Carbon-Pricing Instruments

EES 3310/5310

Global Climate Change

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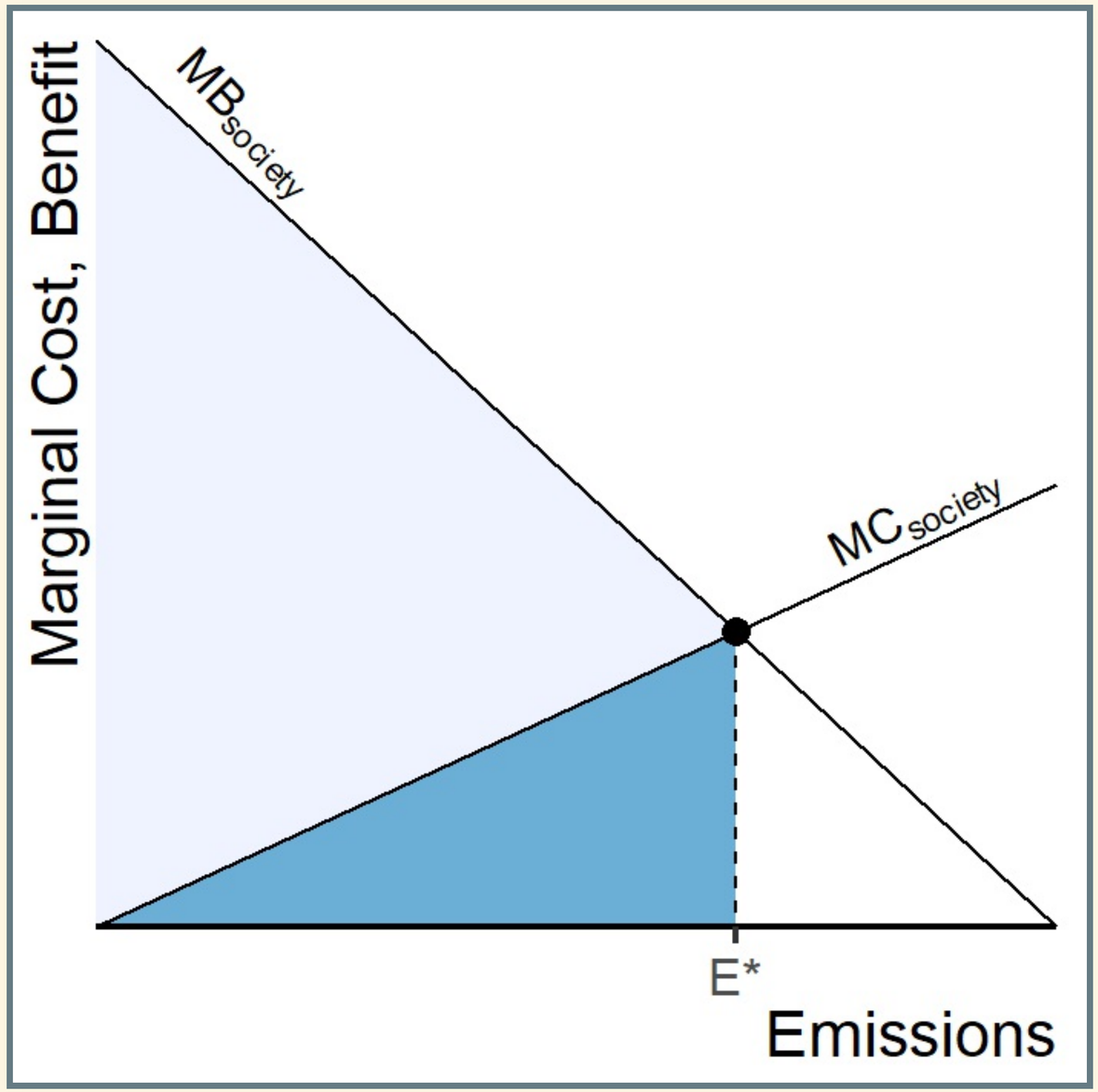
Perspectives on Market-Based Regulations

Market-Based Regulations

- Most economists (liberal & conservative) favor putting a price on greenhouse gas emissions.
  - **Cap-and-trade:**
    - Require a permit for every ton of fossil fuels
    - Issue a limited number of permits
    - Companies can buy and sell permits
  - **Carbon tax:**
    - Charge a tax on every ton of fossil fuels
    - Price equal to social cost of carbon emissions
- In principle, cap-and-trade and carbon tax are equivalent if costs and benefits are known accurately.
  - Different consequences for inaccuracies in costs or benefits.

