# Seminari 1

## Matematika za ekonomiste 2

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FOI, Varaždin

# Sadržaj

# prvi zadatak

## Zadatak 1

*Zadane su funkcija potražnje* $q_1 = -3p^2 + 14p - 10$ *i funkcija ponude* $q_2 = p + 2$.

a) *Prikažite grafički zadane funkcije.*

b) *Odredite cijene ekvilibrija i označite ih na grafu. Kolike su ponuda i potražnja u pojedinim cijenama ekvilibrija?*

$$q_1 = -3p^2 + 14p - 10$$

## Rješenje

a) Za crtanje parabole odredimo nultočke i tjeme.

$$-3p^2 + 14p - 10 = 0$$

$$q_1 = -3p^2 + 14p - 10$$

$$ax^2 + bx + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

## Rješenje

a) Za crtanje parabole odredimo nultočke i tjeme.

$$-3p^2 + 14p - 10 = 0$$

$$p_{1,2} = \frac{-14 \pm \sqrt{14^2 - 4 \cdot (-3) \cdot (-10)}}{2 \cdot (-3)}$$

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$$p_{1,2} = \frac{-14 \pm \sqrt{76}}{-6}$$

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$$p_{1,2} = \frac{-14 \pm \sqrt{76}}{-6}$$

$$p_1 \approx 0.88, \quad p_2 \approx 3.79$$

$$q_1 = -3p^2 + 14p - 10$$

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nultočke

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## Rješenje

a) Za crtanje parabole odredimo nultočke i tjeme.

$$-3p^2 + 14p - 10 = 0 \qquad q_1' = -6p + 14$$

$$p_{1,2} = \frac{-14 \pm \sqrt{14^2 - 4 \cdot (-3) \cdot (-10)}}{2 \cdot (-3)}$$

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nultočke

$$q_1' = -6p + 14$$

$$-6p + 14 = 0$$

$$q_1 = -3p^2 + 14p - 10$$

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nultočke

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$$-6p + 14 = 0$$

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nultočke

$$p_1 \approx 0.88, \quad p_2 \approx 3.79$$

$$q_1' = -6p + 14$$

$$-6p + 14 = 0$$

$$-6p = -14$$

$$p = \frac{7}{3}$$

$$q_1 = -3p^2 + 14p - 10$$

$$ax^2 + bx + c = 0$$
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## Rješenje

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$$q_1' = -6p + 14$$

$$-6p + 14 = 0$$

$$-6p = -14$$

$$p = \frac{7}{3}$$

$$q_1\left(\frac{7}{3}\right) =$$

$$q_1 = -3p^2 + 14p - 10$$

$$ax^2 + bx + c = 0$$

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$$-6p + 14 = 0$$

$$-6p = -14$$

$$p = \frac{7}{3}$$

$$q_1\left(\frac{7}{3}\right) = -3 \cdot \left(\frac{7}{3}\right)^2 + 14 \cdot \frac{7}{3} - 10$$

$$q_1 = -3p^2 + 14p - 10$$

$$ax^2 + bx + c = 0$$

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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$$-6p = -14$$

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$$q_1\left(\frac{7}{3}\right) = -3 \cdot \left(\frac{7}{3}\right)^2 + 14 \cdot \frac{7}{3} - 10 = \frac{19}{3}$$

$$q_1 = -3p^2 + 14p - 10$$

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$$-6p + 14 = 0$$

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$$T\left(\frac{7}{3}, \frac{19}{3}\right)$$

$$q_1\left(\frac{7}{3}\right) = -3 \cdot \left(\frac{7}{3}\right)^2 + 14 \cdot \frac{7}{3} - 10 = \frac{19}{3}$$

$$q_1 = -3p^2 + 14p - 10$$

$$ax^2 + bx + c = 0$$

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$$T\left(\frac{7}{3}, \frac{19}{3}\right)$$

tjeme

$$q_1\left(\frac{7}{3}\right) = -3 \cdot \left(\frac{7}{3}\right)^2 + 14 \cdot \frac{7}{3} - 10 = \frac{19}{3}$$

Za crtanje pravca je dovoljno odrediti neke dvije njegove točke.

$$q_2(0) =$$

$$q_2 = p + 2$$

$$q_1 = -3p^2 + 14p - 10$$

Za crtanje pravca je dovoljno odrediti neke dvije njegove točke.

$$q_2(0) = 0 + 2 = 2$$

$$\boxed{q_2 = p + 2}$$

$$\boxed{q_1 = -3p^2 + 14p - 10}$$

Za crtanje pravca je dovoljno odrediti neke dvije njegove točke.

$$q_2(0) = 0 + 2 = 2 \longrightarrow T_1(0, 2)$$

$$q_2 = p + 2$$

$$q_1 = -3p^2 + 14p - 10$$

Za crtanje pravca je dovoljno odrediti neke dvije njegove točke.

$$q_2(0) = 0 + 2 = 2 \longrightarrow T_1(0, 2)$$

$$q_2(1) =$$

$$\boxed{q_2 = p + 2}$$

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Za crtanje pravca je dovoljno odrediti neke dvije njegove točke.

$$q_2(0) = 0 + 2 = 2 \longrightarrow T_1(0, 2)$$

$$q_2(1) = 1 + 2 = 3$$

$$\boxed{q_2 = p + 2}$$

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$$q_2(0) = 0 + 2 = 2 \longrightarrow T_1(0, 2)$$
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b) Cijena ekvilibrija

$$\boxed{q_1 = -3p^2 + 14p - 10}$$

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$$q_2(0) = 0 + 2 = 2 \longrightarrow T_1(0, 2)$$

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b) Cijena ekvilibrija

$$\boxed{q_1 = -3p^2 + 14p - 10}$$

$$q_1 = q_2$$

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$$\boxed{q_1 = -3p^2 + 14p - 10}$$

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b) Cijena ekvilibrija

$$\boxed{q_1 = -3p^2 + 14p - 10}$$

$$q_1 = q_2$$
$$-3p^2 + 14p - 10 = p + 2$$
$$-3p^2 + 13p - 12 = 0$$

Za crtanje pravca je dovoljno odrediti neke dvije njegove točke.

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b) Cijena ekvilibrija

$$\boxed{q_1 = -3p^2 + 14p - 10}$$

$$q_1 = q_2$$
$$-3p^2 + 14p - 10 = p + 2$$
$$-3p^2 + 13p - 12 = 0$$
$$p_{1,2} = \frac{-13 \pm \sqrt{13^2 - 4 \cdot (-3) \cdot (-12)}}{2 \cdot (-3)}$$

$$ax^2 + bx + c = 0$$
$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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$$\boxed{q_1 = -3p^2 + 14p - 10}$$

$$q_1 = q_2$$
$$-3p^2 + 14p - 10 = p + 2$$
$$-3p^2 + 13p - 12 = 0$$

$$p_{1,2} = \frac{-13 \pm \sqrt{13^2 - 4 \cdot (-3) \cdot (-12)}}{2 \cdot (-3)}$$

$$p_{1,2} = \frac{-13 \pm 5}{-6}$$

$$ax^2 + bx + c = 0$$
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b) Cijena ekvilibrija

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$$p_{1,2} = \frac{-13 \pm 5}{-6}$$

$$p_1 = \frac{4}{3}, \quad p_2 = 3$$

$$ax^2 + bx + c = 0$$
$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$q_1 = -3p^2 + 14p - 10$ $q_2 = p + 2$

Ponuda i potražnja u cijenama ekvilibrija su međusobno jednake.

$$q_1\left(\frac{4}{3}\right) = q_2\left(\frac{4}{3}\right)$$

$$q_1(3) = q_2(3)$$

$q_1 = -3p^2 + 14p - 10$ $q_2 = p + 2$

Ponuda i potražnja u cijenama ekvilibrija su međusobno jednake.

$$q_1\left(\frac{4}{3}\right) = q_2\left(\frac{4}{3}\right) = \frac{4}{3} + 2 = \frac{10}{3}$$

$$q_1(3) = q_2(3)$$

$q_1 = -3p^2 + 14p - 10$ $q_2 = p + 2$

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$$q_1\left(\frac{4}{3}\right) = q_2\left(\frac{4}{3}\right) = \frac{4}{3} + 2 = \frac{10}{3}$$

$$q_1(3) = q_2(3) = 3 + 2 = 5$$

$q_1 = -3p^2 + 14p - 10$ $q_2 = p + 2$

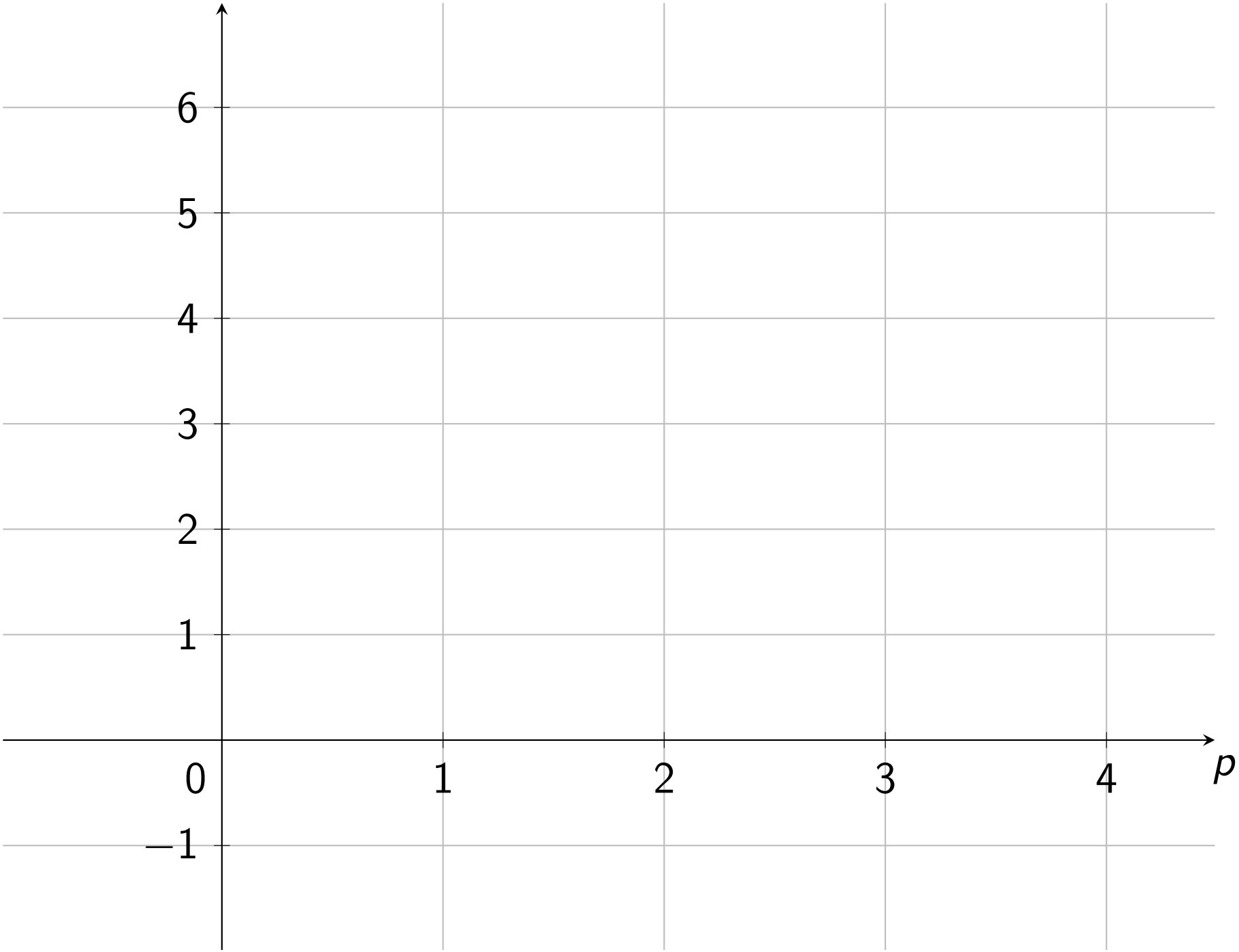
Ponuda i potražnja u cijenama ekvilibrija su međusobno jednake.

$$q_1\left(\frac{4}{3}\right) = q_2\left(\frac{4}{3}\right) = \frac{4}{3} + 2 = \frac{10}{3}$$

