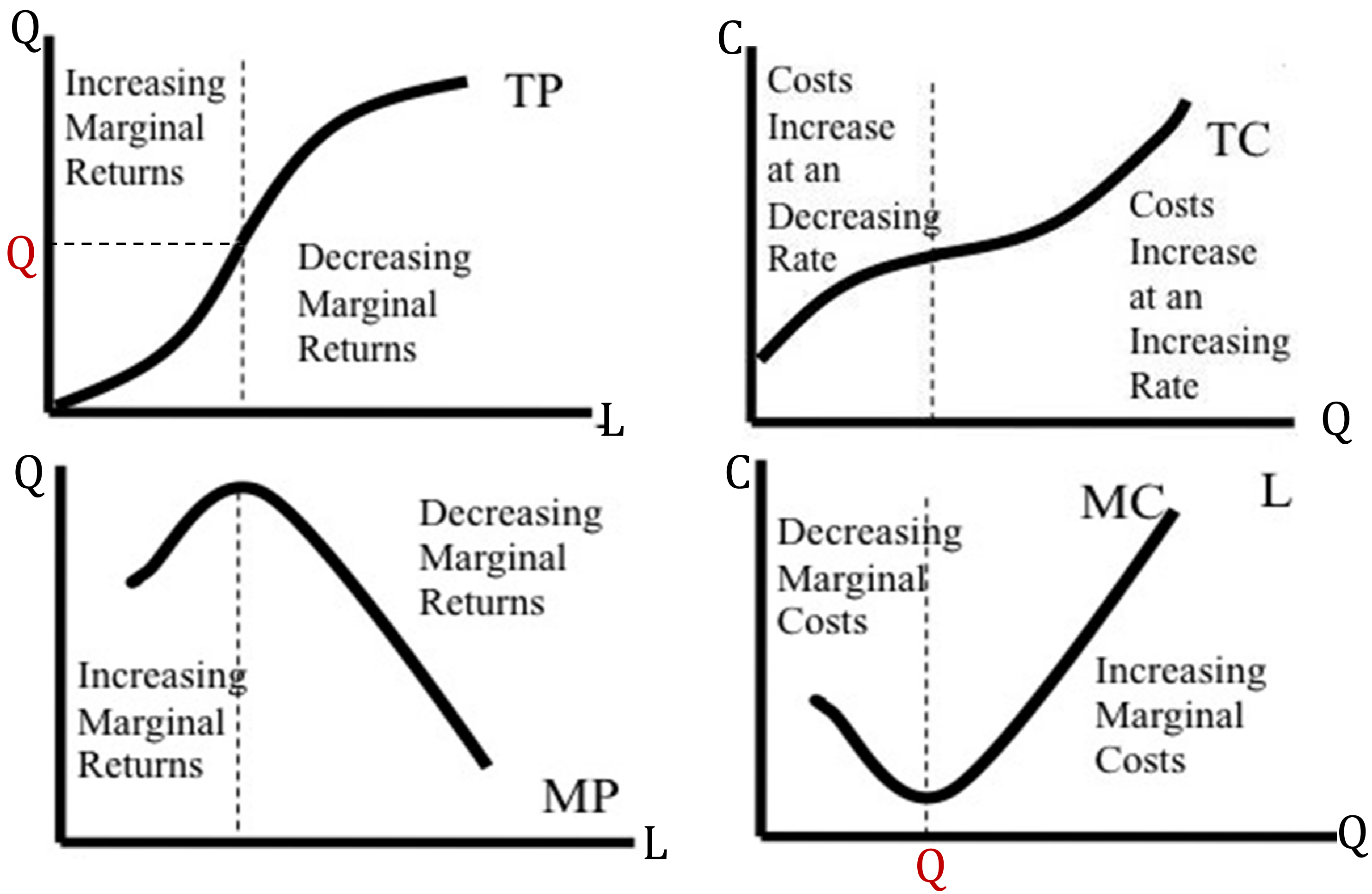
Introductory Microeconomics

Tutorial 7

Nhan La

Production functions



Task 1

- Definitions and expressions:

Total Product: $TP(L) = Q(L)$

Marginal Product: $MP(L) = \frac{\partial Q(L)}{\partial L}$

Short run total cost: $SRTC(Q) = FC + VC(Q)$

Short run marginal cost: $SRMC(Q) = \frac{\partial SRTC(Q)}{\partial Q} = \frac{\partial VC(Q)}{\partial Q}$