Optimum Emissions Abatement

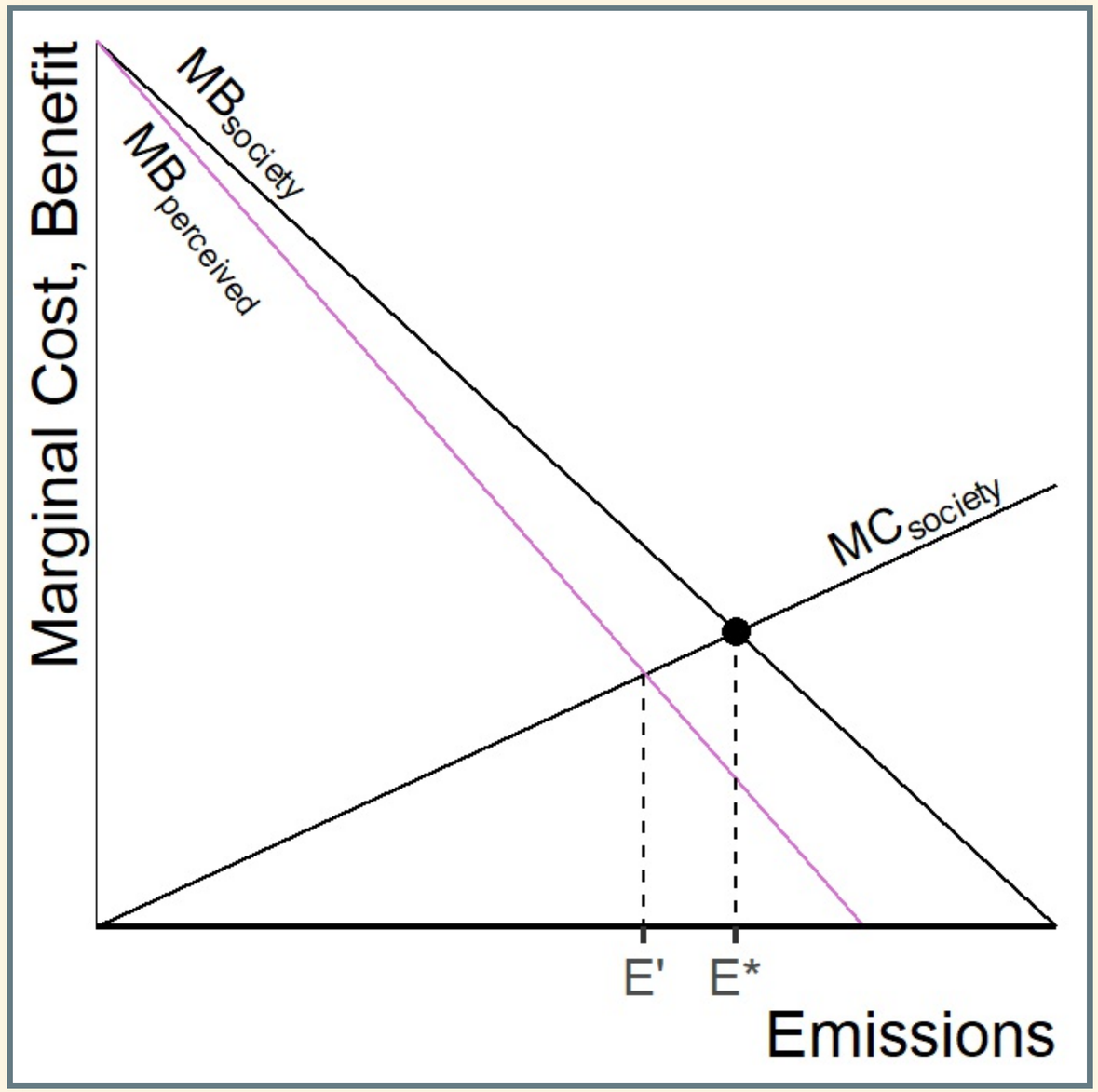
- Optimum emissions = E^*
- EPA issues permits for E^* tons of emissions
- Free-trading in permits reduces emissions to E^* at minimal cost
- Total net benefits are maximized