$$q_1(3) = q_2(3) = 3 + 2 = 5$$

**Napomena**

Kako je funkcija potražnje u pravilu padajuća funkcija, možemo reći da imamo samo jednu cijenu ekvilibrija $p = 3$.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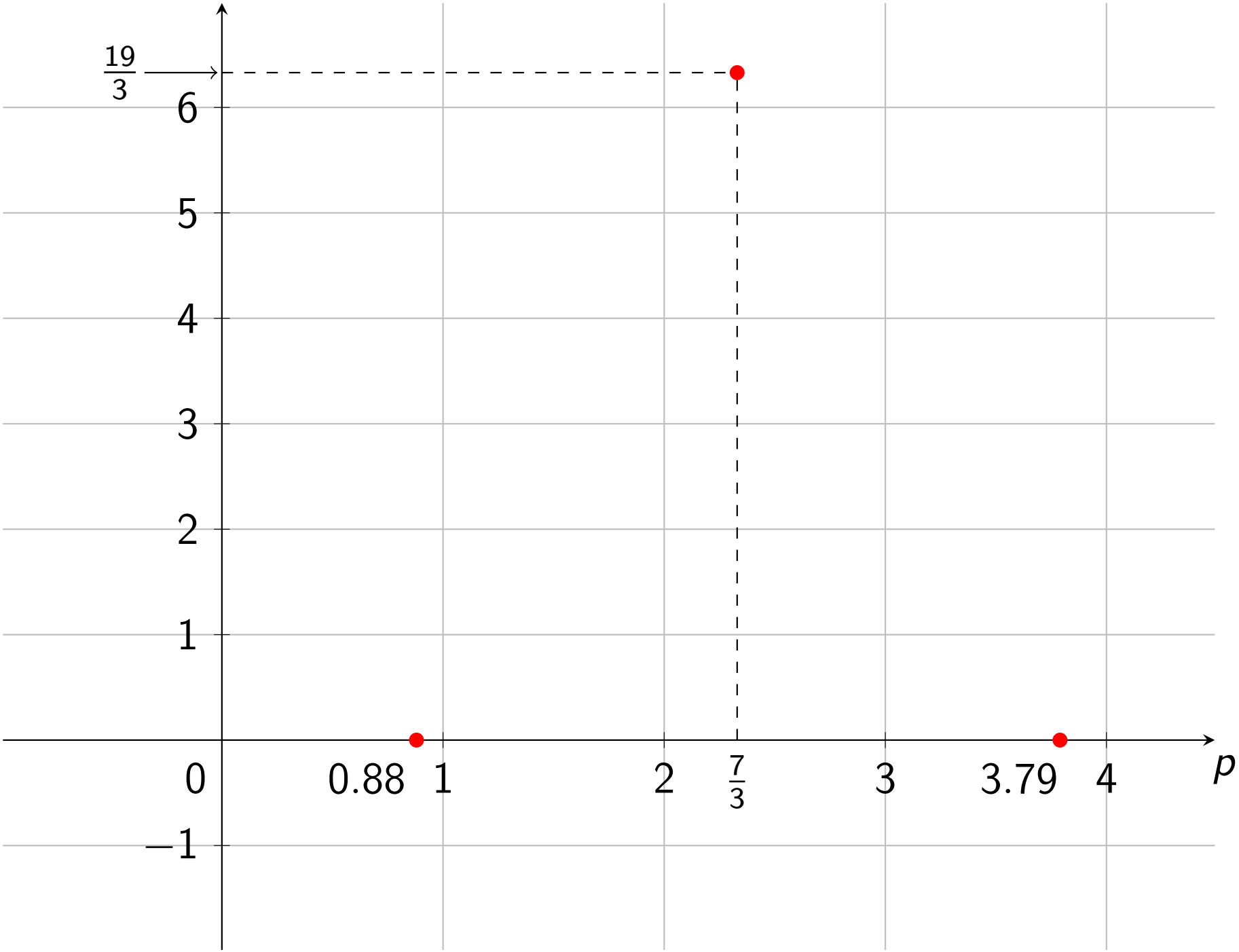
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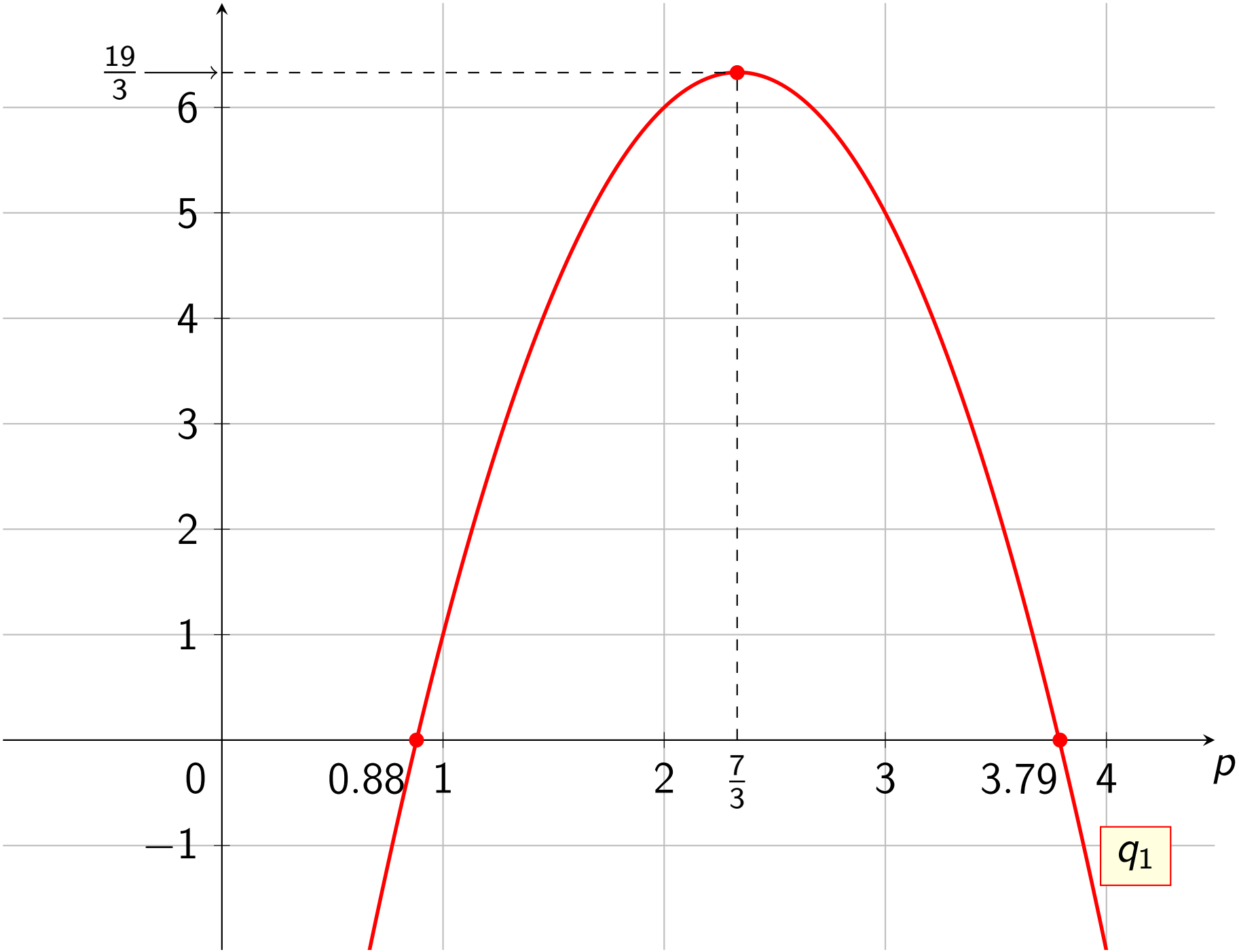
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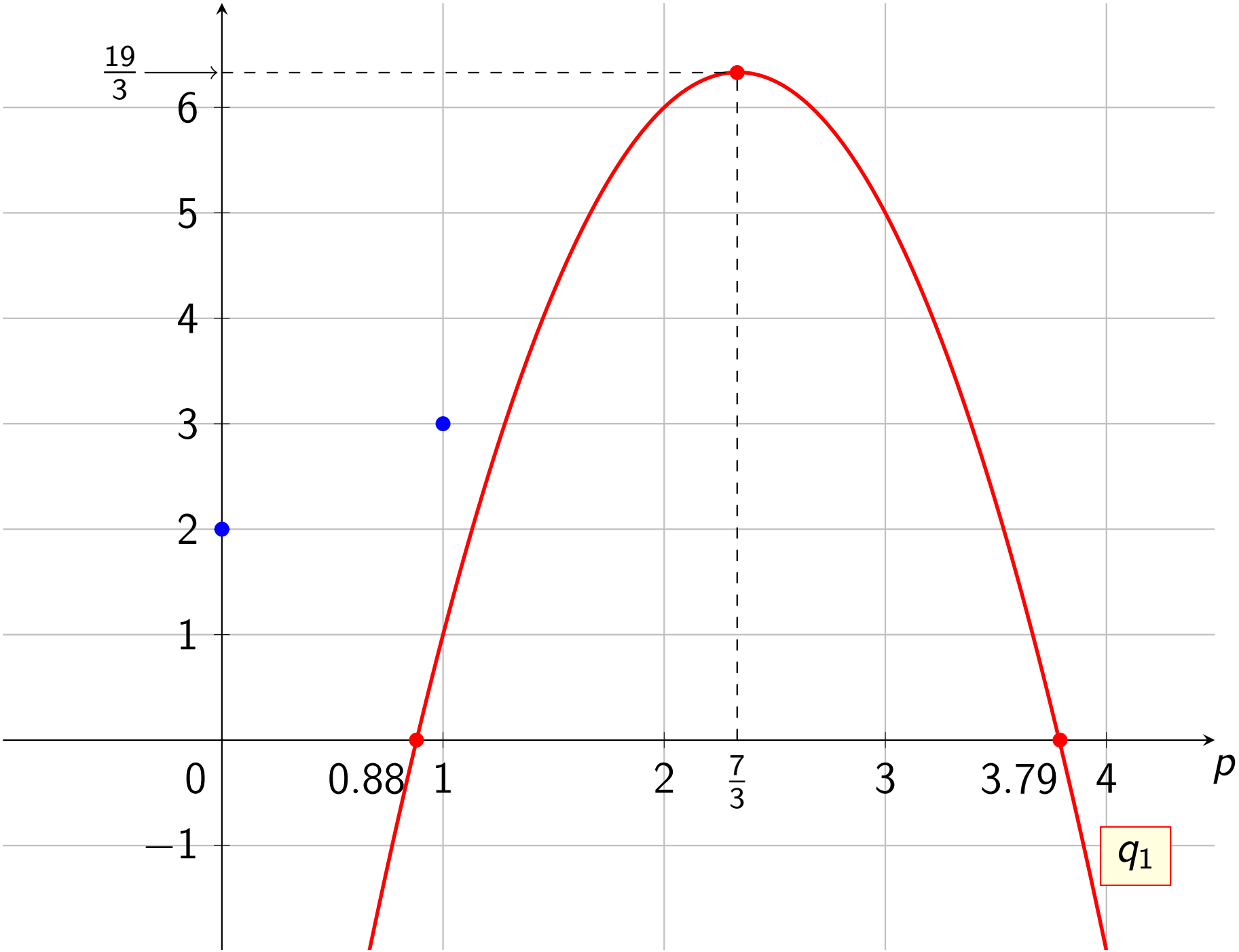
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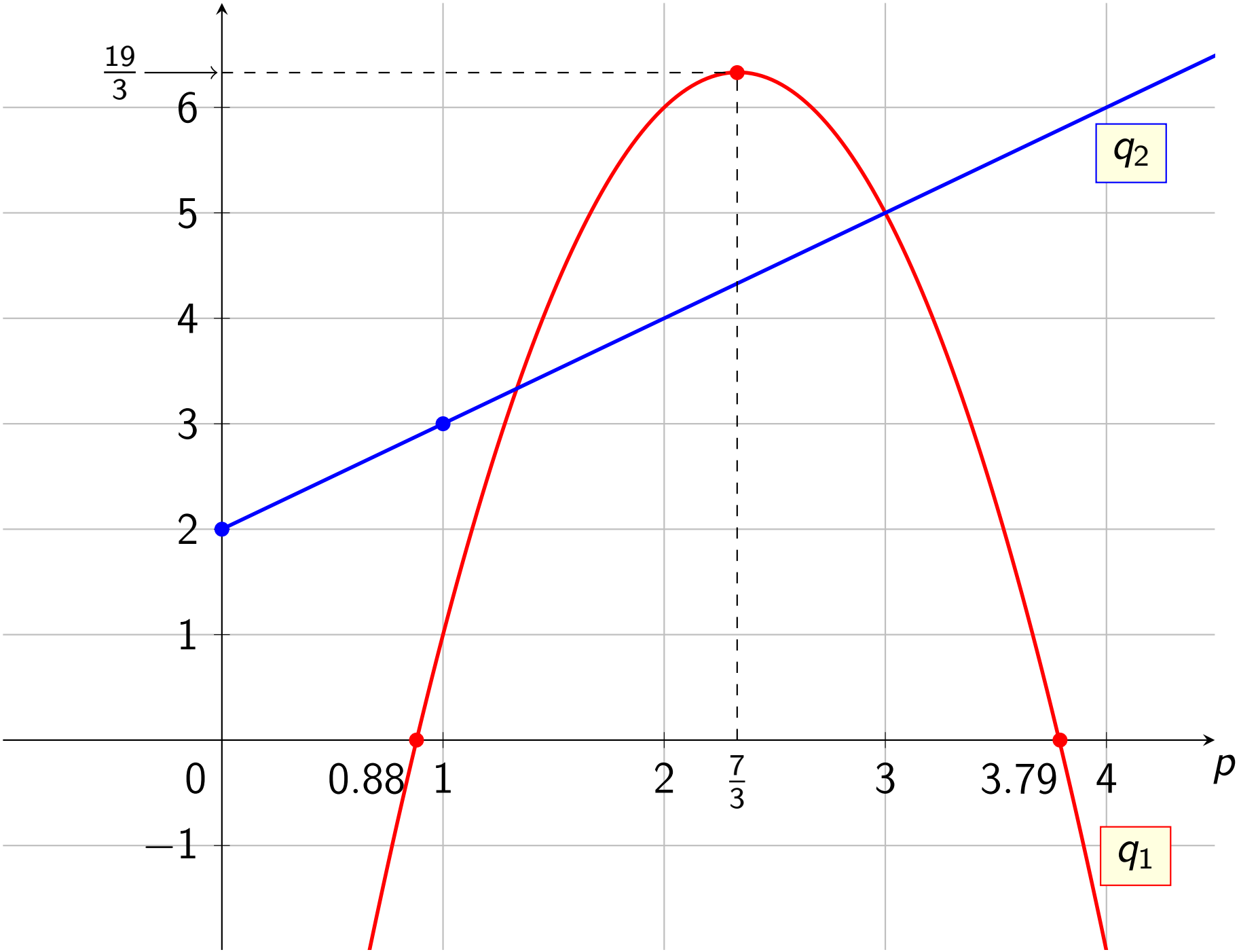
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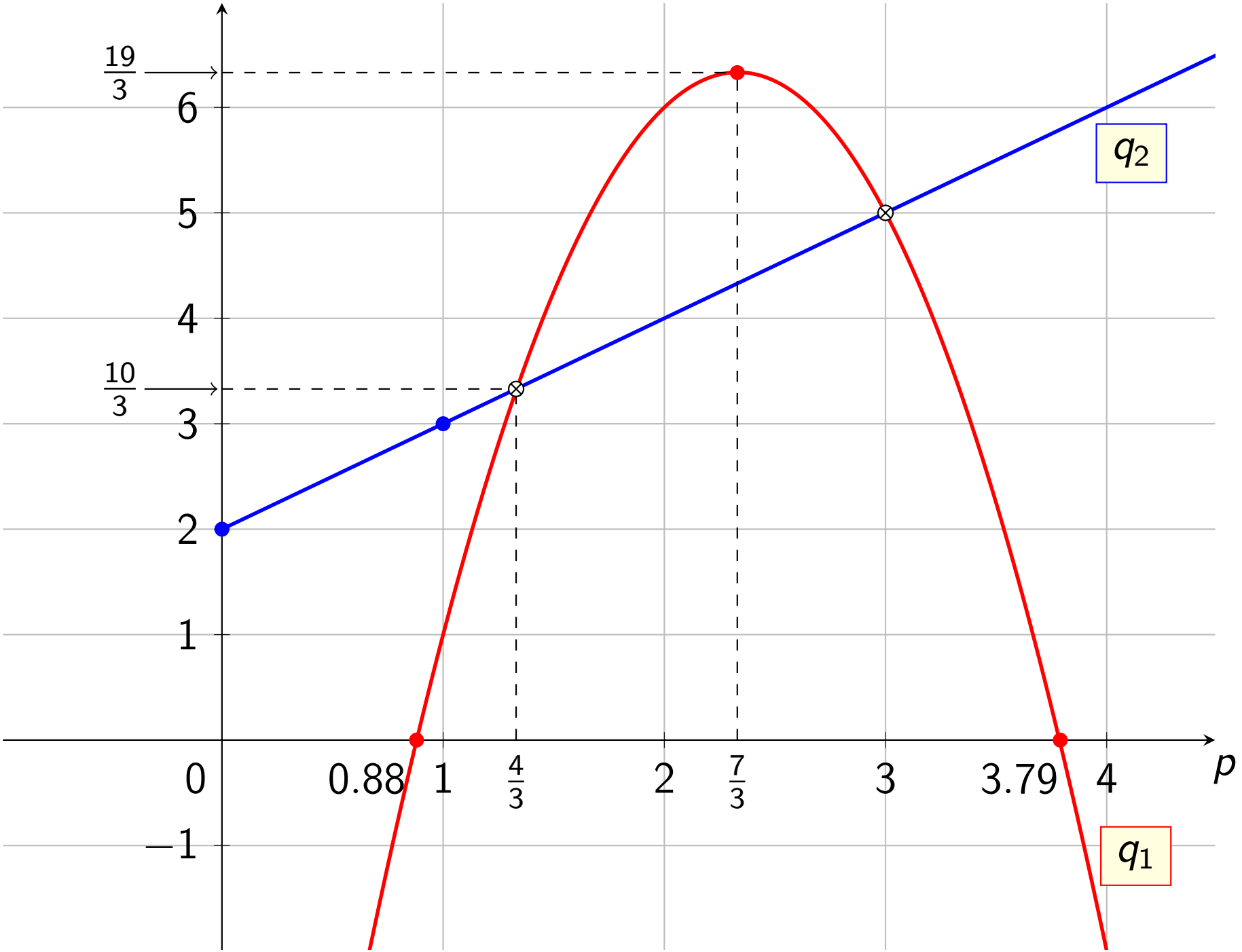
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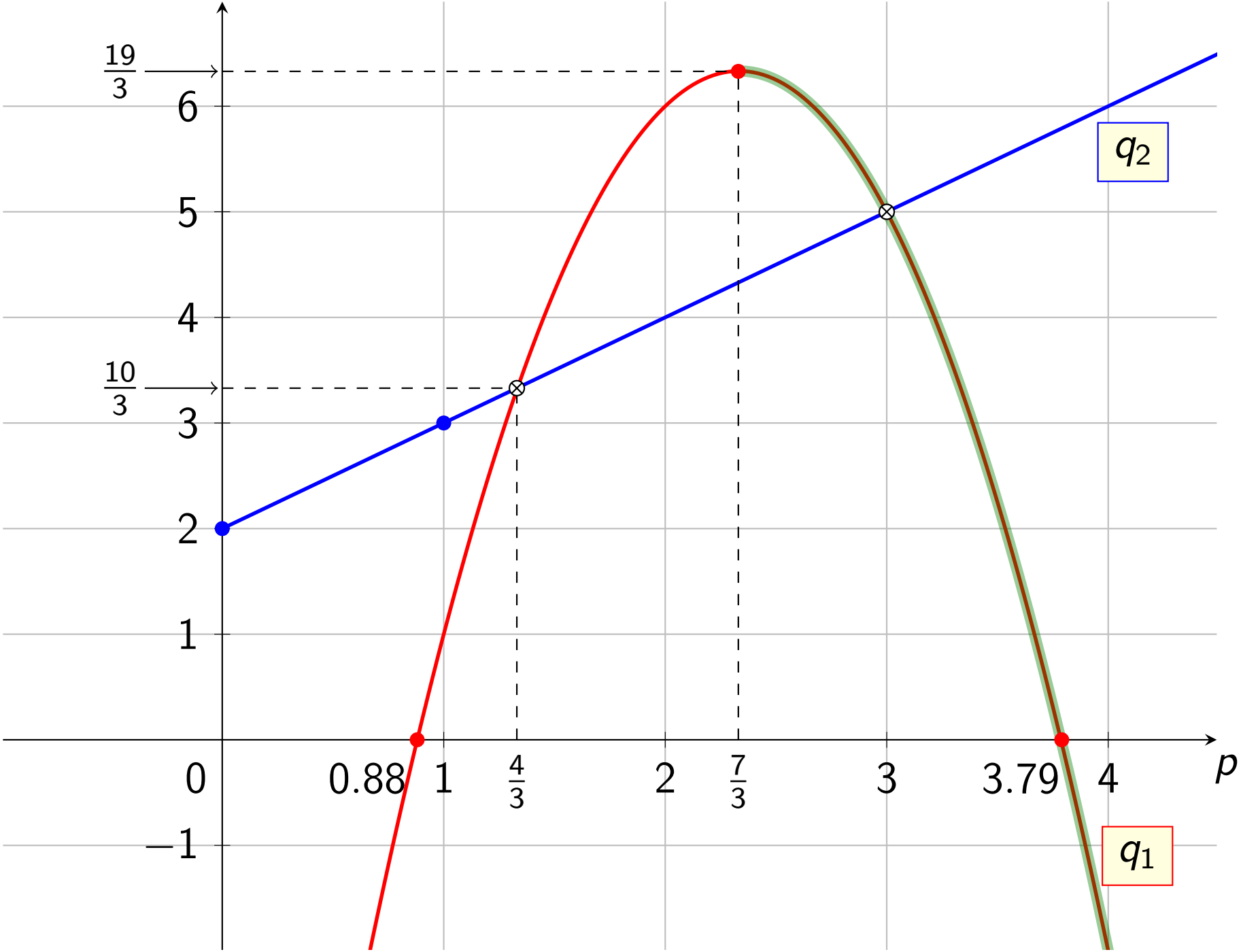
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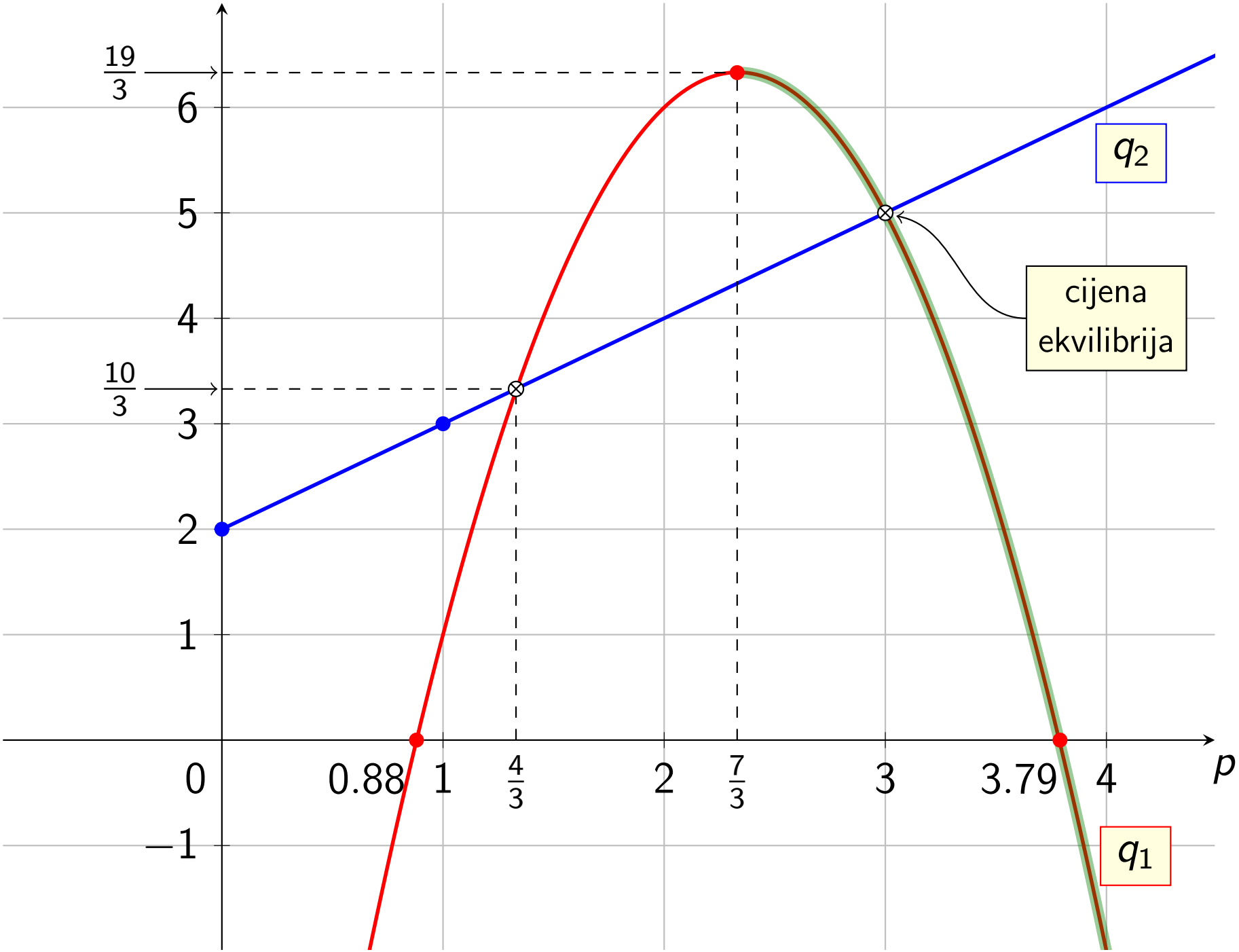
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cijena ekvilibrija
$q_1$