Task 1

a/ Adrian's Pizzeria

Workers	TP	MP $(TP_{i+1} - TP_i)$	FC	VC	TC $(FC + VC)$	MC $\left(\frac{TC_{i+1} - TC_i}{MP}\right)$
0	0		$100	$0	$100	
1	50	50	$100	$50	$150	$50/50=1
2	90	40	$100	$100	$200	$50/40=1.25
3	120	30	$100	$150	$250	$50/30=1.66
4	140	20	$100	$200	$300	$50/20=2.5
5	150	10	$100	$250	$350	$50/10=5

Task 1

a/ Yvonne's Pizza Place

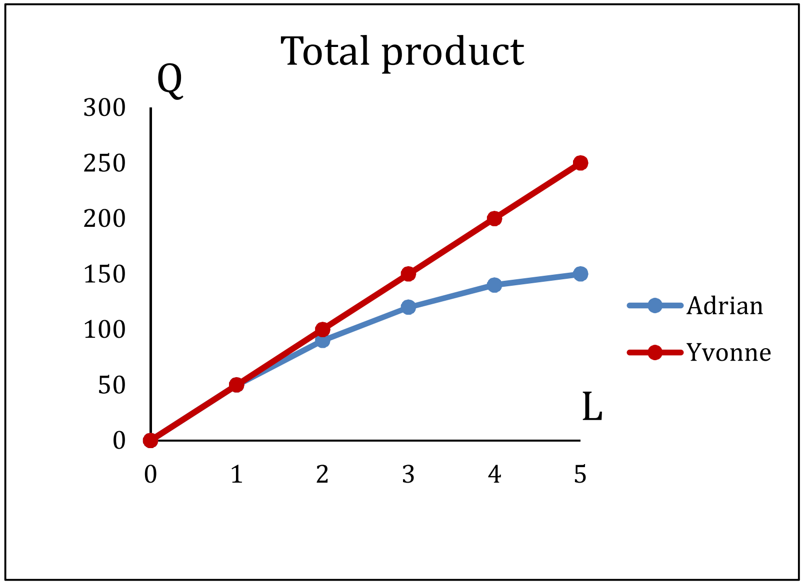
Workers	TP	MP $(TP_{i+1} - TP_i)$	FC	VC	TC $(FC + VC)$	MC $\left(\frac{TC_{i+1} - TC_i}{MP}\right)$
0	0		$100	$0	$100	
1	50	50	$100	$50	$150	$50/50=1
2	100	50	$100	$100	$200	$50/50=1
3	150	50	$100	$150	$250	$50/50=1
4	200	50	$100	$200	$300	$50/50=1
5	250	50	$100	$250	$350	$50/50=1