Uncertainty and Errors

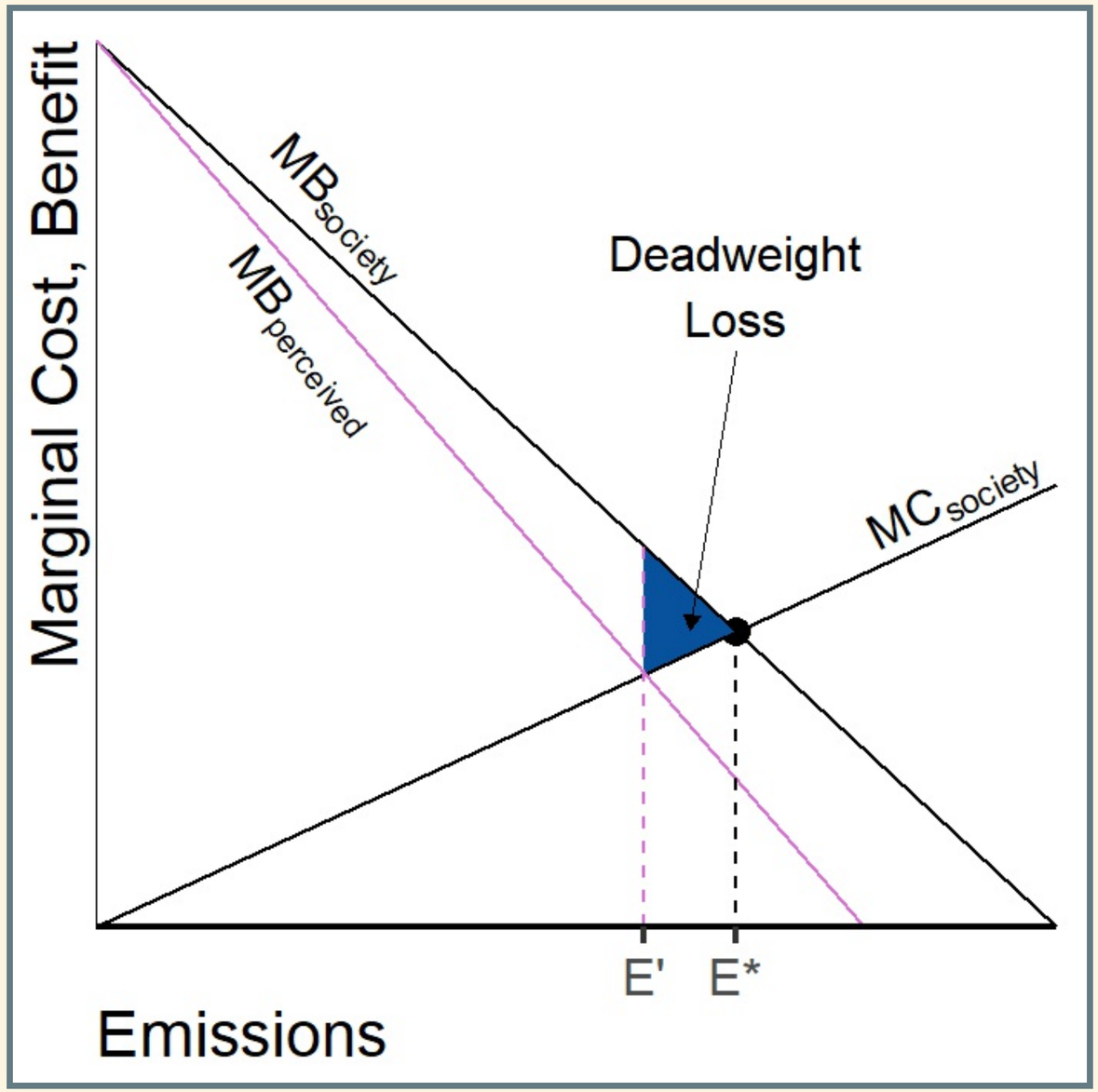
Imperfect Emissions Abatement

- Optimum emissions = E^*
- EPA underestimates benefits of emissions (cost of cutting emissions)
  - Issues permits for E'



Deadweight Losses

- Optimum emissions = E^*
- EPA underestimates benefits of emissions (cost of cutting emissions)
  - Issues permits for E'
- Deadweight loss (gray triangle) = difference between **actual net benefit** and **optimum net benefit**.