# drugi zadatak

## Zadatak 2

*Da bi nešto zaradio, student kroz ljetne mjesece prodaje ogrlice na plaži. Prošlo ljeto je prodavao ogrlice po 10 € i dnevno je prodao 20 ogrlica. Međutim, kada je povećao cijenu ogrlice za 1 €, prodaja se smanjila za dvije ogrlice dnevno.*

a) *Pronađite funkciju potražnje za ogrlicama uz pretpostavku da se radi o linearnoj funkciji.*

b) *Ako za izradu svake ogrlice student treba uložiti 6 €, po kojoj cijeni treba prodavati ogrlice da bi ostvario maksimalni profit? Koliko iznosi maksimalni profit i koliko ogrlica će prodati u tom slučaju?*

c) *Nacrtajte grafove funkcija potražnje, troškova, prihoda i profita u ovisnosti o cijeni proizvoda.*

## Rješenje

a) $q = ap + b$,

$$a = \frac{\Delta q}{\Delta p}$$

## Rješenje

a) $q = ap + b, \qquad \Delta p = 1,$

$$a = \frac{\Delta q}{\Delta p}$$

## Rješenje

a) $q = ap + b, \qquad \Delta p = 1, \quad \Delta q = -2$

$$a = \frac{\Delta q}{\Delta p}$$

## Rješenje

a) $q = ap + b, \qquad \Delta p = 1, \quad \Delta q = -2$

$$a = \frac{\Delta q}{\Delta p} = \frac{-2}{1}$$

## Rješenje

a) $q = ap + b, \qquad \Delta p = 1, \quad \Delta q = -2$

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## Rješenje

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$$q(10) = 20$$
$$-2 \cdot 10 + b = 20$$
$$b = 40$$

## Rješenje

a) $q = ap + b, \qquad \Delta p = 1, \quad \Delta q = -2$

$$a = \frac{\Delta q}{\Delta p} = \frac{-2}{1} = -2$$

$$q = -2p + b$$

$$\begin{aligned} q(10) &= 20 \\ -2 \cdot 10 + b &= 20 \\ b &= 40 \end{aligned}$$

Funkcija potražnje za ogrlicama: $q = -2p + 40$

b)

$$\text{PROFIT (ili DOBIT)} = \text{PRIHOD} - \text{TROŠKOVI}$$

$$\text{PRIHOD} = \text{CIJENA} \cdot \text{POTRAŽNJA}$$

b)

$$\text{PROFIT (ili DOBIT)} = \text{PRIHOD} - \text{TROŠKOVI}$$

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- Prihod kao funkcija cijene: $P(p) = p \cdot q(p)$

$$P(p) =$$

b)

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$$P(p) = p \cdot (-2p + 40)$$

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$$P(p) = p \cdot (-2p + 40) = -2p^2 + 40p$$

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- Troškovi kao funkcija cijene

$$T(p) =$$

b)

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- Troškovi kao funkcija cijene

$$T(p) = 6 \cdot (-2p + 40)$$

b)
$$\text{PROFIT (ili DOBIT)} = \text{PRIHOD} - \text{TROŠKOVI}$$
$$\text{PRIHOD} = \text{CIJENA} \cdot \text{POTRAŽNJA}$$

- Prihod kao funkcija cijene: $P(p) = p \cdot q(p)$

$$P(p) = p \cdot (-2p + 40) = -2p^2 + 40p$$

- Troškovi kao funkcija cijene

$$T(p) = 6 \cdot (-2p + 40) = -12p + 240$$

b)
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$$T(p) = 6 \cdot (-2p + 40) = -12p + 240$$

- Profit kao funkcija cijene

$$D(p) = P(p) - T(p) =$$

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$$D(p) = P(p) - T(p) = \left(-2p^2 + 40p\right)$$

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$$D(p) = P(p) - T(p) = \left(-2p^2 + 40p\right) -$$

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- Troškovi kao funkcija cijene

$$T(p) = 6 \cdot (-2p + 40) = -12p + 240$$

- Profit kao funkcija cijene

$$D(p) = P(p) - T(p) = \left(-2p^2 + 40p\right) - \left(-12p + 240\right)$$

b)

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- Troškovi kao funkcija cijene

$$T(p) = 6 \cdot (-2p + 40) = -12p + 240$$

- Profit kao funkcija cijene

$$D(p) = P(p) - T(p) = \left(-2p^2 + 40p\right) - \left(-12p + 240\right)$$

$$D(p) = -2p^2 + 52p - 240$$

Tražimo ekstreme funkcije $D(p) = -2p^2 + 52p - 240$.

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$$D'(p) =$$

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$$D'(p) = -4p + 52$$

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Tražimo ekstreme funkcije $D(p) = -2p^2 + 52p - 240$.

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$$-4p + 52 = 0$$

$$-4p = -52 \ / : (-4)$$

Tražimo ekstreme funkcije $D(p) = -2p^2 + 52p - 240$.

$$D'(p) = -4p + 52$$

$$-4p + 52 = 0$$

$$-4p = -52 \ / : (-4)$$

$$p = 13$$

Tražimo ekstreme funkcije $D(p) = -2p^2 + 52p - 240$.

$$D'(p) = -4p + 52$$

$$-4p + 52 = 0$$

$$-4p = -52 \ / : (-4)$$

$$p = 13$$

$$D''(p) = -4, \qquad D''(13) = -4 < 0$$

Student mora ogrlice prodavati po cijeni od $13\,€$ ukoliko želi ostvariti maksimalni profit.

Tražimo ekstreme funkcije $D(p) = -2p^2 + 52p - 240$.

$$D'(p) = -4p + 52$$

$$-4p + 52 = 0$$

$$-4p = -52 \ / : (-4)$$

$$p = 13$$

$$D''(p) = -4, \qquad D''(13) = -4 < 0$$

$$D(13) = -2 \cdot 13^2 + 52 \cdot 13 - 240$$

Student mora ogrlice prodavati po cijeni od 13 € ukoliko želi ostvariti maksimalni profit. Maksimalni profit u tom slučaju iznosi

Tražimo ekstreme funkcije $D(p) = -2p^2 + 52p - 240$.

$$D'(p) = -4p + 52$$

$$-4p + 52 = 0$$

$$-4p = -52 \ / : (-4)$$

$$p = 13$$

$$D''(p) = -4, \qquad D''(13) = -4 < 0$$

$$D(13) = -2 \cdot 13^2 + 52 \cdot 13 - 240 = 98$$

Student mora ogrlice prodavati po cijeni od 13 € ukoliko želi ostvariti maksimalni profit. Maksimalni profit u tom slučaju iznosi 98 €, a proda se ukupno __ ogrlica.

