Two-Part Tariff with Maple Solution

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> *restart* :

Finding profit maximizing two-part tariff with different consumer types that cannot be separated.

Let Q1 be larger demand type and lest Q2 be smaller demand type. marginal cost is constant at 2

Three options:
Option 1: set P = MC and charge both types fee equal to smaller CS
Option 2: set P = MC and charge fee equal to larger type CS (This will cause smaller type to drop out of market)
Option 3: Hybrid. Set up profit function where fee and and mark-up is a function of price. Maximize with respect to P

From the three options, choose the one with the greatest profit

Demand conditions:

> $Q1 := 18 - 3 \cdot P;$

$$Q1 := 18 - 3\,P \tag{1}$$

> $Q2 := 10 - 2 \cdot P;$

$$Q2 := 10 - 2\,P \tag{2}$$

Total demand

> $Q := Q1 + Q2;$

$$Q := 28 - 5\,P \tag{3}$$

Inverse of total demand:

> $p := solve(Q = q, P);$

$$p := \frac{28}{5} - \frac{1}{5}\,q \tag{4}$$

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Consumer Surplus functions for both types (as function of price) CS1 larger demand and CS2 smaller demand

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> $CS1 := (6 - P) \cdot Q1 \cdot 0.5;$

$$CS1 := 0.5\,(6 - P)\,(18 - 3\,P) \tag{5}$$

> $CS2 := (5 - P) \cdot Q2 \cdot 0.5;$

$$CS2 := 0.5\,(5 - P)\,(10 - 2\,P) \tag{6}$$

Option 1: set **P = MC** and charge both group a fee equal to smaller CS
(***profit = 2 x CS2 when P = 2***)

> $Option1profit := 2 \cdot subs(P = 2, CS2);$

$$Option1profit := 18.0 \qquad (7)$$

Option 2: set **P = MC** and charge fee equal to larger CS ***(profit = CS1 when P = 2)***

> $Option2profit := subs(P = 2, CS1);$

$$Option2profit := 24.0 \qquad (8)$$

Option 3: set up a Hybrid profit function:

profit = 2 x Fee +(P-MC)(Q1+Q2)

where the fee is equal to the formula for **CS2**

> $hybridprofit := 2 \cdot CS2 + (P - 2) \cdot Q;$

$$hybridprofit := 1.0\ (5 - P)\ (10 - 2\ P) + (P - 2)\ (28 - 5\ P) \qquad (9)$$

> $hybridprime := diff(hybridprofit, P);$

$$hybridprime := 18.0 - 6.0\ P \qquad (10)$$

> $Pstar := solve(hybridprime = 0, P);$

$$Pstar := 3. \qquad (11)$$

> $Option3profit := subs(P = 3, hybridprofit);$

$$Option3profit := 21.0 \qquad (12)$$

Option 3 profit is 21 whereas option 2 profit is 24. (option 1 is the lowest profit at 18)

It is more profitable to use larger demand CS for fee and drive smaller demand types out of the market.

In this case, the DWL is the entire CS2 when P = 2.

Graphing the problem (requires inverse demands for both groups)

> $p1 := 6 - \left(\frac{1}{3}\right) \cdot q;$

$$p1 := 6 - \frac{1}{3} q \quad (13)$$

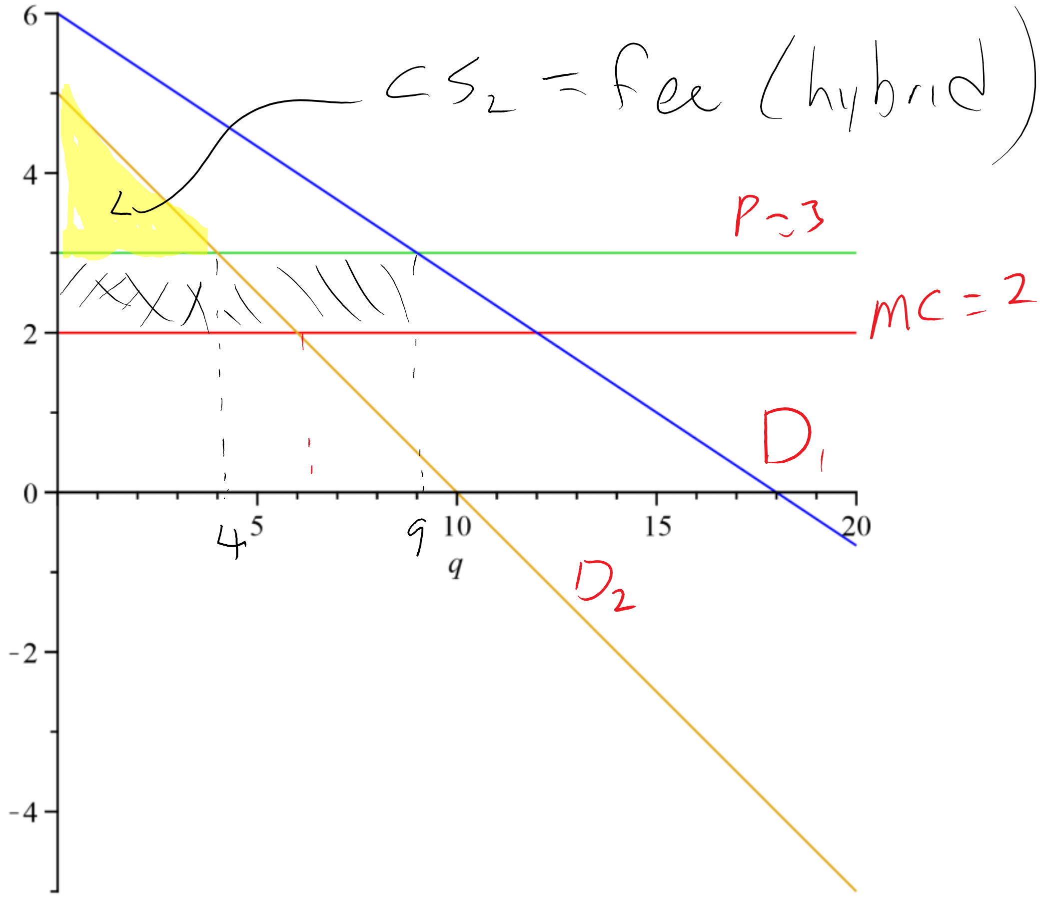
> $p2 := 5 - \left(\frac{1}{2}\right) \cdot q;$

$$p2 := 5 - \frac{1}{2} q \quad (14)$$

> $mc := 2;$

$$mc := 2 \quad (15)$$

> $plot(\{p1, p2, mc, Pstar\}, q = 0..20);$



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