idea in the long run.

3. *(8 points)* Since Ankara is in a valley surrounded by mountains, the air quality downtown sometimes becomes very bad. This is part of the reason Bilkent is located up in the hills, here the air is (fairly) fresh at all times. It has been proposed to put a tax on fuel in the county of Ankara (Buyuksehir) to curb this problem. Explain how this would *not* be Pareto improving. Be careful to discuss who would benefit and who would not from this tax.

4. *(6 points)* In general equilibrium, what important fact does the *decentralization theorem* tell us about command economies like Robinson Crusoe's? Explain. (**NOTE**: A *command economy* is defined as one that works without a market. Instead the government tells everyone what to produce and consume. Robinson Crusoe's economy is a command economy because he is both the sole producer and the only consumer.)

5. *(18 points)* In a given industry the Demand curve is $Q_d = 36 - 2P_d$ and the supply curve is $Q_s = -6 + P_s$.

   (a) *(2 points)* What conditions determine an equilibrium in a market like this?

   (b) *(4 points)* Find the equilibrium price and quantity.

   (c) *(4 points)* The government now imposes a per-unit tax of $t = 6$. Find the equilibrium price sellers receive, the price demanders pay, and quantity in this market.

   (d) *(4 points)* Find the deadweight loss in this market with the tax, explaining how you derive it.

   (e) *(4 points)* Since there is deadweight loss in this market, would it be Pareto improving to remove the tax? Explain your reasoning.

6. *(19 points total)* Robinson Crusoe's preferences are $U(F, C) = \min(4F, 3C)$ and they have the production possibilities set of $F^2 + C^2 \leq 73$.

   (a) *(4 points)* Explain how we know that $C = \frac{4}{3}F$ in any Pareto efficient allocation in this economy. **Note:** You may use this even if you can not explain it.

   (b) *(2 points)* Explain why we can be sure that he will consume on the production possibilities frontier. **Note:** You may use this even if you can not explain it.

   (c) *(4 points)* Find the optimal amount of $F$ and $C$ to produce.

   (d) *(6 points)* Now he has discovered he can trade with the (very advanced) inhabitants of the next island. In their economy $p_f = 40$ and $p_c = 30$. Given this find out how much food and clothing he should produce.

(e) *(3 points) Without any further analysis* explain how we can be certain that Robinson Crusoe is better off if he trades with the next island.

7. *(28 points total)* The cost function is defined as the minimum over $(L, K)$ of $wL + rK$ such that $f(L, K) \geq q$. Note that $L \geq 0$, $K \geq 0$, $w > 0$, $r > 0$ and $q > 0$.

   (a) *(8 points)* Prove the envelope theorem. Let $L^*$ and $K^*$ be the optimal quantities of labor and capital, and assume that $L^* > 0$ and $K^* > 0$. You may also assume that $f(L, K)$ is twice continuously differentiable.

(b) *(8 points)* Prove that this function is non-decreasing in input prices using only algebra and the definition of the cost function.

(c) *(4 points)* Prove that this function is *strictly* increasing in $(w, r)$ using the envelope theorem when $L^* > 0$ and $K^* > 0$.

(d) *(8 points)* Prove that this function is non-decreasing in output using only algebra and the definition of the cost function. What does this tell us about marginal cost?

# ECON 203
# Final

Be sure to show your work for all answers, even if the work is simple.

This exam will begin around 12:30 in V04, 12:35 in V02

1. *(5 points)* **Honor Statement:** Please read and sign the following statement:

   I promise that my answers to this test are based on my own work without reference to any notes, books, or the assistance of any other person. I will also not use a calculator or other electronic aid for calculation.

   Name and Surname: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   Student ID: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   Signature:

   _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

2. *(8 points)* Tariffs have been on my mind a lot lately. Using firm based analysis (*NOT the elasticity of demand and supply*) explain the maximum amount that a firm can absorb of a new tax like Trump's tariffs. How will it change as we move towards the long run? In the end, who will pay Trump's tariffs? Explain how—in theory—the tariffs could be a good idea in the long run.

3. *(8 points)* Since Ankara is in a valley surrounded by mountains, the air quality downtown sometimes becomes very bad. This is part of the reason Bilkent is located up in the hills, here the air is (fairly) fresh at all times. It has been proposed to put a tax on fuel in the county of Ankara (Buyuksehir) to curb this problem. Explain how this would *not* be Pareto improving. Be careful to discuss who would benefit and who would not from this tax.

4. *(6 points)* In general equilibrium, what important fact does the *decentralization theorem* tell us about command economies like Robinson Crusoe's? Explain. (**NOTE**: A *command economy* is defined as one that works without a market. Instead the government tells everyone what to produce and consume. Robinson Crusoe's economy is a command economy because he is both the sole producer and the only consumer.)

5. *(18 points)* In a given industry the Demand curve is $Q_d = 44 - 2P_d$ and the supply curve is $Q_s = -8 + 2P_s$.

   (a) *(2 points)* What conditions determine an equilibrium in a market like this?

   (b) *(4 points)* Find the equilibrium price and quantity.

   (c) *(4 points)* The government now imposes a per-unit tax of $t = 4$. Find the equilibrium price sellers receive, the price demanders pay, and quantity in this market.

   (d) *(4 points)* Find the deadweight loss in this market with the tax, explaining how you derive it.

   (e) *(4 points)* Since there is deadweight loss in this market, would it be Pareto improving to remove the tax? Explain your reasoning.

6. *(19 points total)* Robinson Crusoe's preferences are $U(F, C) = \min(3F, C)$ and they have the production possibilities set of $F^2 + C^2 \leq 82$.