Tražimo ekstreme funkcije $D(p) = -2p^2 + 52p - 240$.

$$D'(p) = -4p + 52$$

$$-4p + 52 = 0$$

$$-4p = -52 \ / : (-4)$$

$$p = 13$$

$$D''(p) = -4, \qquad D''(13) = -4 < 0$$

$$D(13) = -2 \cdot 13^2 + 52 \cdot 13 - 240 = 98$$

Student mora ogrlice prodavati po cijeni od $13\,€$ ukoliko želi ostvariti maksimalni profit. Maksimalni profit u tom slučaju iznosi $98\,€$, a proda se ukupno __ ogrlica.

$$q(13) = -2 \cdot 13 + 40$$

$$\boxed{q = -2p + 40}$$

Tražimo ekstreme funkcije $D(p) = -2p^2 + 52p - 240$.

$$D'(p) = -4p + 52$$

$$-4p + 52 = 0$$

$$-4p = -52 \ / : (-4)$$

$$p = 13$$

$$D''(p) = -4, \qquad D''(13) = -4 < 0$$

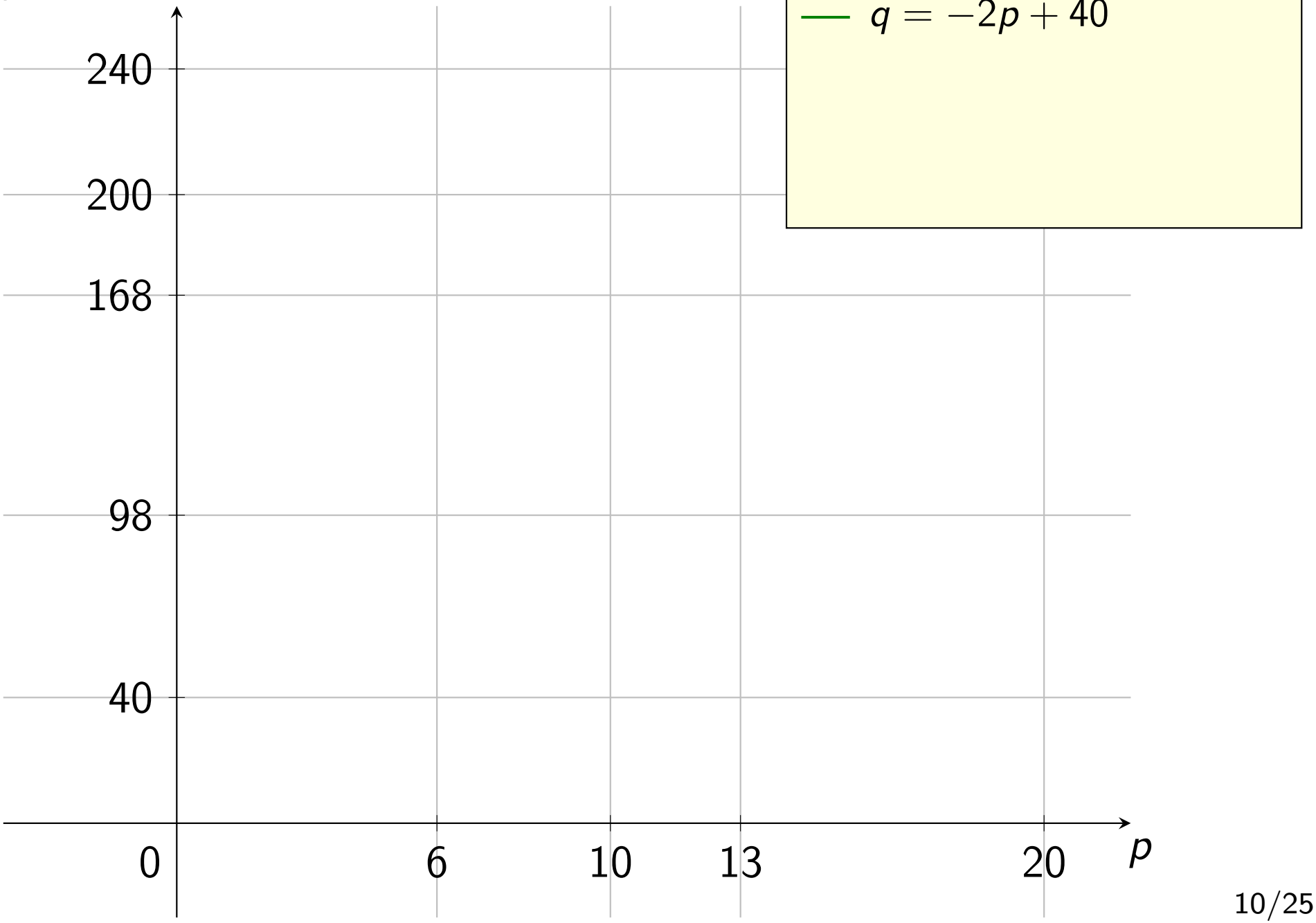
$$D(13) = -2 \cdot 13^2 + 52 \cdot 13 - 240 = 98$$

Student mora ogrlice prodavati po cijeni od $13\,€$ ukoliko želi ostvariti maksimalni profit. Maksimalni profit u tom slučaju iznosi $98\,€$, a proda se ukupno $\underline{14}$ ogrlica.

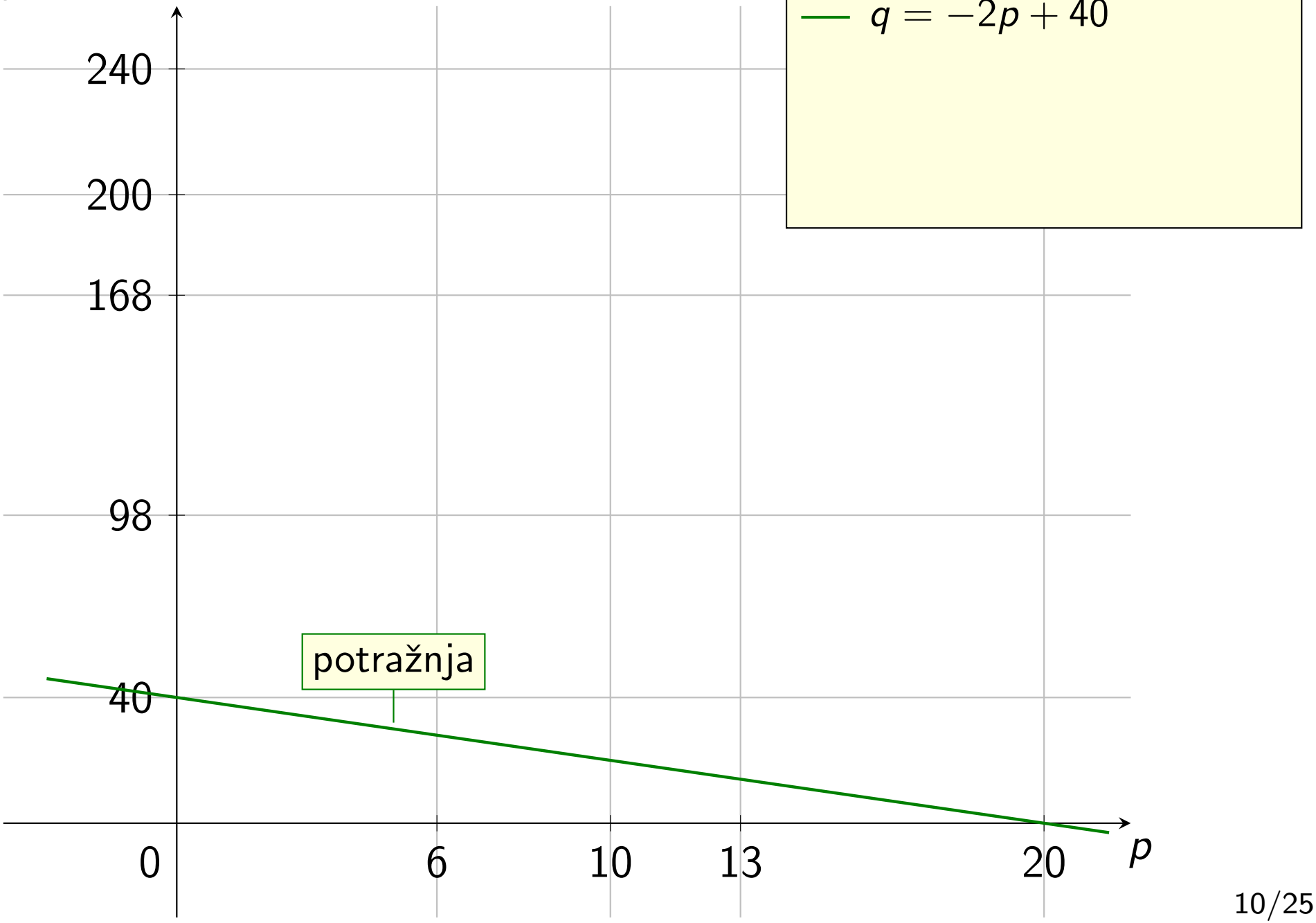
$$q(13) = -2 \cdot 13 + 40 = 14$$

$$\boxed{q = -2p + 40}$$

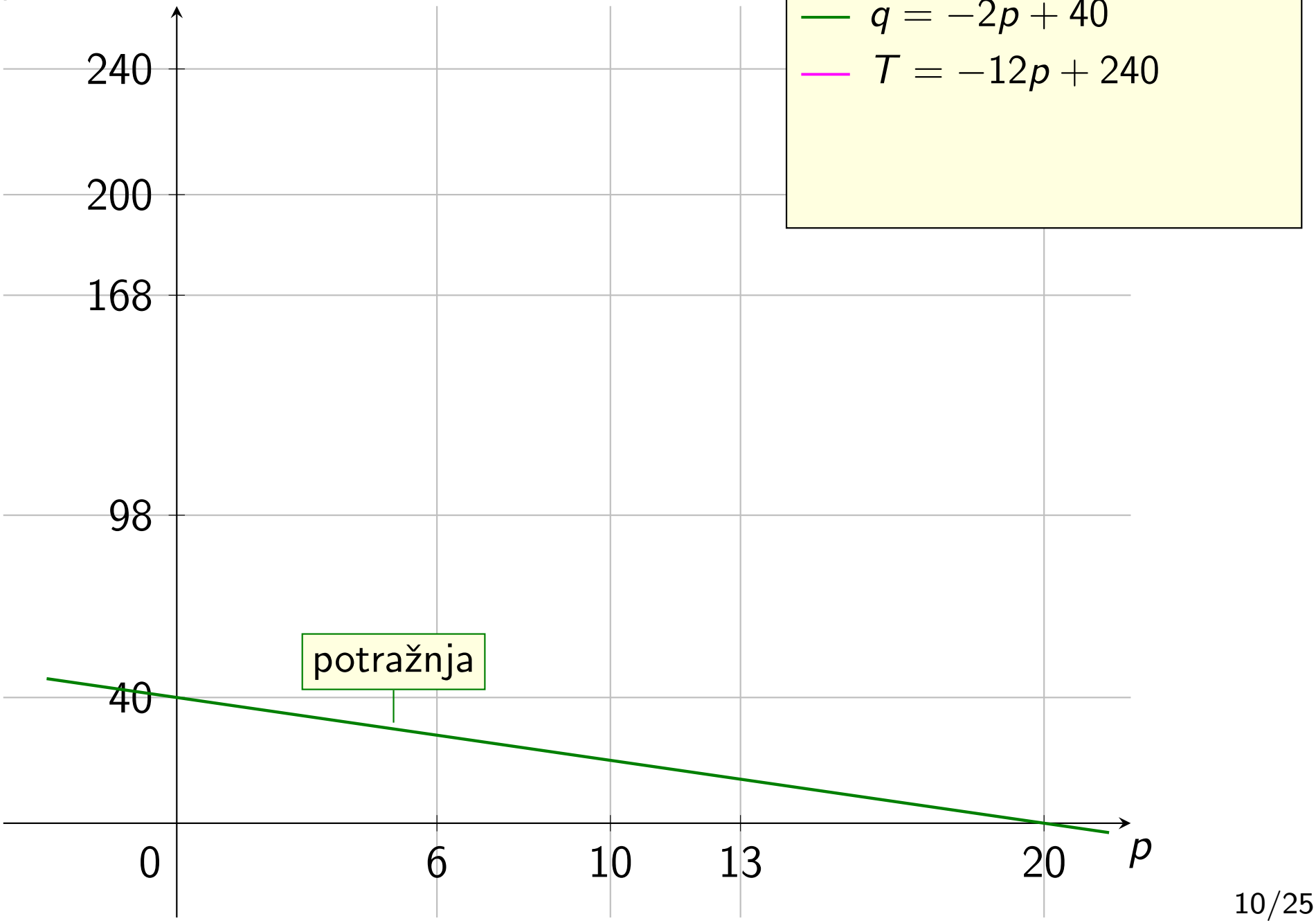
c)



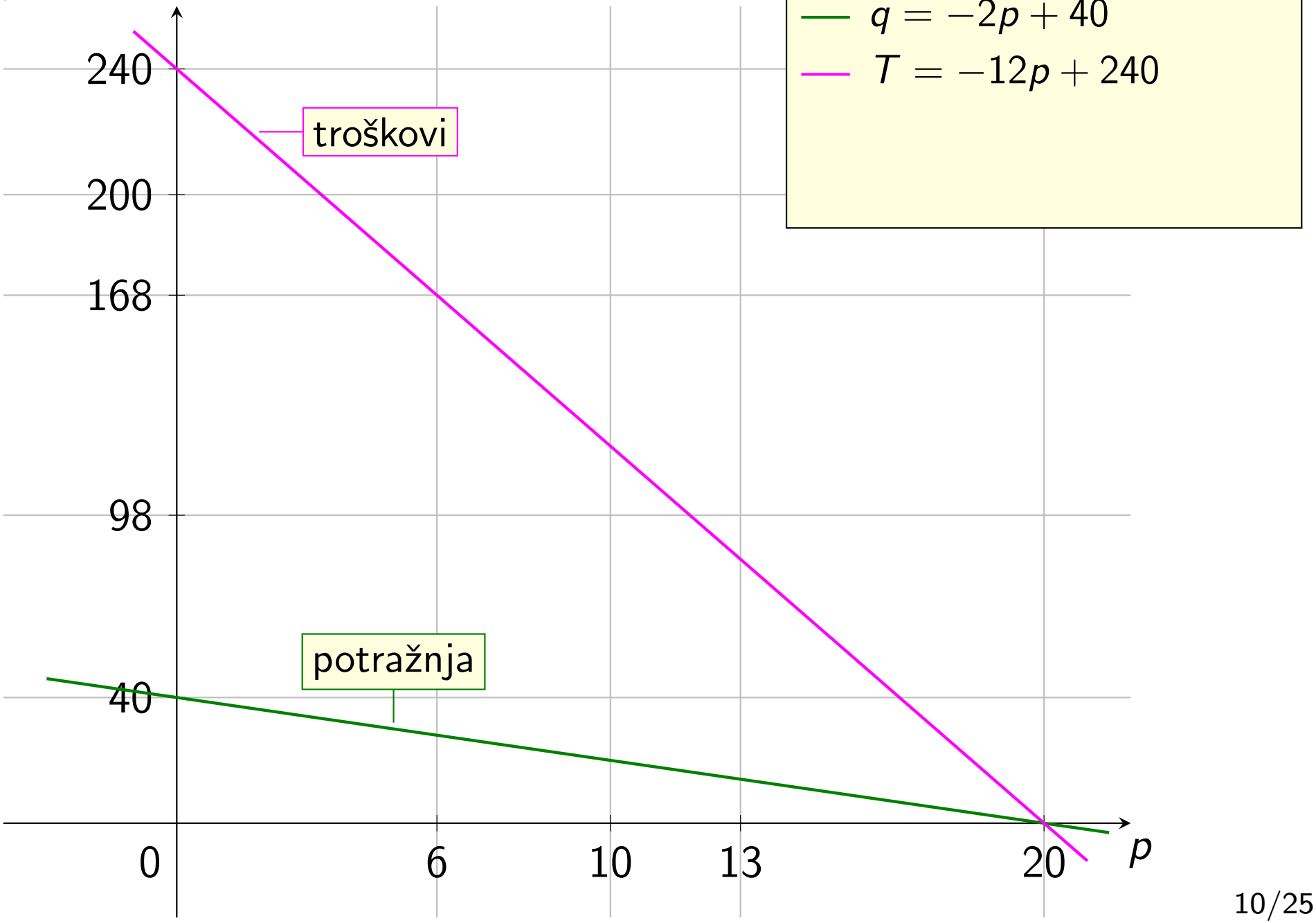
c)