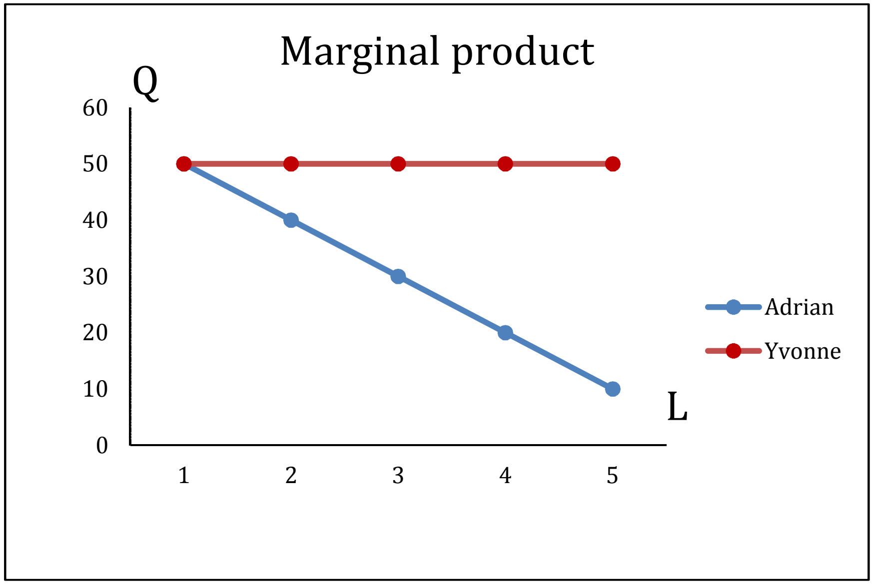
Task 1

b/

Adrian: Declining gradient of TP, negative gradient of MP

Yvonne: Constant gradient of TP, constant MP

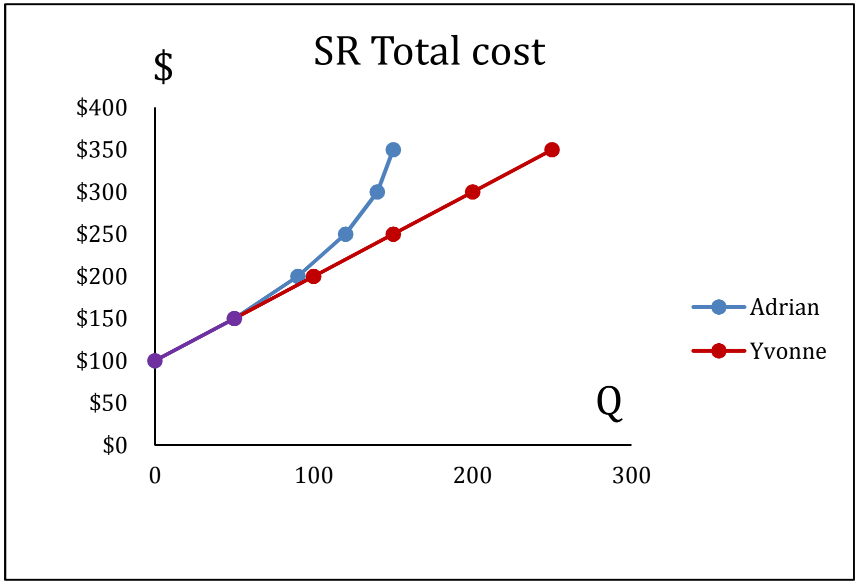


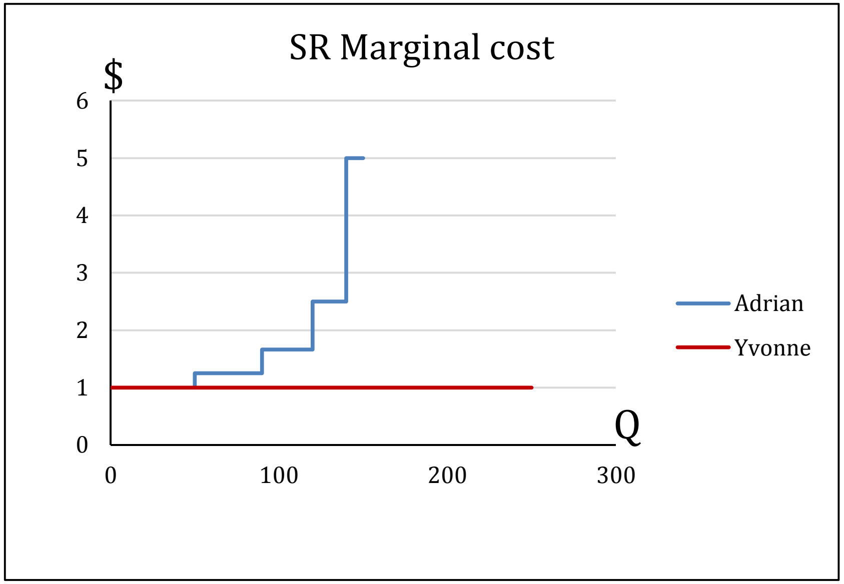


Task 1

d/ Adrian: Increasing gradient SRTC and SRMC

Yvonne: Constant gradient SRTC, constant SRMC





Task 2

a/

	FC	VC	SRMC	SRTC	SRATC
2 trucks					
20 orders	6,000	2,000	100	8,000	400
40 orders	6,000	5,000	150	11,000	275
60 orders	6,000	12,000	350	18,000	300
3 trucks					
20 orders	7,000	1,800	90	8,800	440
40 orders	7,000	3,800	100	10,800	270
60 orders	7,000	10,800	350	17,800	297
4 trucks					
20 orders	8,000	1,200	60	9,200	460
40 orders	8,000	3,600	120	11,600	290
60 orders	8,000	8,400	240	16,400	273