   (a) *(4 points)* Explain how we know that $C = 3F$ in any Pareto efficient allocation in this economy. **Note:** You may use this even if you can not explain it.

   (b) *(2 points)* Explain why we can be sure that he will consume on the production possibilities frontier. **Note:** You may use this even if you can not explain it.

   (c) *(4 points)* Find the optimal amount of $F$ and $C$ to produce.

   (d) *(6 points)* Now he has discovered he can trade with the (very advanced) inhabitants of the next island. In their economy $p_f = 300$ and $p_c = 100$. Given this find out how much food and clothing he should produce.

(e) *(3 points) Without any further analysis* explain how we can be certain that Robinson Crusoe is better off if he trades with the next island.

7. *(28 points total)* The cost function is defined as the minimum over $(L, K)$ of $wL + rK$ such that $f(L, K) \geq q$. Note that $L \geq 0$, $K \geq 0$, $w > 0$, $r > 0$ and $q > 0$.

   (a) *(8 points)* Prove the envelope theorem. Let $L^*$ and $K^*$ be the optimal quantities of labor and capital, and assume that $L^* > 0$ and $K^* > 0$. You may also assume that $f(L, K)$ is twice continuously differentiable.

(b) *(8 points)* Prove that this function is non-decreasing in input prices using only algebra and the definition of the cost function.

(c) *(4 points)* Prove that this function is *strictly* increasing in $(w, r)$ using the envelope theorem when $L^* > 0$ and $K^* > 0$.

(d) *(8 points)* Prove that this function is non-decreasing in output using only algebra and the definition of the cost function. What does this tell us about marginal cost?

# ECON 203
# Final

Be sure to show your work for all answers, even if the work is simple.

This exam will begin around 12:30 in V04, 12:35 in V02

1. *(5 points)* **Honor Statement:** Please read and sign the following statement:

   I promise that my answers to this test are based on my own work without reference to any notes, books, or the assistance of any other person. I will also not use a calculator or other electronic aid for calculation.

   Name and Surname: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   Student ID: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
   Signature:

   _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

2. *(8 points)* Tariffs have been on my mind a lot lately. Using firm based analysis (*NOT the elasticity of demand and supply*) explain the maximum amount that a firm can absorb of a new tax like Trump's tariffs. How will it change as we move towards the long run? In the end, who will pay Trump's tariffs? Explain how—in theory—the tariffs could be a good idea in the long run.

3. *(8 points)* Since Ankara is in a valley surrounded by mountains, the air quality downtown sometimes becomes very bad. This is part of the reason Bilkent is located up in the hills, here the air is (fairly) fresh at all times. It has been proposed to put a tax on fuel in the county of Ankara (Buyuksehir) to curb this problem. Explain how this would *not* be Pareto improving. Be careful to discuss who would benefit and who would not from this tax.

4. *(6 points)* In general equilibrium, what important fact does the *decentralization theorem* tell us about command economies like Robinson Crusoe's? Explain. (**NOTE**: A *command economy* is defined as one that works without a market. Instead the government tells everyone what to produce and consume. Robinson Crusoe's economy is a command economy because he is both the sole producer and the only consumer.)

5. *(18 points)* In a given industry the Demand curve is $Q_d = 28 - \frac{1}{2}P_d$ and the supply curve is $Q_s = -2 + P_s$.

   (a) *(2 points)* What conditions determine an equilibrium in a market like this?

   (b) *(4 points)* Find the equilibrium price and quantity.

   (c) *(4 points)* The government now imposes a per-unit tax of $t = 6$. Find the equilibrium price sellers receive, the price demanders pay, and quantity in this market.

   (d) *(4 points)* Find the deadweight loss in this market with the tax, explaining how you derive it.

   (e) *(4 points)* Since there is deadweight loss in this market, would it be Pareto improving to remove the tax? Explain your reasoning.

6. *(19 points total)* Robinson Crusoe's preferences are $U(F, C) = \min(5F, C)$ and they have the production possibilities set of $F^2 + C^2 \leq 101$.

   (a) *(4 points)* Explain how we know that $C = F5$ in any Pareto efficient allocation in this economy. **Note:** You may use this even if you can not explain it.

   (b) *(2 points)* Explain why we can be sure that he will consume on the production possibilities frontier. **Note:** You may use this even if you can not explain it.

   (c) *(4 points)* Find the optimal amount of $F$ and $C$ to produce.

   (d) *(6 points)* Now he has discovered he can trade with the (very advanced) inhabitants of the next island. In their economy $p_f = 50$ and $p_c = 5$. Given this find out how much food and clothing he should produce.

(e) *(3 points) Without any further analysis* explain how we can be certain that Robinson Crusoe is better off if he trades with the next island.

7. *(28 points total)* The cost function is defined as the minimum over $(L, K)$ of $wL + rK$ such that $f(L, K) \geq q$. Note that $L \geq 0$, $K \geq 0$, $w > 0$, $r > 0$ and $q > 0$.

   (a) *(8 points)* Prove the envelope theorem. Let $L^*$ and $K^*$ be the optimal quantities of labor and capital, and assume that $L^* > 0$ and $K^* > 0$. You may also assume that $f(L, K)$ is twice continuously differentiable.

(b) *(8 points)* Prove that this function is non-decreasing in input prices using only algebra and the definition of the cost function.

(c) *(4 points)* Prove that this function is *strictly* increasing in $(w, r)$ using the envelope theorem when $L^* > 0$ and $K^* > 0$.

(d) *(8 points)* Prove that this function is non-decreasing in output using only algebra and the definition of the cost function. What does this tell us about marginal cost?