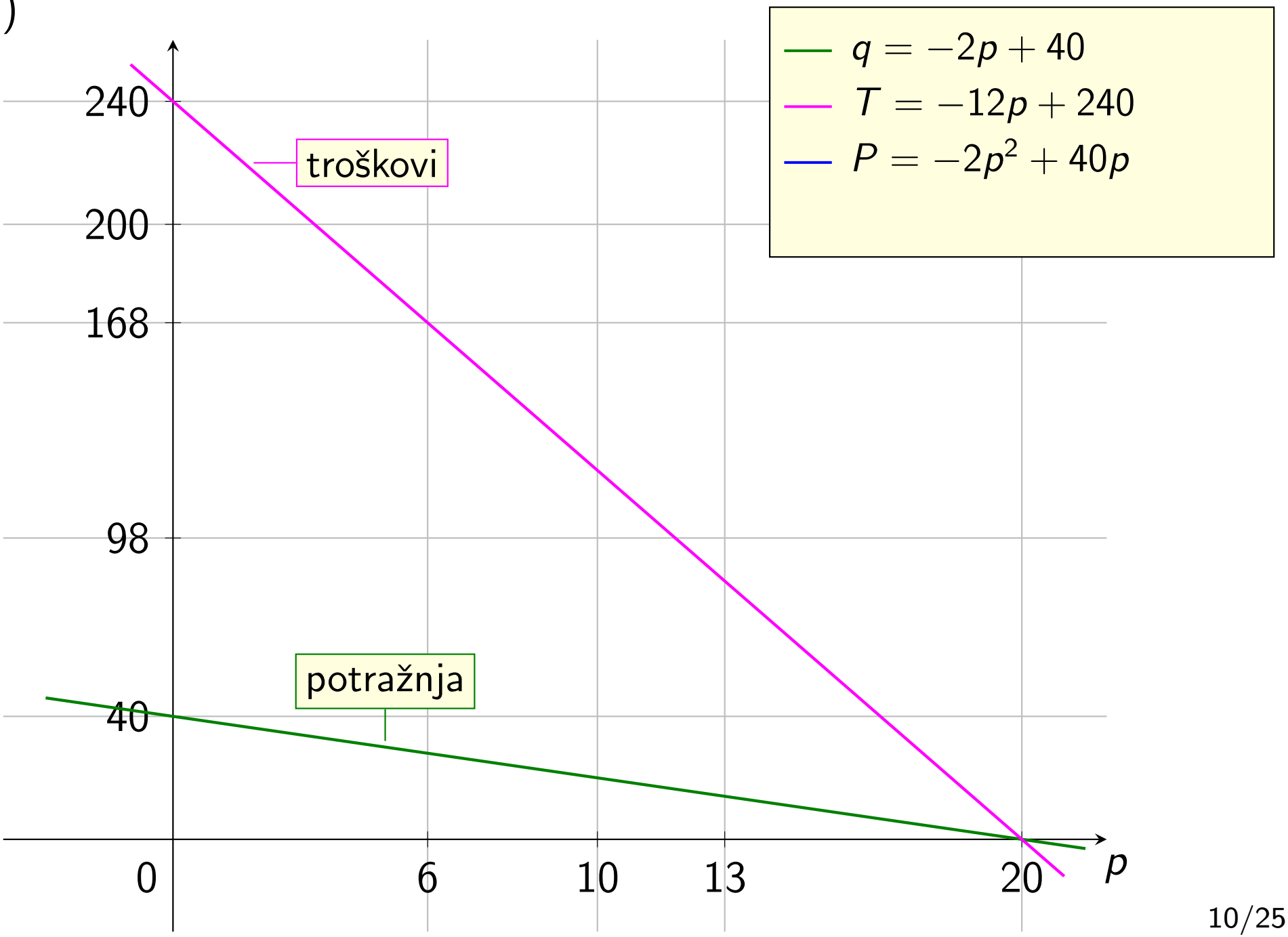
c)



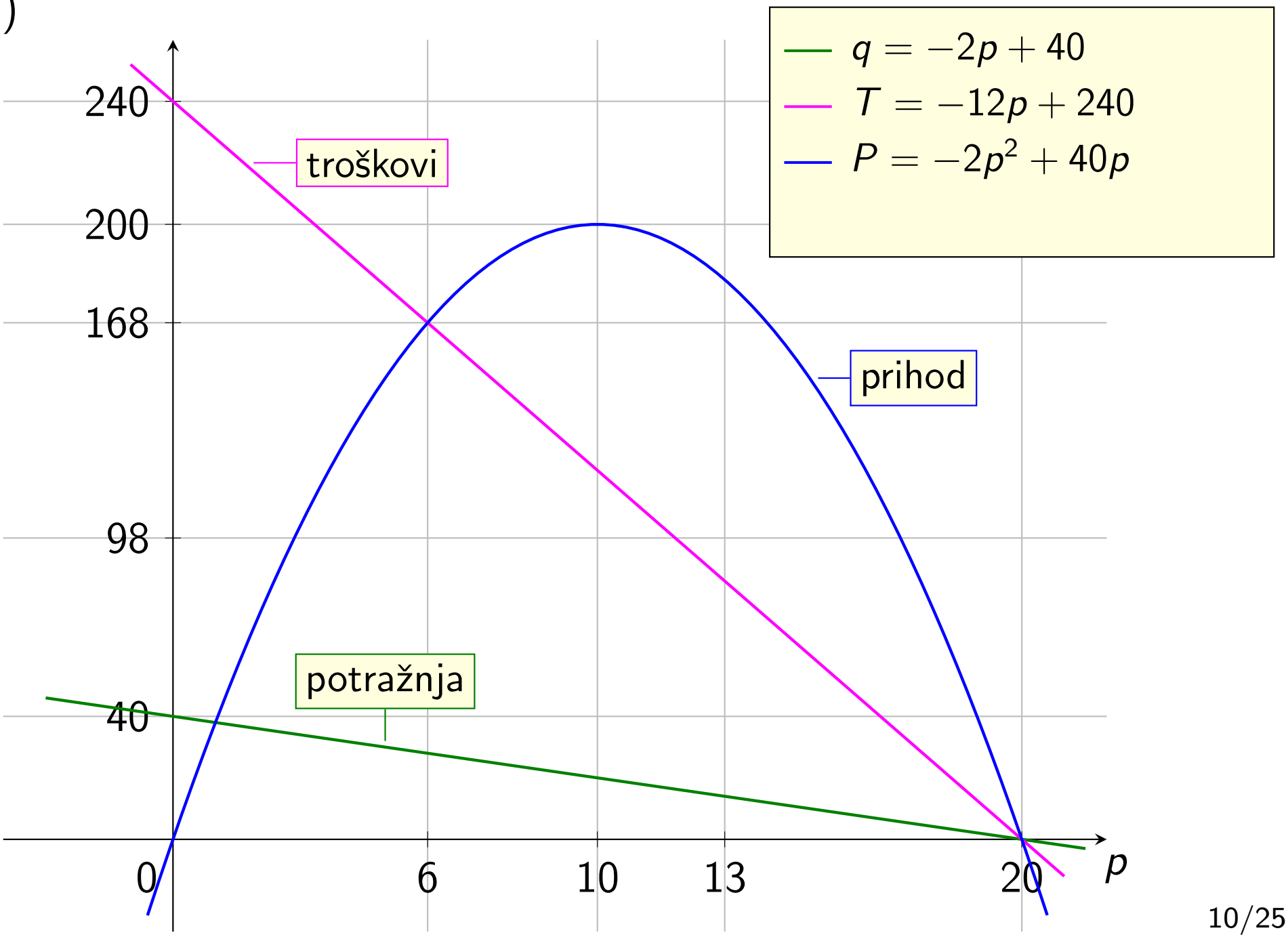
c)


$q = -2p + 40$
$T = -12p + 240$
troškovi
potražnja
240
200
168
98
40
0
6
10
13
20
$p$

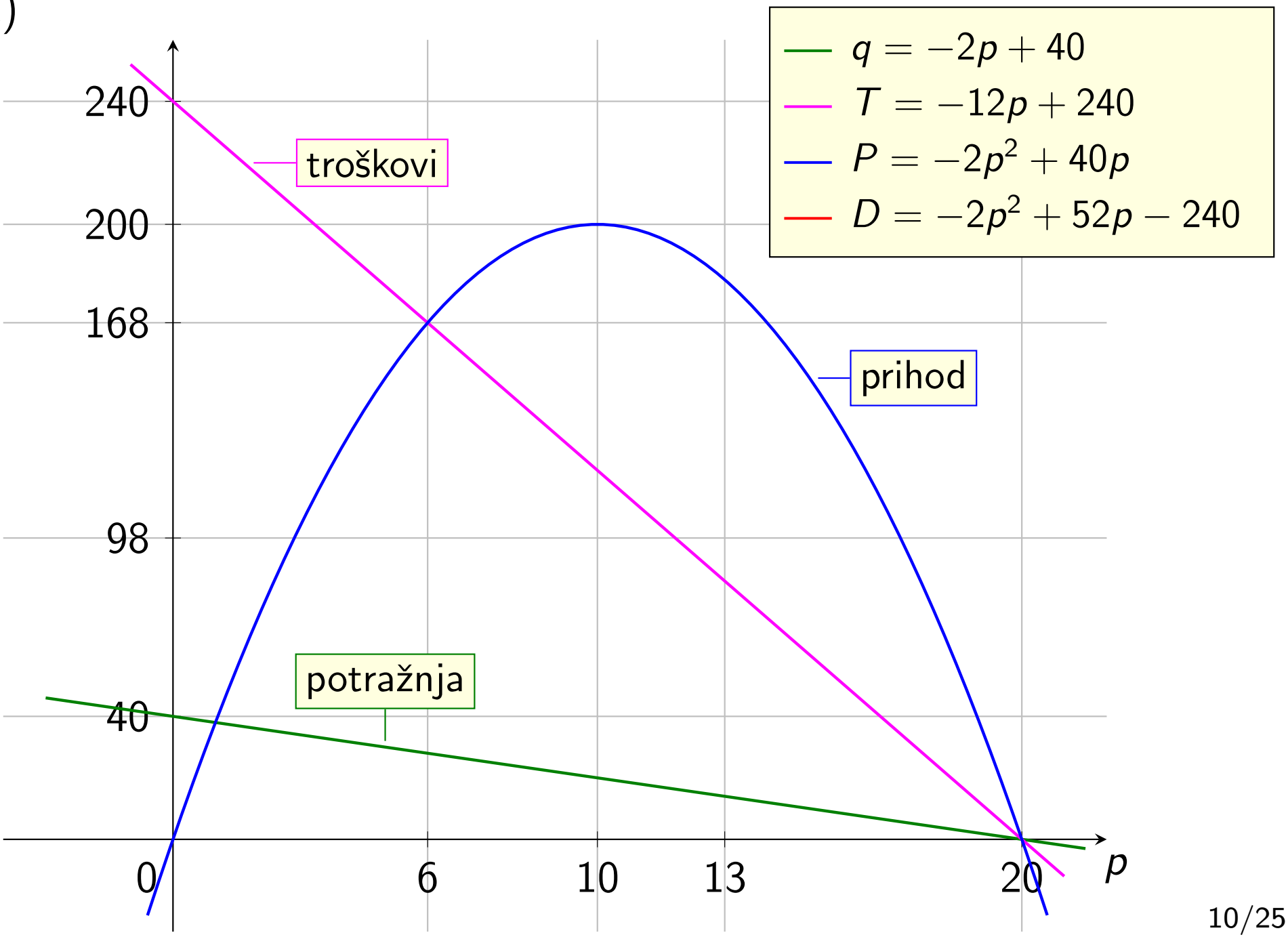
c)


$q = -2p + 40$
$T = -12p + 240$
$P = -2p^2 + 40p$
troškovi
potražnja
240
200
168
98
40
0
6
10
13
20
$p$

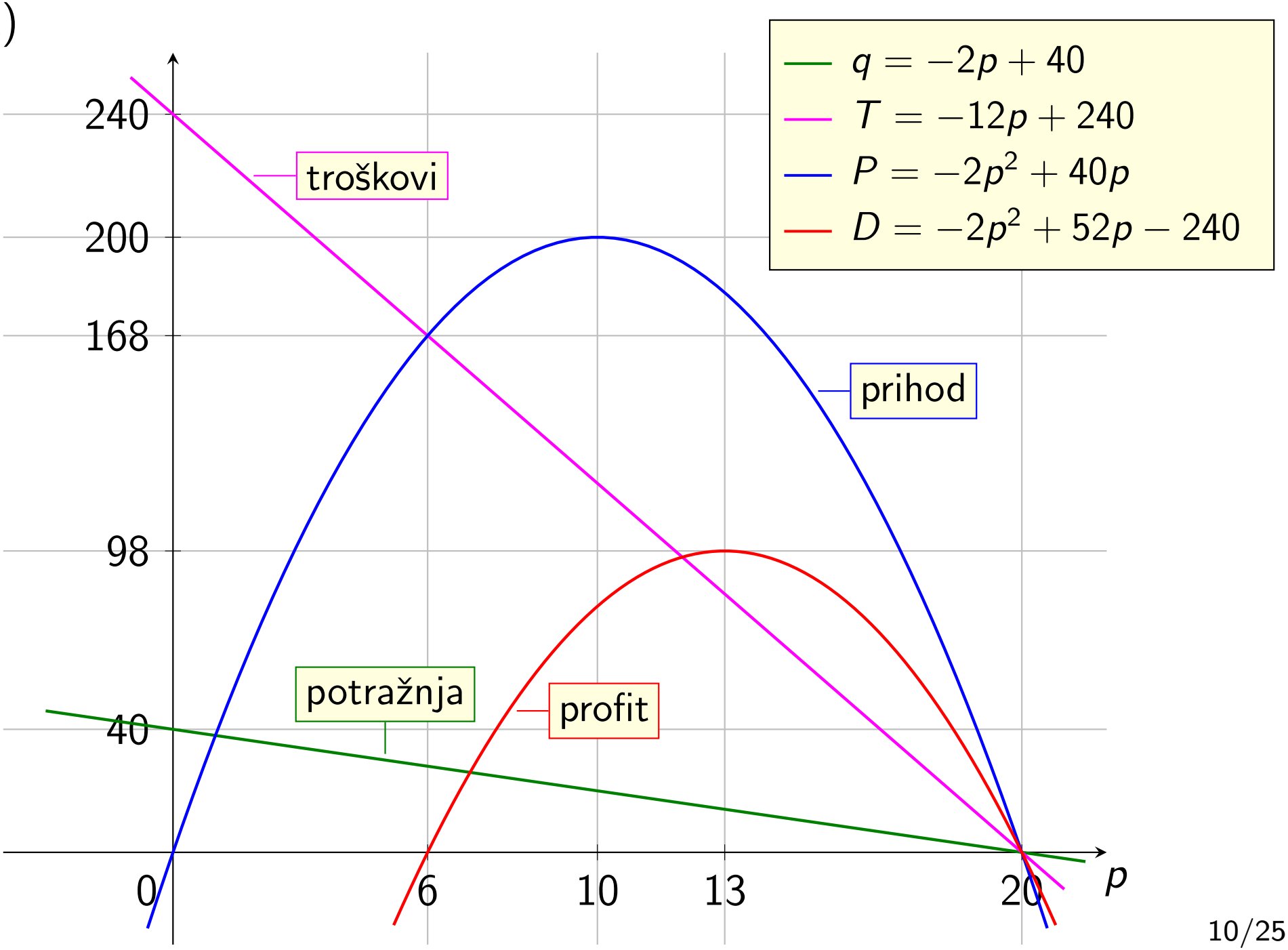
c)


$q = -2p + 40$
$T = -12p + 240$
$P = -2p^2 + 40p$
troškovi
prihod
potražnja
240
200
168
98
40
0
6
10
13
20
$p$

c)


$q = -2p + 40$
$T = -12p + 240$
$P = -2p^2 + 40p$
$D = -2p^2 + 52p - 240$
troškovi
prihod
potražnja
240
200
168
98
40
0
6
10
13
20
$p$

c)


$q = -2p + 40$
$T = -12p + 240$
$P = -2p^2 + 40p$
$D = -2p^2 + 52p - 240$
troškovi
prihod
potražnja
profit
240
200
168
98
40
0
6
10
13
20
$p$

