Firm $\xrightarrow{x \text{ units}}$ each unit x has price $P > 0$

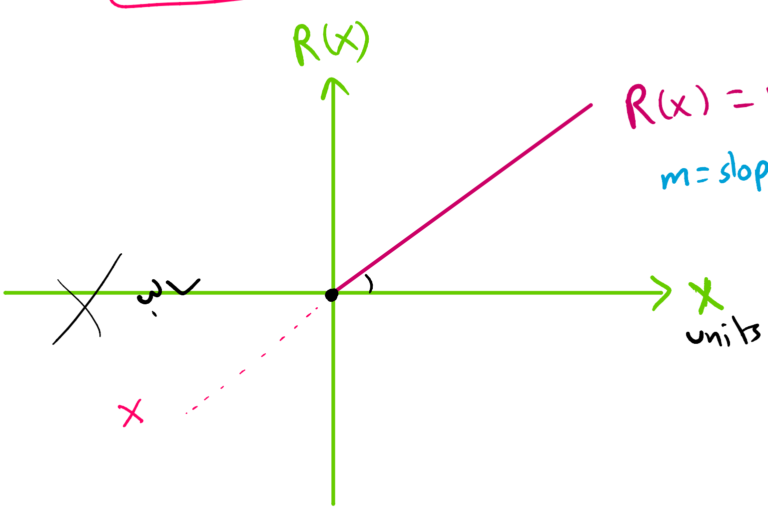
Total Revenue from sale x units

= (price per unit)(number of units)

$$\boxed{R(x) = P\,x}$$

line through origin (0,0)

when $x = 0 \Rightarrow R(x) = P(0) = 0$



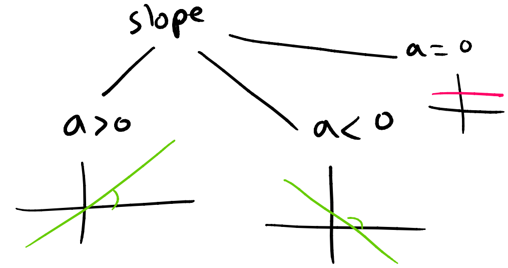
$m = \text{slope} = P = mr$

marginal revenue

line equation

$y = a x + b$

slope



Total cost of production and sale =

Variable cost + fixed cost

VC FC

تكاليف ثابتة تدفعها الشركة حتى لو لم تنتج أي كمية

$x = 0 \Rightarrow b = FC$

$C(x) = VC + FC$ [illegible] $= C(0)$

$C(x) = VC + FC$

$\boxed{C(x) = mx + b}$ → line

$m > 0$

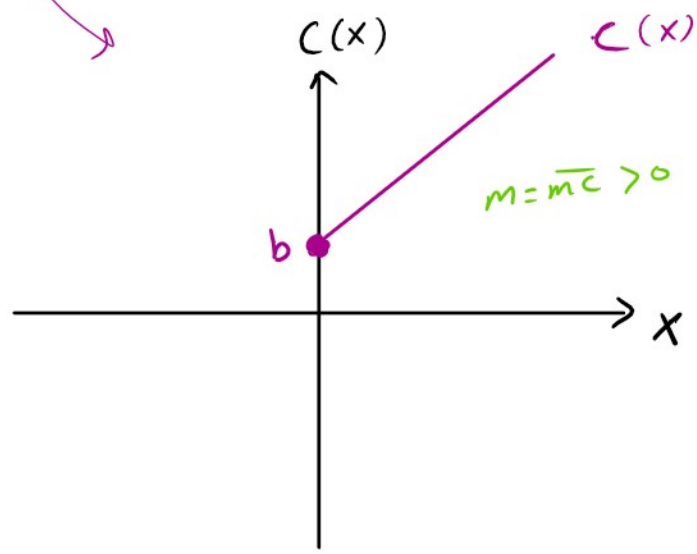
slope $= m = \overline{mc} =$ marginal cost