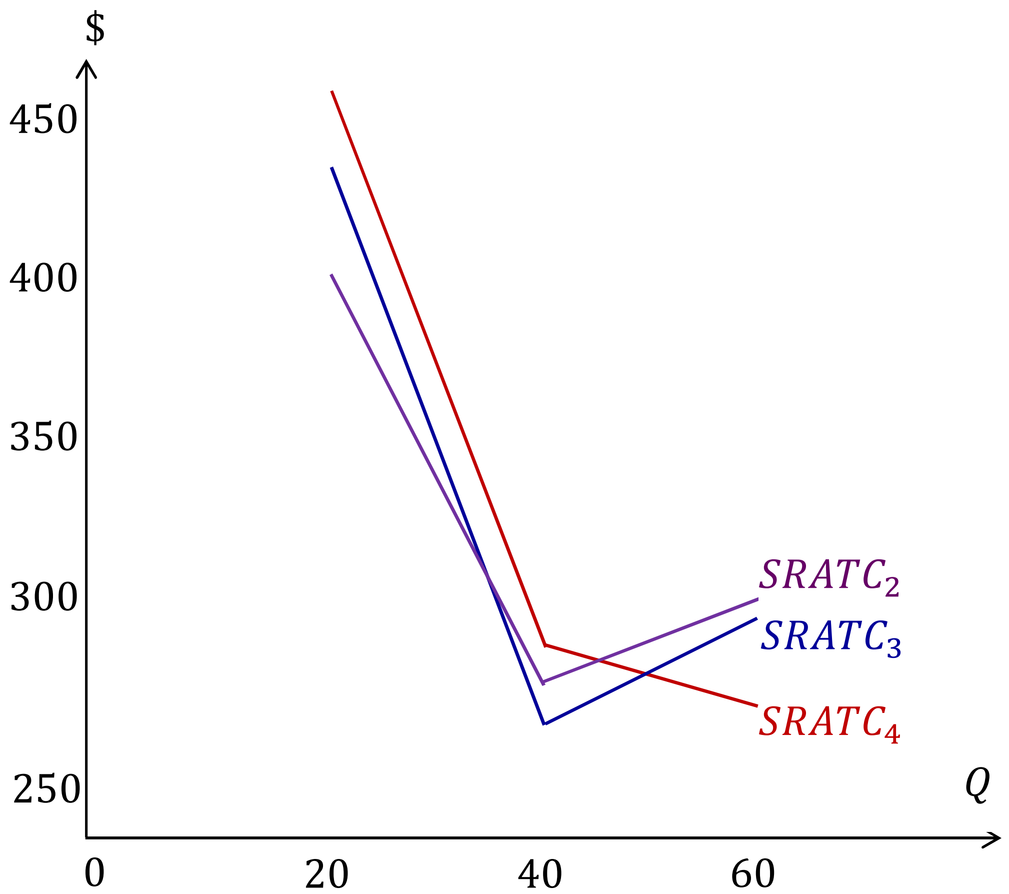
Task 2

b/ SRMC increases with number of outputs.

Diminishing marginal product zone.