# treći zadatak

## Zadatak 3

*Menadžer je utvrdio da je veza između prodajne cijene $p$ robe i broja komada $N$ dana s*

$$N(p) = \frac{1500}{p^2 + 100}.$$

*Prosječni troškovi za $N$ komada robe jednaki su*

$$T_p = 2 + \frac{14}{N}.$$

*Odredite cijenu uz koju se ostvaruje maksimalni profit i izračunajte taj profit. Odredite za koje prodajne cijene robe je profit pozitivan.*

## Rješenje

- Funkcija prosječnih troškova

$$\text{prosječni troškovi} = \frac{\text{troškovi}}{\text{broj proizvoda}}$$

## Rješenje

- Funkcija prosječnih troškova

$$\text{prosječni troškovi} = \frac{\text{troškovi}}{\text{broj proizvoda}} \qquad T_p(N) = \frac{T(N)}{N}$$

## Rješenje

- Funkcija prosječnih troškova

$$\text{prosječni troškovi} = \frac{\text{troškovi}}{\text{broj proizvoda}} \qquad T_p(N) = \frac{T(N)}{N}$$

- Funkcija troškova

$$T(N) = T_p(N) \cdot N$$

$$T_p = 2 + \frac{14}{N}$$

## Rješenje

- Funkcija prosječnih troškova

$$\text{prosječni troškovi} = \frac{\text{troškovi}}{\text{broj proizvoda}} \qquad T_p(N) = \frac{T(N)}{N}$$

- Funkcija troškova

$$T(N) = T_p(N) \cdot N = \left(2 + \frac{14}{N}\right) \cdot N$$

$$T_p = 2 + \frac{14}{N}$$

## Rješenje

- Funkcija prosječnih troškova

$$\text{prosječni troškovi} = \frac{\text{troškovi}}{\text{broj proizvoda}} \qquad T_p(N) = \frac{T(N)}{N}$$

- Funkcija troškova

$$T(N) = T_p(N) \cdot N = \left(2 + \frac{14}{N}\right) \cdot N = 2N + 14$$

$$T_p = 2 + \frac{14}{N}$$

## Rješenje

- Funkcija prosječnih troškova

$$\text{prosječni troškovi} = \frac{\text{troškovi}}{\text{broj proizvoda}} \qquad T_p(N) = \frac{T(N)}{N}$$

- Funkcija troškova

$$T(N) = T_p(N) \cdot N = \left(2 + \frac{14}{N}\right) \cdot N = 2N + 14$$

$$T(p) = 2N(p) + 14$$

$$N(p) = \frac{1500}{p^2 + 100}$$

$$T_p = 2 + \frac{14}{N}$$

## Rješenje

- Funkcija prosječnih troškova

$$\text{prosječni troškovi} = \frac{\text{troškovi}}{\text{broj proizvoda}} \qquad T_p(N) = \frac{T(N)}{N}$$

- Funkcija troškova

$$T(N) = T_p(N) \cdot N = \left(2 + \frac{14}{N}\right) \cdot N = 2N + 14$$

$$T(p) = 2N(p) + 14 = 2 \cdot \frac{1500}{p^2 + 100} + 14$$

$$N(p) = \frac{1500}{p^2 + 100}$$

$$T_p = 2 + \frac{14}{N}$$

## Rješenje

- Funkcija prosječnih troškova

$$\text{prosječni troškovi} = \frac{\text{troškovi}}{\text{broj proizvoda}} \qquad T_p(N) = \frac{T(N)}{N}$$

- Funkcija troškova

$$T(N) = T_p(N) \cdot N = \left(2 + \frac{14}{N}\right) \cdot N = 2N + 14$$

$$T(p) = 2N(p) + 14 = 2 \cdot \frac{1500}{p^2 + 100} + 14 = \frac{3000}{p^2 + 100} + 14$$

- Funkcija prihoda: PRIHOD $=$ CIJENA $\cdot$ POTRAŽNJA

$$P(p) = p \cdot N(p)$$

- Funkcija prihoda: PRIHOD $=$ CIJENA $\cdot$ POTRAŽNJA

$$P(p) = p \cdot N(p) = p \cdot \frac{1500}{p^2 + 100}$$

$$\boxed{N(p) = \frac{1500}{p^2 + 100}}$$

- Funkcija prihoda: PRIHOD $=$ CIJENA $\cdot$ POTRAŽNJA

$$P(p) = p \cdot N(p) = p \cdot \frac{1500}{p^2 + 100} = \frac{1500p}{p^2 + 100}$$

$$\boxed{N(p) = \frac{1500}{p^2 + 100}}$$

- Funkcija prihoda: PRIHOD $=$ CIJENA $\cdot$ POTRAŽNJA

$$P(p) = p \cdot N(p) = p \cdot \frac{1500}{p^2 + 100} = \frac{1500p}{p^2 + 100}$$

- Funkcija profita: PROFIT $=$ PRIHOD $-$ TROŠKOVI

$$D(p) = P(p) - T(p)$$

$$N(p) = \frac{1500}{p^2 + 100}$$

- Funkcija prihoda: PRIHOD $=$ CIJENA $\cdot$ POTRAŽNJA

$$P(p) = p \cdot N(p) = p \cdot \frac{1500}{p^2 + 100} = \frac{1500p}{p^2 + 100}$$

- Funkcija profita: PROFIT $=$ PRIHOD $-$ TROŠKOVI

$$D(p) = P(p) - T(p) = \frac{1500p}{p^2 + 100} - \left( \frac{3000}{p^2 + 100} + 14 \right)$$

$$\boxed{N(p) = \frac{1500}{p^2 + 100}} \qquad \boxed{T(p) = \frac{3000}{p^2 + 100} + 14}$$

- Funkcija prihoda: PRIHOD $=$ CIJENA $\cdot$ POTRAŽNJA

$$P(p) = p \cdot N(p) = p \cdot \frac{1500}{p^2 + 100} = \frac{1500p}{p^2 + 100}$$

- Funkcija profita: PROFIT $=$ PRIHOD $-$ TROŠKOVI

$$D(p) = P(p) - T(p) = \frac{1500p}{p^2 + 100} - \left( \frac{3000}{p^2 + 100} + 14 \right) =$$

$$= \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\boxed{N(p) = \frac{1500}{p^2 + 100}} \qquad \boxed{T(p) = \frac{3000}{p^2 + 100} + 14}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) =$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \text{\_\_\_\_\_}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \frac{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}{(p^2 + 100)^2}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \frac{1500}{(p^2 + 100)^2}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \frac{1500 \cdot}{(p^2 + 100)^2}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \frac{1500 \cdot (p^2 + 100)}{(p^2 + 100)^2}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \frac{1500 \cdot (p^2 + 100) -}{(p^2 + 100)^2}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \frac{1500 \cdot (p^2 + 100) - (1500p - 3000)}{(p^2 + 100)^2}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \frac{1500 \cdot (p^2 + 100) - (1500p - 3000) \cdot}{(p^2 + 100)^2}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \frac{1500 \cdot (p^2 + 100) - (1500p - 3000) \cdot 2p}{(p^2 + 100)^2}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \frac{1500 \cdot (p^2 + 100) - (1500p - 3000) \cdot 2p}{(p^2 + 100)^2} - 0$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

$$\left(\frac{u}{v}\right)'(x) = \frac{u'(x) \cdot v(x) - u(x) \cdot v'(x)}{v(x)^2}$$

$$D'(p) = \frac{1500 \cdot (p^2 + 100) - (1500p - 3000) \cdot 2p}{(p^2 + 100)^2} - 0$$

$$D'(p) = \text{———————————————————————}$$

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$$D'(p) = \frac{1500 \cdot (p^2 + 100) - (1500p - 3000) \cdot 2p}{(p^2 + 100)^2} - 0$$

$$D'(p) = \frac{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}{(p^2 + 100)^2}$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

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$$D'(p) = \frac{1500 \cdot (p^2 + 100) - (1500p - 3000) \cdot 2p}{(p^2 + 100)^2} - 0$$

$$D'(p) = \frac{1500p^2 + 150\,000 - 3000p^2 + 6000p}{(p^2 + 100)^2}$$

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$$-1500p^2 + 6000p + 150\,000 = 0$$

$$D'(p) = 0$$

$$\frac{-1500p^2 + 6000p + 150\,000}{(p^2 + 100)^2} = 0$$

$$-1500p^2 + 6000p + 150\,000 = 0 \,/ : (-1500)$$

$$p^2 - 4p - 100 = 0$$

$$D'(p) = 0$$

$$\frac{-1500p^2 + 6000p + 150\,000}{(p^2 + 100)^2} = 0$$

$$-1500p^2 + 6000p + 150\,000 = 0 \,/ : (-1500)$$

$$p^2 - 4p - 100 = 0$$

$$p_{1,2} = \frac{4 \pm \sqrt{16 + 400}}{2}$$

$$D'(p) = 0$$

$$\frac{-1500p^2 + 6000p + 150\,000}{(p^2 + 100)^2} = 0$$

$$-1500p^2 + 6000p + 150\,000 = 0 \,/ : (-1500)$$

$$p^2 - 4p - 100 = 0$$

$$p_{1,2} = \frac{4 \pm \sqrt{16 + 400}}{2}$$

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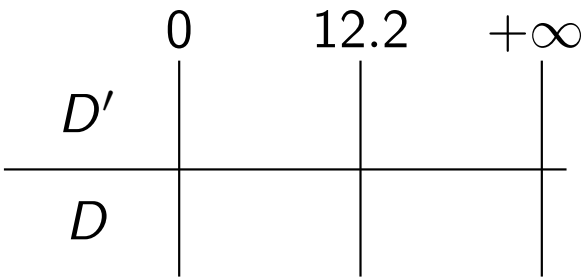

$$D'(p) = 0$$

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$$p^2 - 4p - 100 = 0$$

$$p_{1,2} = \frac{4 \pm \sqrt{16 + 400}}{2}$$

$$p_1 = 12.2, \quad \cancel{p_2 = -8.2}$$

| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | | |
| $D$ | | | | | |

$$D'(p) = 0$$

$$\frac{-1500p^2 + 6000p + 150\,000}{(p^2 + 100)^2} = 0$$

$$-1500p^2 + 6000p + 150\,000 = 0 \,/ : (-1500)$$

$$p^2 - 4p - 100 = 0$$

$$p_{1,2} = \frac{4 \pm \sqrt{16 + 400}}{2}$$

$$p_1 = 12.2, \quad \cancel{p_2 = -8.2}$$

| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | $-$ | |
| $D$ | | | | | |

$$D'(p) = 0$$

$$\frac{-1500p^2 + 6000p + 150\,000}{(p^2 + 100)^2} = 0$$

$$-1500p^2 + 6000p + 150\,000 = 0 \,/ : (-1500)$$

$$p^2 - 4p - 100 = 0$$

$$p_{1,2} = \frac{4 \pm \sqrt{16 + 400}}{2}$$

$$p_1 = 12.2, \quad \cancel{p_2 = -8.2}$$

| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | $-$ | |
| $D$ | | $\nearrow$ | | | |

$$D'(p) = 0$$

$$\frac{-1500p^2 + 6000p + 150\,000}{(p^2 + 100)^2} = 0$$

$$-1500p^2 + 6000p + 150\,000 = 0 \,/ : (-1500)$$

$$p^2 - 4p - 100 = 0$$

$$p_{1,2} = \frac{4 \pm \sqrt{16 + 400}}{2}$$

$$p_1 = 12.2, \quad \cancel{p_2 = -8.2}$$

| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | $-$ | |
| $D$ | | $\nearrow$ | | $\searrow$ | |

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$$\frac{-1500p^2 + 6000p + 150\,000}{(p^2 + 100)^2} = 0$$

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$$p_{1,2} = \frac{4 \pm \sqrt{16 + 400}}{2}$$

$$p_1 = 12.2, \quad p_2$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | $-$ | |
| $D$ | | $\nearrow$ | | $\searrow$ | |

$$D(12.2) =$$

$$D'(p) = 0$$

$$\frac{-1500p^2 + 6000p + 150\,000}{(p^2 + 100)^2} = 0$$

$$-1500p^2 + 6000p + 150\,000 = 0 \,/ : (-1500)$$

$$p^2 - 4p - 100 = 0$$

$$p_{1,2} = \frac{4 \pm \sqrt{16 + 400}}{2}$$

$$p_1 = 12.2, \quad p_2$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | $-$ | |
| $D$ | | $\nearrow$ | | $\searrow$ | |

$$D(12.2) = \frac{1500 \cdot 12.2 - 3000}{12.2^2 + 100} - 14$$

$$D'(p) = 0$$

$$\frac{-1500p^2 + 6000p + 150\,000}{(p^2 + 100)^2} = 0$$

$$-1500p^2 + 6000p + 150\,000 = 0 \,/ : (-1500)$$

$$p^2 - 4p - 100 = 0$$

$$p_{1,2} = \frac{4 \pm \sqrt{16 + 400}}{2}$$

$$p_1 = 12.2, \quad p_2$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | $-$ | |
| $D$ | | $\nearrow$ | | $\searrow$ | |

$$D(12.2) = \frac{1500 \cdot 12.2 - 3000}{12.2^2 + 100} - 14 = 47.49$$

$$D'(p) = 0$$

$$\frac{-1500p^2 + 6000p + 150\,000}{(p^2 + 100)^2} = 0$$

$$-1500p^2 + 6000p + 150\,000 = 0 \,/ : (-1500)$$

$$p^2 - 4p - 100 = 0$$

$$p_{1,2} = \frac{4 \pm \sqrt{16 + 400}}{2}$$

$$p_1 = 12.2, \quad p_2$$

$$D(p) = \frac{1500p - 3000}{p^2 + 100} - 14$$

| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | $-$ | |
| $D$ | | $\nearrow$ | | $\searrow$ | |

$$D(12.2) = \frac{1500 \cdot 12.2 - 3000}{12.2^2 + 100} - 14 = 47.49$$

Maksimalni profit jednak je 47.49 novčanih jedinica i ostvaruje se po cijeni od 12.2 novčanih jedinica.