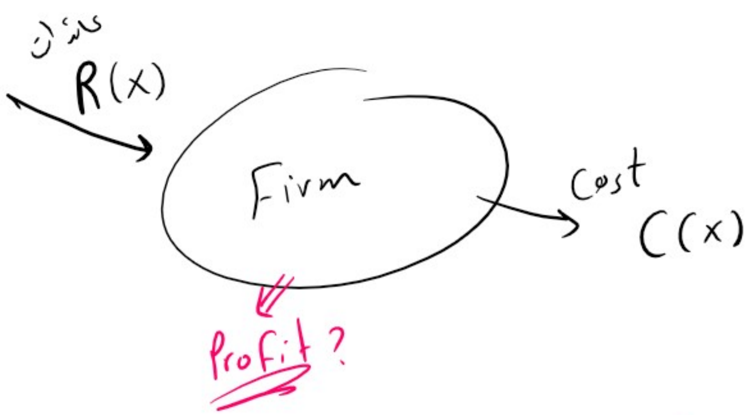
is the cost of producing an additional unit at any level of production

y-intercept $= C(0)$
$= m(0) + b$
$= 0 + b$
$= b$

التكاليف

$(x, y) = (0, b)$





Total profit from sale of x units = Total Revenue − Total Cost

$P(x) = R(x) - C(x)$

$= px - (mx + b)$

$= px - mx - b$

$\boxed{P(x) = (p - m)x - b}$

$$\boxed{P(x) = (p - m)x - b}$$

p: سعر المشروب الكولا

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m: تكلفة انتاج المشروب الكولا

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$p > m \Rightarrow$ profit

· marginal profit $= \overline{mp} = p - m$

Q: Find the point (number of units x) such that the firm makes zero profit.

Q: Question
A: Answer

A: · This point is called Break-Even point

· At this point $\bar{x} \Rightarrow P(\bar{x}) = 0$

$\Rightarrow$ Total Revenue = Total cost

$\Rightarrow R(\bar{x}) = C(\bar{x})$

$R(x) = px$

$C(x) = mx + b$

$$p\bar{x} = m\bar{x} + b$$

$$p\bar{x} - m\bar{x} = b$$

$$\bar{x}(p - m) = b$$

Break-Even

$$\boxed{\bar{x} = \frac{b}{p - m}}$$

line

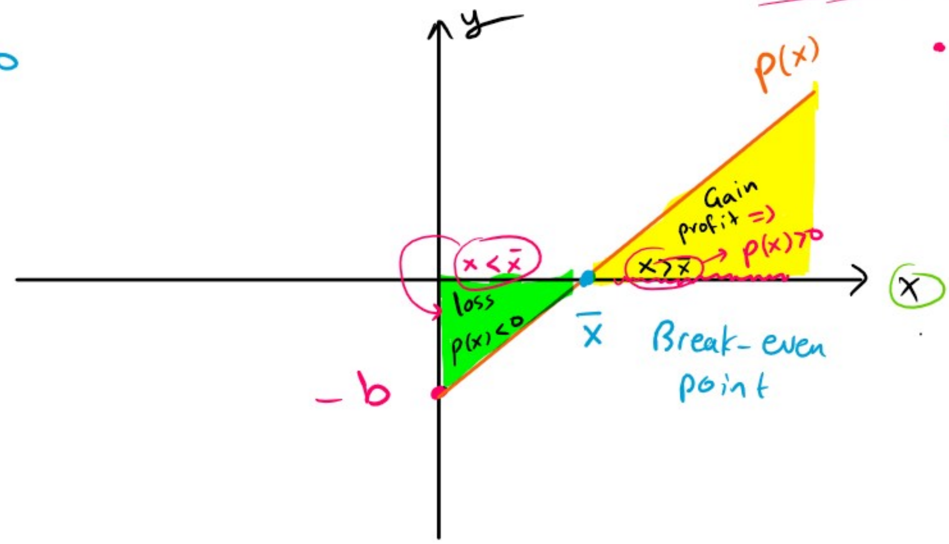
$p > m$

$$\boxed{p(x) = (p-m)x - b}$$, $p > m$

line

slope $= p - m > 0$

$p(\bar{x}) = 0$



• $x = 0$ ⟹ (no product)

$p(0) = (p-m)(0) - b$

$= 0 - b$

$= -b$

Exp Suppose that when a company produces it's product, the fixed costs are \$12500 and the variable cost per item is \$75. Assume x represents the number of units. Find

$FC = b = \$12500$

$\overline{MC} = m = \$75$

① total cost

$C(x) = mx + b$

$$\boxed{C(x) = 75x + 12500}$$

② Is $FC = C(0)$?

