 # AGEC 5403 Problem Set 3 Q2 Complete Solution. Bijesh Mishra

```
restart;
x1 := b; a1 := 2512; a2 := 180; a3 := -1.5; p := 2; VC := 2000; FC := 0;
```

$$x1 := b$$
$$a1 := 2512$$
$$a2 := 180$$
$$a3 := -1.5$$
$$p := 2$$
$$VC := 2000$$
$$FC := 0 \quad \textbf{(1)}$$

```
f := a1·x1 + a2·x1^2 + a3·x1^3;
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$$f := -1.5\,b^3 + 180\,b^2 + 2512\,b \quad \textbf{(2)}$$

```
profit := f·p - (x1·VC + FC);
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$$profit := 3024\,b - 3.0\,b^3 + 360\,b^2 \quad \textbf{(3)}$$

```
EP_x1 := diff(profit, x1);
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$$EP\_x1 := 3024 - 9.0\,b^2 + 720\,b \quad \textbf{(4)}$$

```
x1_demand := solve(EP_x1 = 0, b); #This is just a demand but not demand at maximum profit.
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$$x1\_demand := -4., 84. \quad \textbf{(5)}$$

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APP := simplify(f/x1);
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$$APP := -1.5\,b^2 + 180.\,b + 2512. \quad \textbf{(6)}$$

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MPP := diff(f, x1);
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$$MPP := -4.5\,b^2 + 360\,b + 2512 \quad \textbf{(7)}$$

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AVP := p·APP;
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$$AVP := -3.0\,b^2 + 360.\,b + 5024. \quad \textbf{(8)}$$

$boat := diff(AVP, x1);$

$$boat := -6.0\,b + 360. \quad \textbf{(9)}$$

#HW3_Q2_a:

$MaximumBoat\_2a := solve(boat = 0,\ x1);$

$$MaximumBoat\_2a := 60. \quad \textbf{(10)}$$

#Answer: individual will use 60 boats

 # Total fish caught by 60 boats (maximum number of fish caught by 60 boats);

$Totfish := eval(f, x1 = MaximumBoat\_2a);$

$$Totfish := 474720.0 \quad \textbf{(11)}$$

$Profit\_2a := eval(profit, [f = Totfish,\ x1 = MaximumBoat\_2a]);$ *#under scenario in 2a..*

$$Profit\_2a := 829440.0 \quad \textbf{(12)}$$

 # #HW3_Q2_b: *New boat will be added* **if** *there is profit. So, number of boat reach* **to** *maximum when profit is zero under perfect comptition.*

$profit\_zero := Totfish \cdot p - x1 \cdot VC;$

$$profit\_zero := -2000\,b + 949440.0 \quad \textbf{(13)}$$

$maximum\_boat := solve(profit\_zero = 0, x1);$

$$maximum\_boat := 474.7200000 \quad \textbf{(14)}$$

 # Ans = 474.72 boats.

#HW3_Q2_c: *Cooperative is formed and share profit equally.*

$fb := simplify\left(\frac{f}{x1}\right)$; #production function of individual boat.

$$fb := -1.5\,b^2 + 180.\,b + 2512. \tag{15}$$

$profit\_fb := p \cdot fb - x1 \cdot VC - FC$;

$$profit\_fb := -1640.\,b - 3.0\,b^2 + 5024. \tag{16}$$

$APP\_fb := simplify\left(\frac{fb}{x1}\right)$;

$$APP\_fb := \frac{-1.5\,b^2 + 180.\,b + 2512.}{b} \tag{17}$$

$fb\_x1\_demand := solve(\,diff\,(profit\_fb, x1), x1)$; #not a maximizing demand.

$$fb\_x1\_demand := -273.3333333 \tag{18}$$

$AVP\_fb := simplify(\,p \cdot APP\_fb)$;

$$AVP\_fb := \frac{-3.\,b^2 + 360.\,b + 5024.}{b} \tag{19}$$

$boat\_fb := simplify(diff\,(AVP\_fb, x1))$; # For max profit, first derivative of AVP should be 0.

$$boat\_fb := \frac{-3.\,b^2 - 5024.}{b^2} \tag{20}$$

$MaxBoat\_fb := solve(boat\_fb = 0, x1)$;

$$MaxBoat\_fb := -40.92269134\ \mathrm{I},\ 40.92269134\ \mathrm{I} \tag{21}$$

 # *Answer:*

 # Already negative or indetermined. So, it is not profitable to operate as cooperate. Not operating any boat is most profitable.

 # *HW3_Q2_d.* *This is* **in** *the third stage of production*

$MPP\_fb := diff\,(fb, x1)$;

$$MPP\_fb := -3.0\,b + 180. \tag{22}$$

$Curvature\_fb := diff\,(MPP\_fb, x1)$;

$$Curvature\_fb := -3.0 \tag{23}$$

$Elasticity := \frac{MPP\_fb}{APP\_fb}$;

$$Elasticity := \frac{(-3.0\,b + 180.)\,b}{-1.5\,b^2 + 180.\,b + 2512.} \tag{24}$$

$StatgeIII := solve(Elasticity = 0, x1)$;

$$StatgeIII := 0., 60. \tag{25}$$

$StatgeI := solve(Elasticity = 1, x1)$

$$StatgeI := 40.92269134\ \mathrm{I},\ -40.92269134\ \mathrm{I} \tag{26}$$