# Kada je profit pozitivan?

- Odredimo nultočke funkcije profita $D(p)$

$$D(p) = 0$$

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$$1500p - 3000 - 14 \cdot (p^2 + 100) = 0$$

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- Odredimo nultočke funkcije profita $D(p)$

$$D(p) = 0$$

$$\frac{1500p - 3000}{p^2 + 100} - 14 = 0 \,/ \cdot (p^2 + 100)$$

$$1500p - 3000 - 14 \cdot (p^2 + 100) = 0$$

$$-14p^2 + 1500p - 4400 = 0$$

# Kada je profit pozitivan?

- Odredimo nultočke funkcije profita $D(p)$

$$D(p) = 0$$

$$\frac{1500p - 3000}{p^2 + 100} - 14 = 0 \,/ \cdot (p^2 + 100)$$

$$1500p - 3000 - 14 \cdot (p^2 + 100) = 0$$

$$-14p^2 + 1500p - 4400 = 0 \,/ : 2$$

$$-7p^2 + 750p - 2200 = 0$$

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$$p_{1,2} = \frac{-750 \pm \sqrt{750^2 - 4 \cdot (-7) \cdot (-2200)}}{-14}$$

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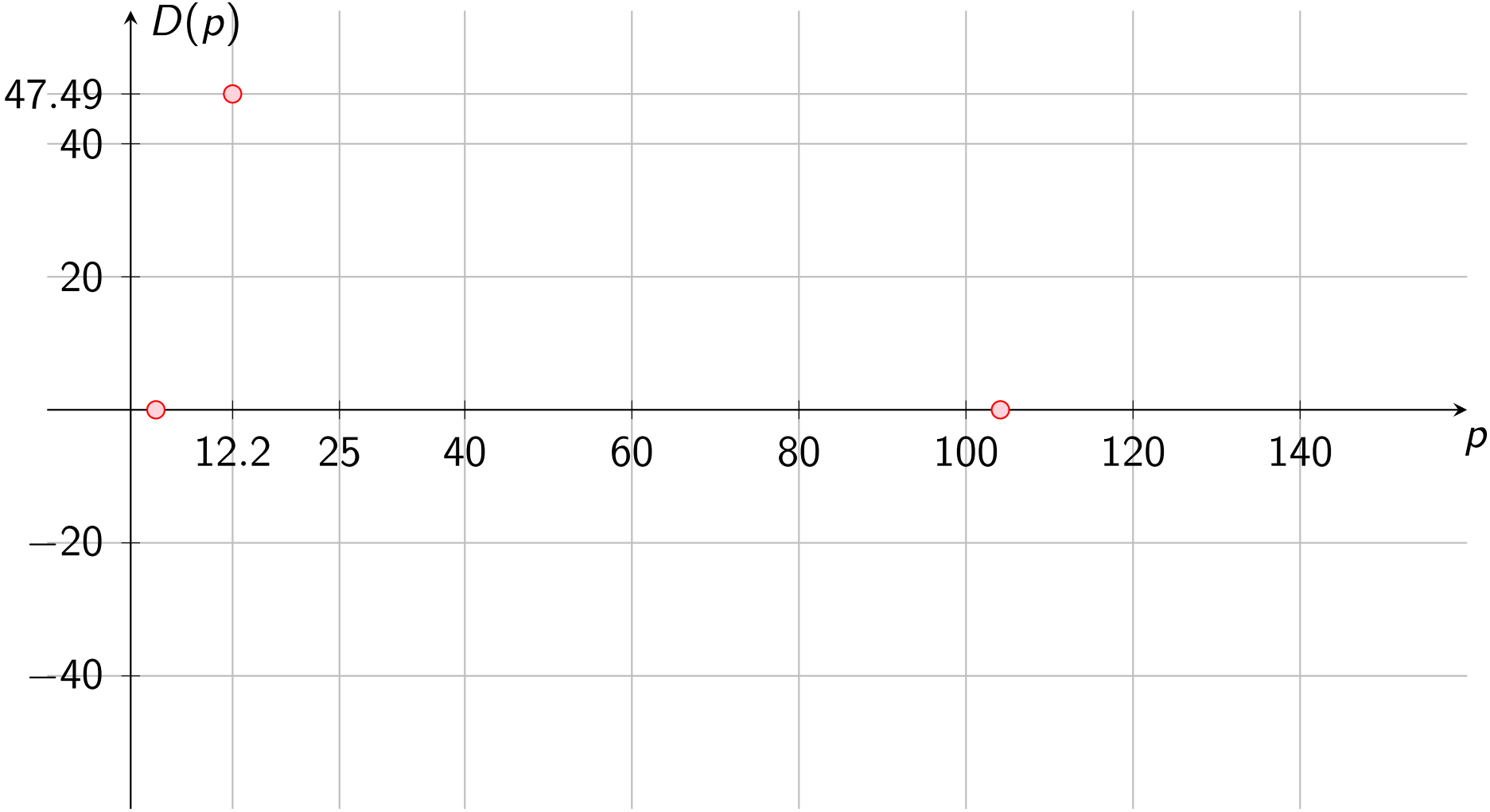
$$-14p^2 + 1500p - 4400 = 0 \,/ : 2$$

$$-7p^2 + 750p - 2200 = 0$$

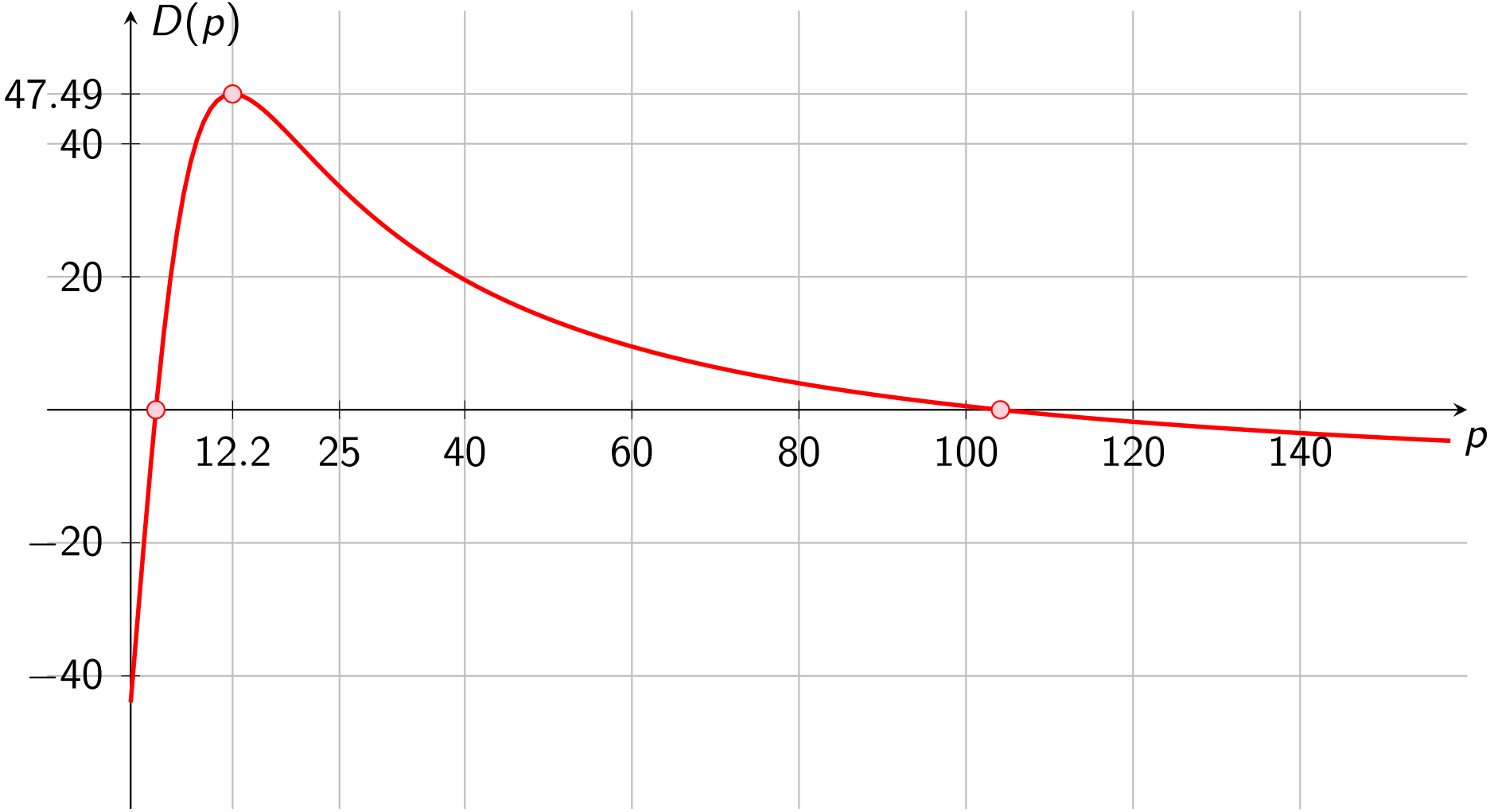
$$p_{1,2} = \frac{-750 \pm \sqrt{750^2 - 4 \cdot (-7) \cdot (-2200)}}{-14}$$

$$p_1 = 3.02, \quad p_2 = 104.12$$



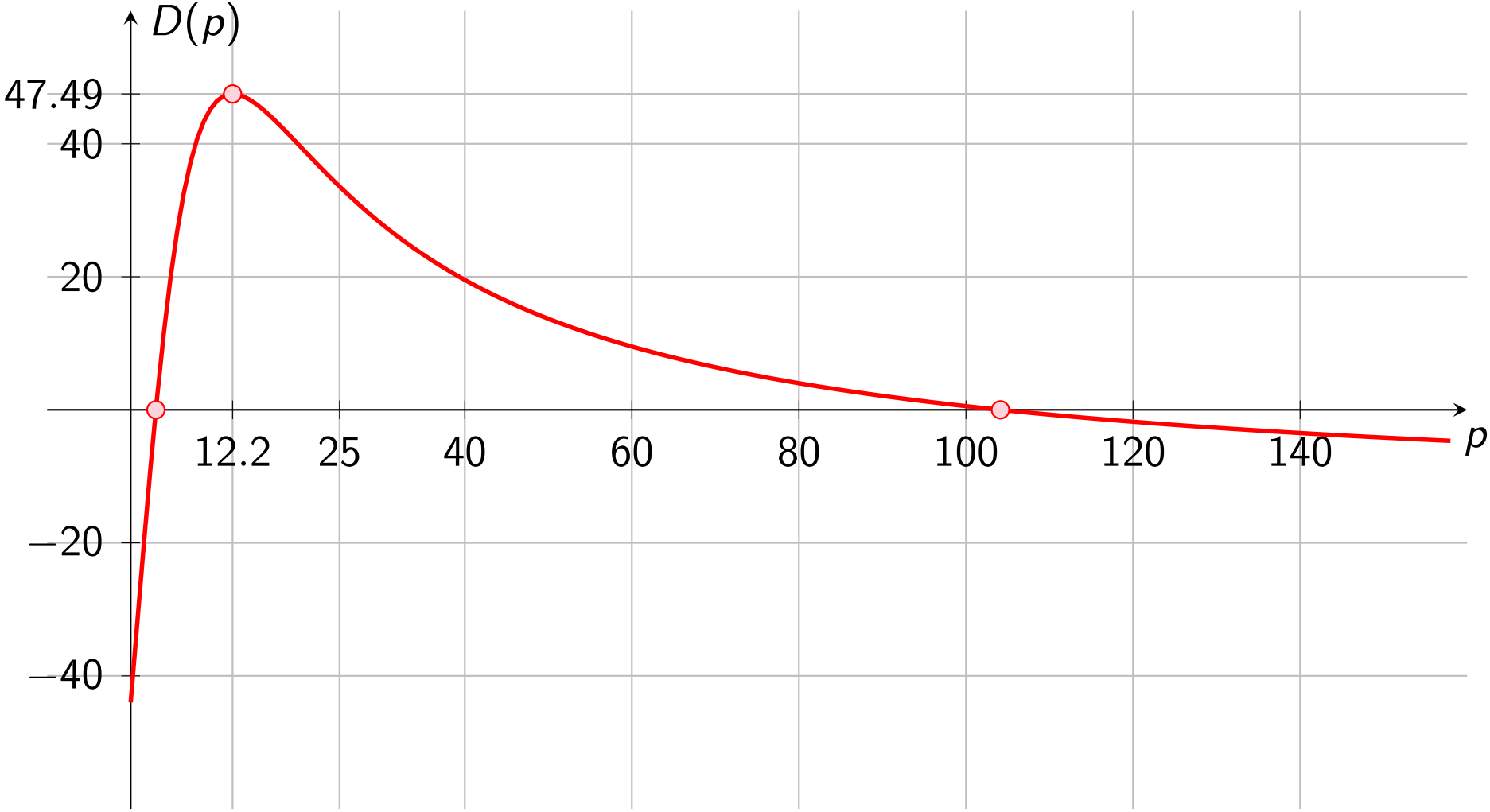

| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | $-$ | |
| $D$ | | ↗ | | ↘ | |

nultočke: 3.02, 104.12




| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | $-$ | |
| $D$ | | ↗ | | ↘ | |

nultočke: 3.02, 104.12




| | 0 | | 12.2 | | $+\infty$ |
|---|---|---|---|---|---|
| $D'$ | | $+$ | | $-$ | |
| $D$ | | $\nearrow$ | | $\searrow$ | |

nultočke: 3.02, 104.12

Profit je pozitivan za $p \in \langle 3.02, 104.12 \rangle$.

# četvrti zadatak

## Zadatak 4

*Analizom tržišta zapaženo je da potrošači dnevno kupuju sljedeće količine jakni uz navedene cijene u kunama.*

| *cijena* | *200* | *150* | *120* | *100* |
|---|---|---|---|---|
| *količina* | *15* | *22* | *25* | *30* |

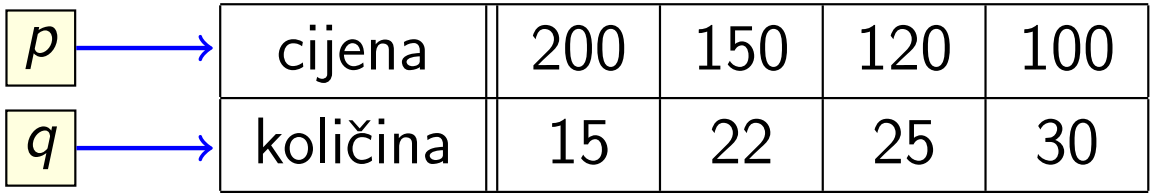
*Odredite linearnu funkciju potražnje koja najbolje aproksimira zadanu funkciju tablicom i nacrtajte na slici tablične podatke i dobivenu funkciju.*

*Koristeći se dobivenim linearnim modelom procijenite:*

a) *Koliko se maksimalno jakni traži dnevno? Koliko se jakni traži po cijeni od 110 kn? Po kojoj cijeni se traži 35 jakni dnevno?*

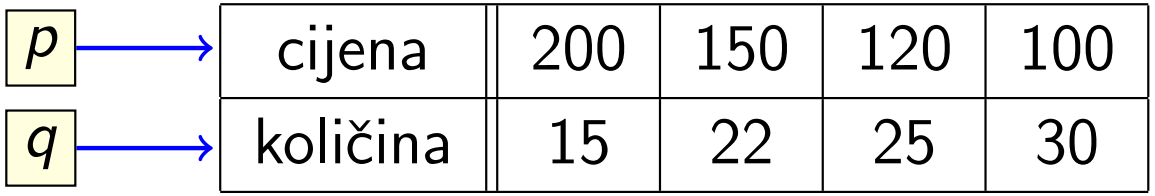
b) *Za koliko se treba smanjiti cijena jakne da bi se prodale dvije jakne više dnevno ako se jakne prodaju po cijeni od 110 kn.*

c) *Za koliko posto se smanji potražnja za jaknama ako se cijena na razini 110 kn poveća za 1 %? Što se u tom slučaju dogodi s ukupnim prihodom?*




## Rješenje

- Linearna funkcija potražnje: $q = ap + b$




| cijena | 200 | 150 | 120 | 100 |
|---|---|---|---|---|
| količina | 15 | 22 | 25 | 30 |

## Rješenje

- Linearna funkcija potražnje: $q = ap + b$
- Na početku promatramo sustav linearnih jednadžbi $AX = B$.

| | | | | | |
|---|---|---|---|---|---|
| $p$ → | cijena | 200 | 150 | 120 | 100 |
| $q$ → | količina | 15 | 22 | 25 | 30 |

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$$A = \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix}$$

| | | | | | |
|---|---|---|---|---|---|
| $p$ → | cijena | 200 | 150 | 120 | 100 |
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| | | | | | |
|---|---|---|---|---|---|
| $p$ → | cijena | 200 | 150 | 120 | 100 |
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| | | | | | |
|---|---|---|---|---|---|
| $p$ → | cijena | 200 | 150 | 120 | 100 |
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- Sustav $AX = B$ je preodređen i općenito nema rješenja.

| | | | | | |
|---|---|---|---|---|---|
| $p$ → | cijena | 200 | 150 | 120 | 100 |
| $q$ → | količina | 15 | 22 | 25 | 30 |