$FC = 12{,}500 \overset{??}{=} C(0) = 75(0) + 12500$

$12{,}500 \overset{??}{=} 0 + 12500$

$12,500 \overset{??}{=} 0 + 12500$

Yes

$\boxed{FC = C(0)} \to$ y-intercept

③ If the company sells its product for $\underbrace{\$175}_{p}$

$p = \overline{mr} = 175$

Find ⓐ total revenue

$R(x) = p\,x$

$\boxed{R(x) = 175x}$

ⓑ total revenue if $\underbrace{100}_{x}$ units are sold

$R(100) = 175(100) = 17,500$

ⓒ total profit

$P(x) = R(x) - C(x)$

$= (p - m)x - b$

$= (175 - 75)x - 12500$

$\boxed{P(x) = \underbrace{100}_{\overline{mp}}x - 12500}$

ⓓ the break-even point

$\bar{x} = \dfrac{b}{p - m} = \dfrac{12,500}{175 - 75} = \dfrac{12,5\cancel{00}}{1\cancel{00}}$

$$\bar{x} = \frac{b}{p-m} = \frac{12,500}{175-75} = \frac{12,500}{1\cancel{0}\cancel{0}}$$

$$\boxed{\bar{x} = 125}$$

If the Firm produces only 125 units then it makes zero profit

Break-even

cost = revenue

$\Rightarrow P(125) = 0$

Check

$P(x) = 100x - 12,500$

$P(125) = 100(125) - 12,500$

$= 12,500 - 12,500$

$= 0$

$C(x) = 75x + 12500$

$R(x) = 175x$

$C(\bar{x}) = C(125)$

$= 75(125) + 12500$