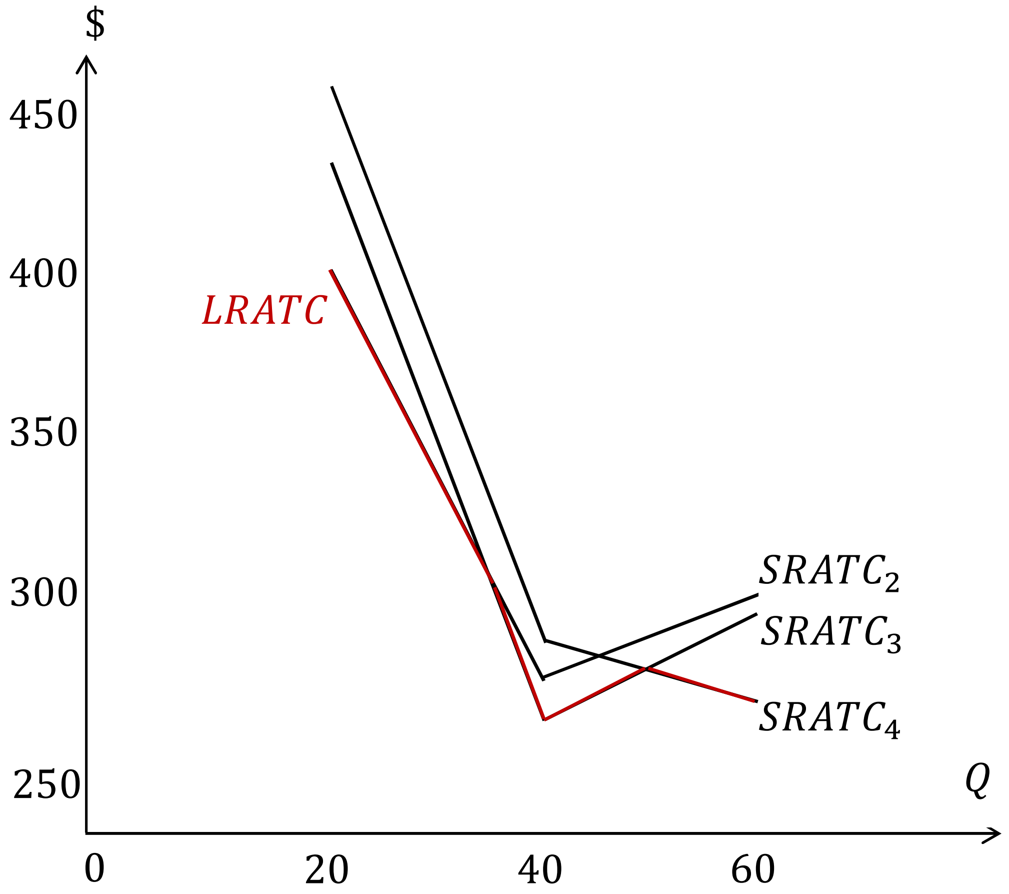
Task 2

c/



Task 2

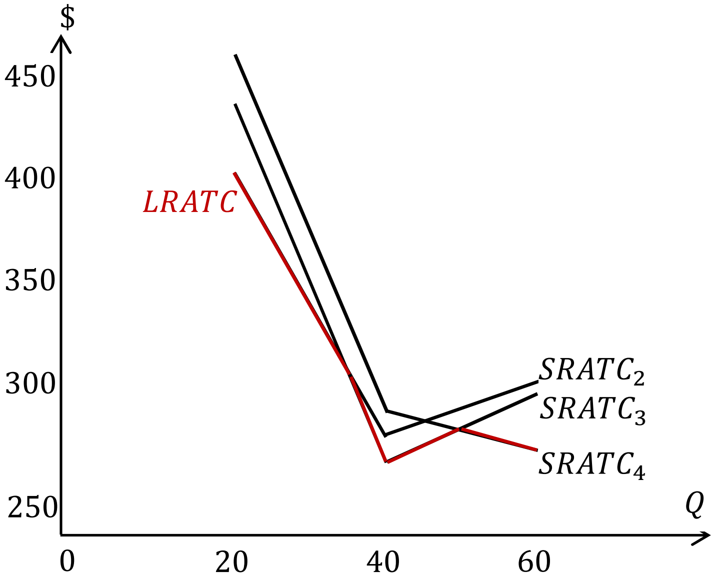
c/



Task 2

c/ For each number of orders, use the trucks that minimise ATC.

Orders	Trucks
20	2
40	3
60	4



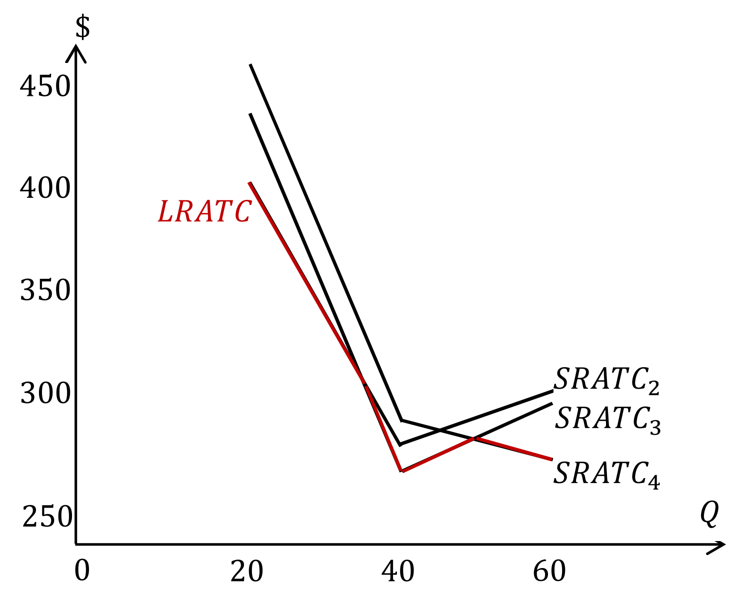
Task 2

d/ Diminishing LRATC at low orders:

- Economy of scale
- Specialisation
- Market wider and cost effective

Increasing LRATC at large orders

- Management and coordination



Task 3

$$TC = 10 + 5Q - Q^2 + 0.2Q^3$$

a/ $TFC = 10$

$TVC = 5Q - Q^2 + 0.2Q^3$

b/ $AFC = \frac{TFC}{Q} = \frac{10}{Q}$;