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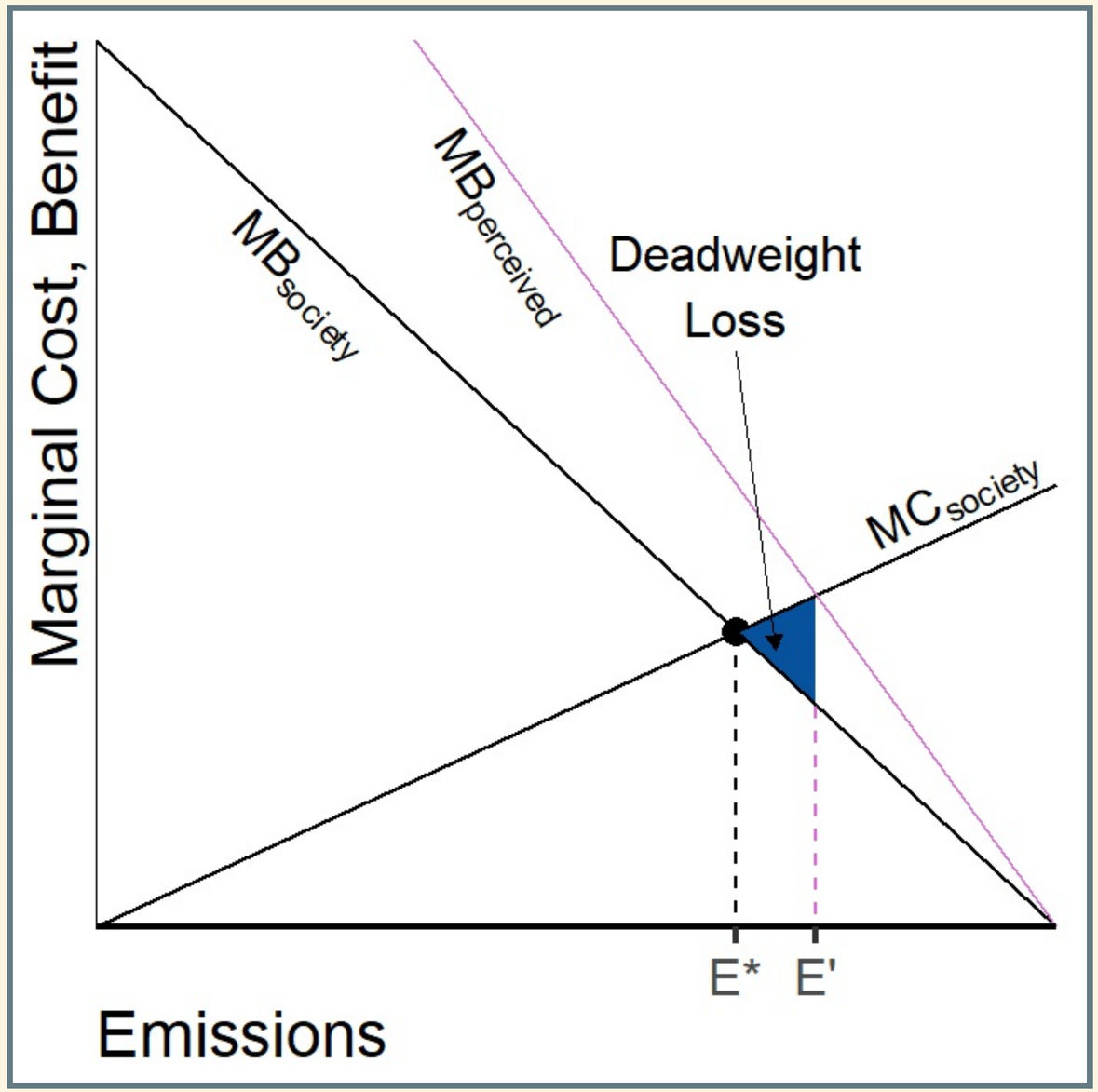
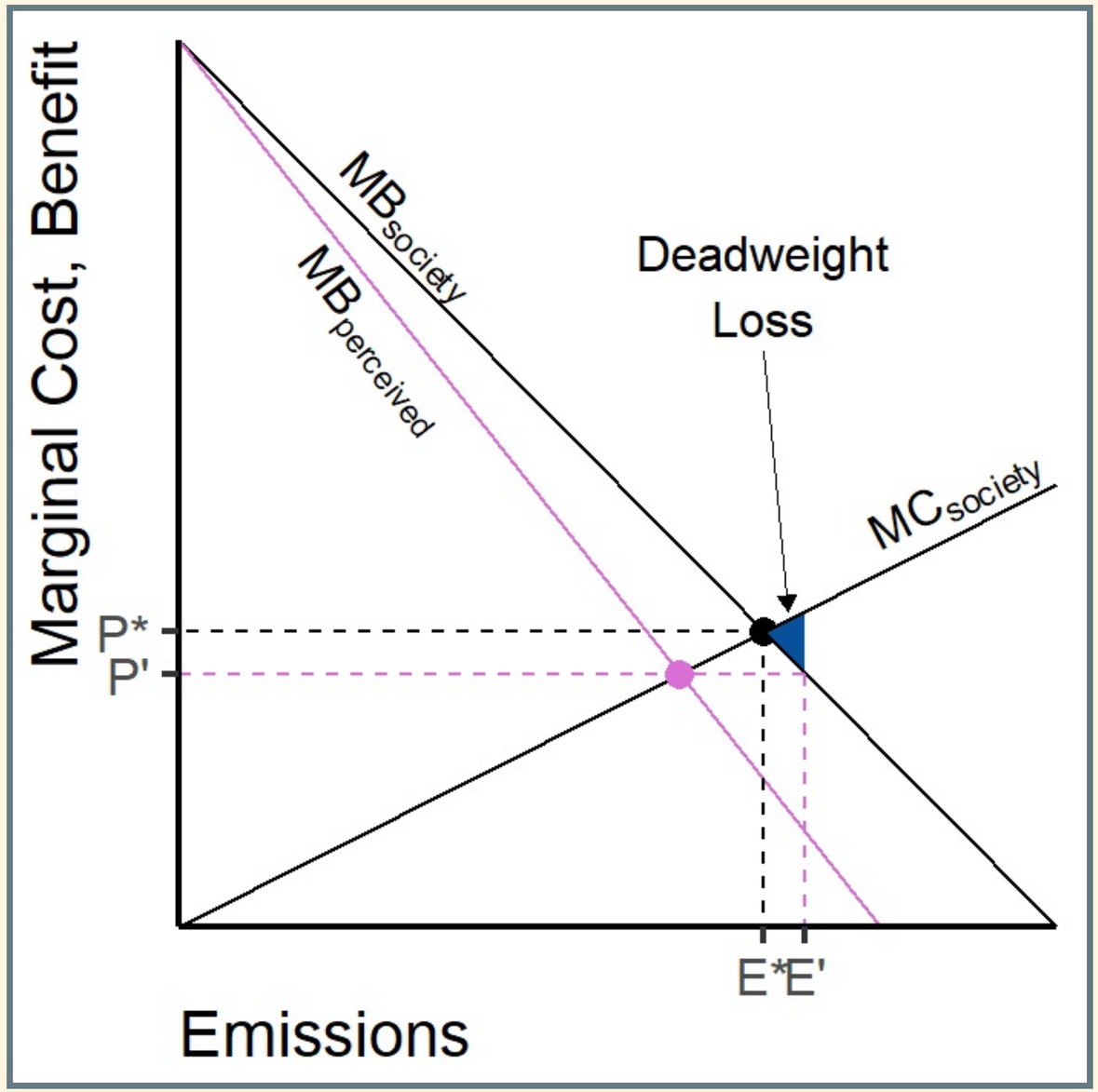