$= 9375 + 12500$

$= 21,875$

$R(\bar{x}) = R(125)$

$= 175(125)$

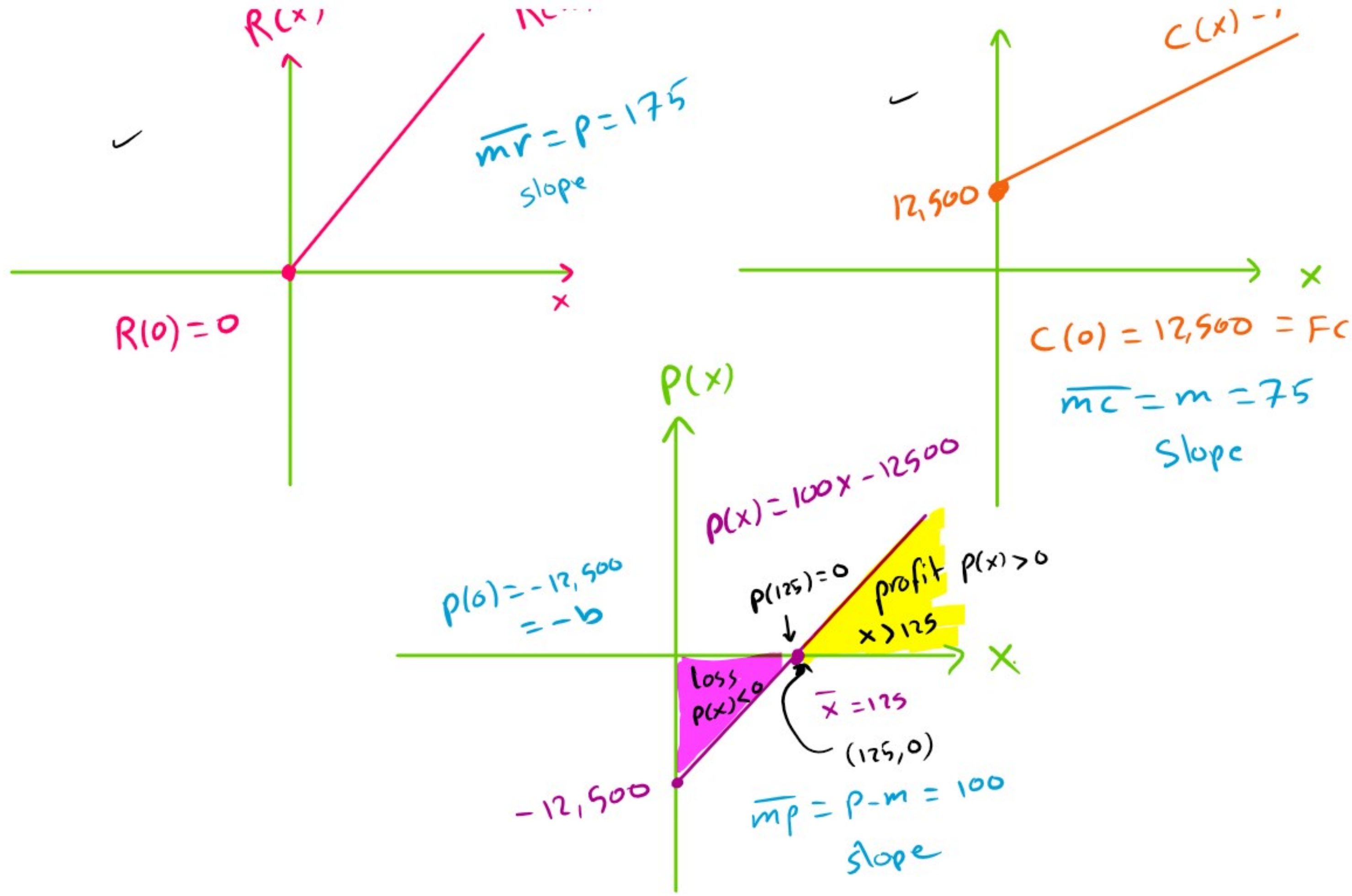
$= 21,875$

(e) marginal revenue $\Rightarrow \bar{mr} = p = 175$

" cost $\Rightarrow \bar{mc} = m = 75$

" profit $\Rightarrow \bar{mp} = p - m = 175 - 75 = 100$

(f) Graph $C(x)$, $R(x)$, $P(x)$



(g) Find the intersection of the two lines R(x) and C(x)

$R(x) = 175x$

$C(x) = 75x + 12500$

$R(x) = C(x)$

$175x = 75x + 12500$

$100x = 12500$

$\boxed{x = 125} \rightarrow$ Break-even point

$\rightarrow P(125) = 0$

The intersection of R(x) and C(x) gives Break-even point

↓

the firm makes zero profit

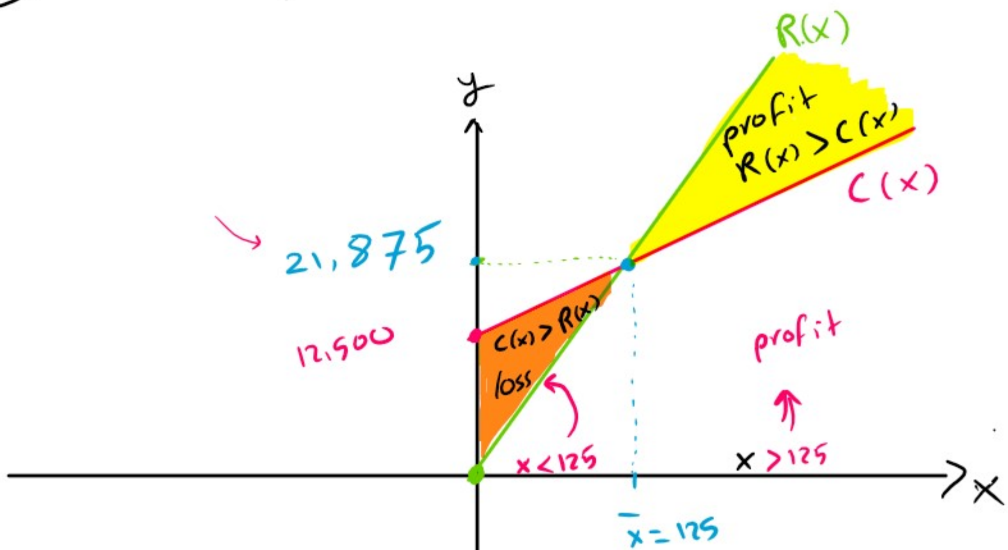
$P(125) = 0$

(i) Graph $R(x)$ and $C(x)$ together

$R(x) = 175x$

$C(x) = 75x + 12,500$

$C(125) = R(125)$
$= 21,875$



The firm makes profit only if $R(x) > C(x) \Rightarrow$ when $x > 125$

" " " loss " " $R(x) < C(x) \Rightarrow$ " $x < 125$

(j) Find the revenue and cost at the Break-even point

$C(125) = R(125) = 21,875$

$C(\bar{x}) = R(\bar{x})$ only at $\bar{x} \rightarrow$ Break-event point

$P(\bar{x}) = P(125) = 0$