$AVC = \frac{TVC}{Q} = 5 - Q + 0.2Q^2$

$ATC = AFC + AVC = \frac{10}{Q} + 5 - Q + 0.2Q^2$

$MC = \frac{\partial TC}{\partial Q} = 5 - 2Q + 0.6Q^2$

Task 3

c/ When AVC is at minimum:

$$AVC = \frac{TVC}{Q} = 5 - Q + 0.2Q^2$$

$$\frac{\partial AVC}{\partial Q} = 0 \Leftrightarrow -1 + 0.4Q = 0 \Leftrightarrow Q = 2.5$$

$$\Longrightarrow \min(AVC) = 5 - 2.5 + 0.2 \times 2.5^2 = 3.75$$

It turns out the minimum point on AVC lies on MC:

$$MC = \frac{\partial TC}{\partial Q} = 5 - 2Q + 0.6Q^2$$

For $Q = 2.5$:

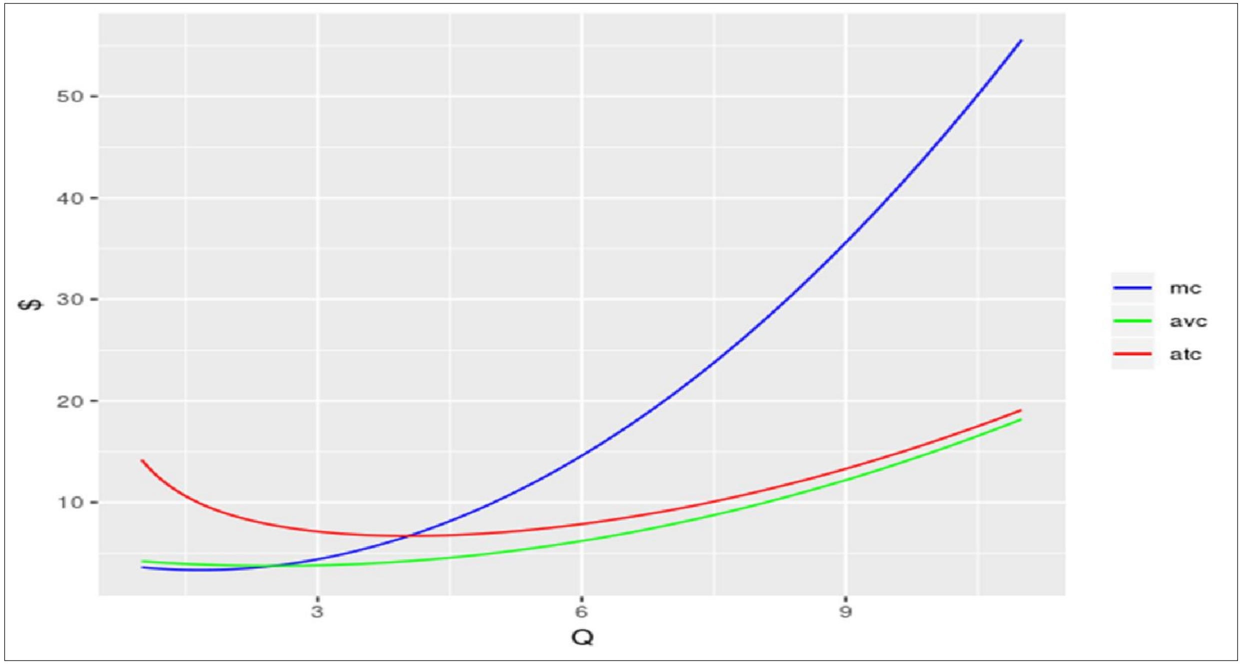
$$MC = 5 - 2 \times 2.5 + 0.6 \times 2.5^2 = 3.75 = \min(AVC)$$

Task 3

d/ When $MC < AC$, extra products pull AC down

When $MC > AC$, extra products pull AC up

When $MC = AC$, extra products have no effect on AC



Task 3

d/ Mathematical proof

$MC = 5 - 2Q + 0.6Q^2$

$ATC = \frac{10}{Q} + 5 - Q + 0.2Q^2$

At minimum ATC: $\frac{\partial ATC}{\partial Q} = \frac{10}{Q^2} - 1 + 0.4Q = 0$

With that condition, we can show the minimum point on ATC $(\text{Q}, \frac{10}{Q} + 5 - Q + 0.2Q^2)$ satisfies (or lies on) MC.