Deadweight Loss with Carbon Tax

- Optimum emissions = E^*
- EPA overestimates benefits of emissions (cost of cutting emissions)
  - Issues permits for E'



Emissions Trading Game

Emissions Trading Game

- What is the optimum amount of emissions?
- What is the total (gross) cost of emissions?
- What is the total (gross) benefit to society?
- What is the net benefit?

CO_2 emissions	Marginal cost	Marginal benefit
0	—	—
1	20	120
2	40	90
3	60	60
4	80	30
5	100	0

Emissions Trading Game

CO_2 emissions	Marginal cost	Marginal benefit	Gross cost	Gross benefit	Net benefit
0	—	—	0	150	150
1	20	120	20	270	250
2	40	90	60	360	300
3	60	60	120	420	300
4	80	30	200	450	250
5	100	0	300	450	150

- What is the optimal number of permits to issue?
- What is the optimal emissions tax?

Two Companies

Emissions	MB
0	—
1	100
2	80
3	60
4	40
5	20

Emissions	MB
0	—
1	125
2	100
3	75
4	50
5	25

Emissions	MC
0	—
1	20
2	40
3	60
4	80
5	100
6	120
7	140
8	160
9	180
10	200

Two Companies

Emissions	Company	MB	MC	Gross Benefits	Gross Costs	Net Benefits
1	B	125	20	125	20	105
2	A	100	40	225	60	165
3	B	100	60	325	120	205
4	A	80	80	405	200	205
5	B	75	100	480	300	180
6	A	60	120	540	420	120
7	B	50	140	590	560	30
8	A	40	160	630	720	-90
9	B	25	180	655	900	-245
10	A	20	200	675	1100	-425