## Rješenje

- Linearna funkcija potražnje: $q = ap + b$
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$$A = \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix} \qquad X = \begin{bmatrix} a \\ b \end{bmatrix} \qquad B = \begin{bmatrix} 15 \\ 22 \\ 25 \\ 30 \end{bmatrix}$$

- Sustav $AX = B$ je preodređen i općenito nema rješenja.
- Umjesto sustava $AX = B$ rješavamo sustav normalnih jednadžbi

$$A^T AX = A^T B.$$

$$A^T AX = A^T B$$

$A^T A =$

$$A^T AX = A^T B$$

$$A^T A = \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix}$$

$$A^T A X = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix}$$

$$A^T AX = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix}$$

$(2, 4)$

$$A^T AX = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix}$$

$(2,4)\ \ (4,2)$

$$A^T A X = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix} = \begin{bmatrix} & \end{bmatrix}$$

$$(2, 4) \quad (4, 2)$$

$$=$$

$$A^T A X = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix} = \begin{bmatrix} 86\,900 & \\ & \end{bmatrix}$$

$(2, 4) \quad (4, 2)$

$=$

$$A^T AX = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix} = \begin{bmatrix} 86\,900 & 570 \\ & \end{bmatrix}$$

$(2, 4) \quad (4, 2)$

$=$

$$A^T AX = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix} = \begin{bmatrix} 86\,900 & 570 \\ 570 & \end{bmatrix}$$

$$(2, 4) \quad (4, 2)$$

$$=$$

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$$(2, 4) \quad (4, 2)$$

$$=$$

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$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix} = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix}$$

$(2,4)\ (4,2)$

$=$

$$A^T B =$$

$$A^T AX = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix} = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix}$$

$(2,4)\ (4,2)$

$=$

$$A^T B = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

$$A^T AX = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix} = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix}$$

$$(2,4) \quad (4,2)$$

$$=$$

$$A^T B = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 15 \\ 22 \\ 25 \\ 30 \end{bmatrix}$$

$$A^T AX = A^T B$$

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$(2, 4)\ (4, 2)$

$=$

$$A^T B = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 15 \\ 22 \\ 25 \\ 30 \end{bmatrix}$$

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$(2, 4)\ \ (4, 2)$

$=$

$$A^T B = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 15 \\ 22 \\ 25 \\ 30 \end{bmatrix}$$

$(2, 4)\ \ (4, 1)$

$$A^T AX = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix} = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix}$$

$$(2, \boxed{4)\ (4}, 2)$$

$$=$$

$$A^T B = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 15 \\ 22 \\ 25 \\ 30 \end{bmatrix} = \begin{bmatrix} \quad \end{bmatrix}$$

$$(2, \boxed{4)\ (4}, 1)$$

$$=$$

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$(2, \boxed{4})\ (\boxed{4}, 2)$

$=$

$$A^T B = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 15 \\ 22 \\ 25 \\ 30 \end{bmatrix} = \begin{bmatrix} 12\,300 \\ \end{bmatrix}$$

$(2, \boxed{4})\ (\boxed{4}, 1)$

$=$

$$A^T AX = A^T B$$

$$A^T A = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 200 & 1 \\ 150 & 1 \\ 120 & 1 \\ 100 & 1 \end{bmatrix} = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix}$$

$$(2, \boxed{4}) \quad (\boxed{4}, 2)$$

$$=$$

$$A^T B = \begin{bmatrix} 200 & 150 & 120 & 100 \\ 1 & 1 & 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} 15 \\ 22 \\ 25 \\ 30 \end{bmatrix} = \begin{bmatrix} 12\,300 \\ 92 \end{bmatrix}$$

$$(2, \boxed{4}) \quad (\boxed{4}, 1)$$

$$=$$

$$A^T A = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix} \qquad A^T B = \begin{bmatrix} 12\,300 \\ 92 \end{bmatrix}$$

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$$\left(A^T A\right)^{-1} \cdot \Big/ A^T AX = A^T B$$

$$A^T A = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix} \qquad A^T B = \begin{bmatrix} 12\,300 \\ 92 \end{bmatrix}$$

$$\boxed{A^T A X = A^T B}$$

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$$X =$$

$$A^T A = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix} \qquad A^T B = \begin{bmatrix} 12\,300 \\ 92 \end{bmatrix}$$

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$$\det\left(A^T A\right) =$$

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$$A^T A = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix} \qquad A^T B = \begin{bmatrix} 12\,300 \\ 92 \end{bmatrix}$$

$$\det\left(A^T A\right) = 86\,900 \cdot 4 - 570 \cdot 570$$

$$A^T AX = A^T B$$

$$\left(A^T A\right)^{-1} \cdot \Big/ A^T AX = A^T B$$

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$$A^T A = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix} \qquad A^T B = \begin{bmatrix} 12\,300 \\ 92 \end{bmatrix}$$

$$\det\left(A^T A\right) = 86\,900 \cdot 4 - 570 \cdot 570 = 22\,700$$

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$$\left(A^T A\right)^{-1} = \frac{1}{22\,700} \begin{bmatrix} & \\ & \end{bmatrix}$$

$$A^T A X = A^T B$$

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$$\left(A^T A\right)^{-1} = \frac{1}{22\,700} \begin{bmatrix} 4 & \\ & 86\,900 \end{bmatrix}$$

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$$X = \left(A^T A\right)^{-1} \cdot \left(A^T B\right)$$

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$$A^T AX = A^T B$$

$$\left(A^T A\right)^{-1} \cdot \Big/ A^T AX = A^T B$$

$$X = \left(A^T A\right)^{-1} \cdot \left(A^T B\right)$$

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$$A^T A X = A^T B$$

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$$(2, 2)$$

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$$(2,2) \quad (2,1)$$

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$$=$$

(2, 2) (2, 1)

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$$X = \frac{1}{22\,700} \begin{bmatrix} -3240 \\ \end{bmatrix}$$

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$$X = \frac{1}{22\,700} \begin{bmatrix} -3240 \\ 983\,800 \end{bmatrix} = \begin{bmatrix} -\frac{162}{1135} \\ \frac{9838}{227} \end{bmatrix}$$

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$$X = \left(A^T A\right)^{-1} \cdot \left(A^T B\right)$$

$$q = ap + b$$

$$A^TA = \begin{bmatrix} 86\,900 & 570 \\ 570 & 4 \end{bmatrix} \qquad A^TB = \begin{bmatrix} 12\,300 \\ 92 \end{bmatrix}$$

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$$\boxed{q = -\frac{162}{1135}p + \frac{9838}{227}}$$

$$a \approx -0.1427$$

$$b \approx 43.3392$$

$$q = -\frac{162}{1135}p + \frac{9838}{227}$$

a) Dnevno se maksimalno traži

$$q = -\frac{162}{1135}p + \frac{9838}{227}$$

a) Dnevno se maksimalno traži oko 43 jakne (kada je $p = 0$).

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$$q(110) = -\frac{162}{1135} \cdot 110 + \frac{9838}{227}$$

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a) Dnevno se maksimalno traži oko 43 jakne (kada je $p = 0$).

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Po cijeni od 110 kn traži se 27.64 jakni, dakle oko 28 jakni.

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$$-\frac{162}{1135}p + \frac{9838}{227} = 35$$

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$$-\frac{162}{1135}p + \frac{9838}{227} = 35 \Big/ \cdot 1135$$

$$-162p + 49\,190 = 39\,725$$

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a) Dnevno se maksimalno traži oko 43 jakne (kada je $p = 0$).

$$q(110) = -\frac{162}{1135} \cdot 110 + \frac{9838}{227} = \frac{6274}{227} \approx 27.64$$

Po cijeni od 110 kn traži se 27.64 jakni, dakle oko 28 jakni.

$$-\frac{162}{1135}p + \frac{9838}{227} = 35 \Big/ \cdot 1135$$

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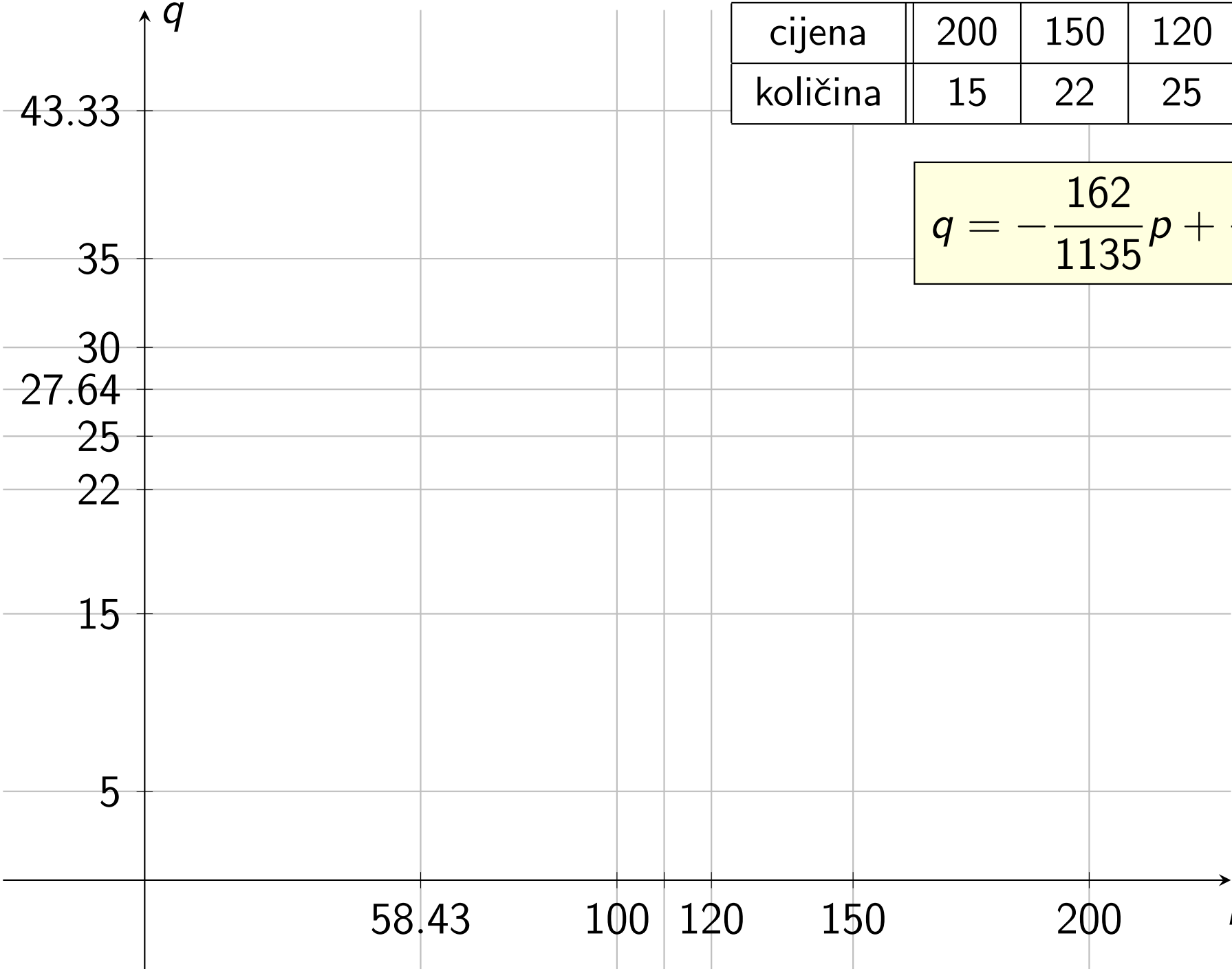
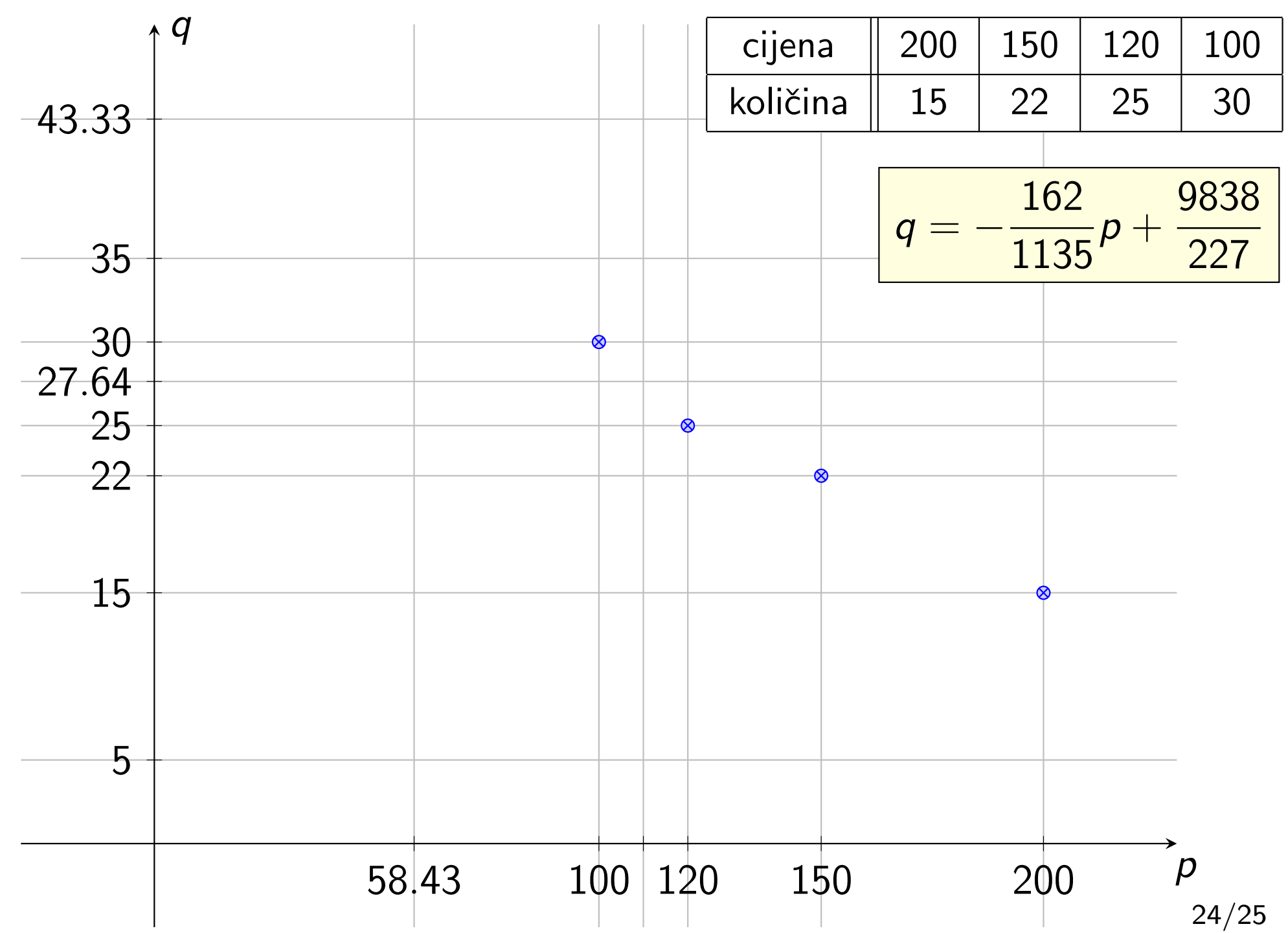
Po cijeni od 58 kuna i 43 lipe dnevno se traži 35 jakni.

| cijena | 200 | 150 | 120 | 100 |
|---|---|---|---|---|
| količina | 15 | 22 | 25 | 30 |

$$q = -\frac{162}{1135}p + \frac{9838}{227}$$



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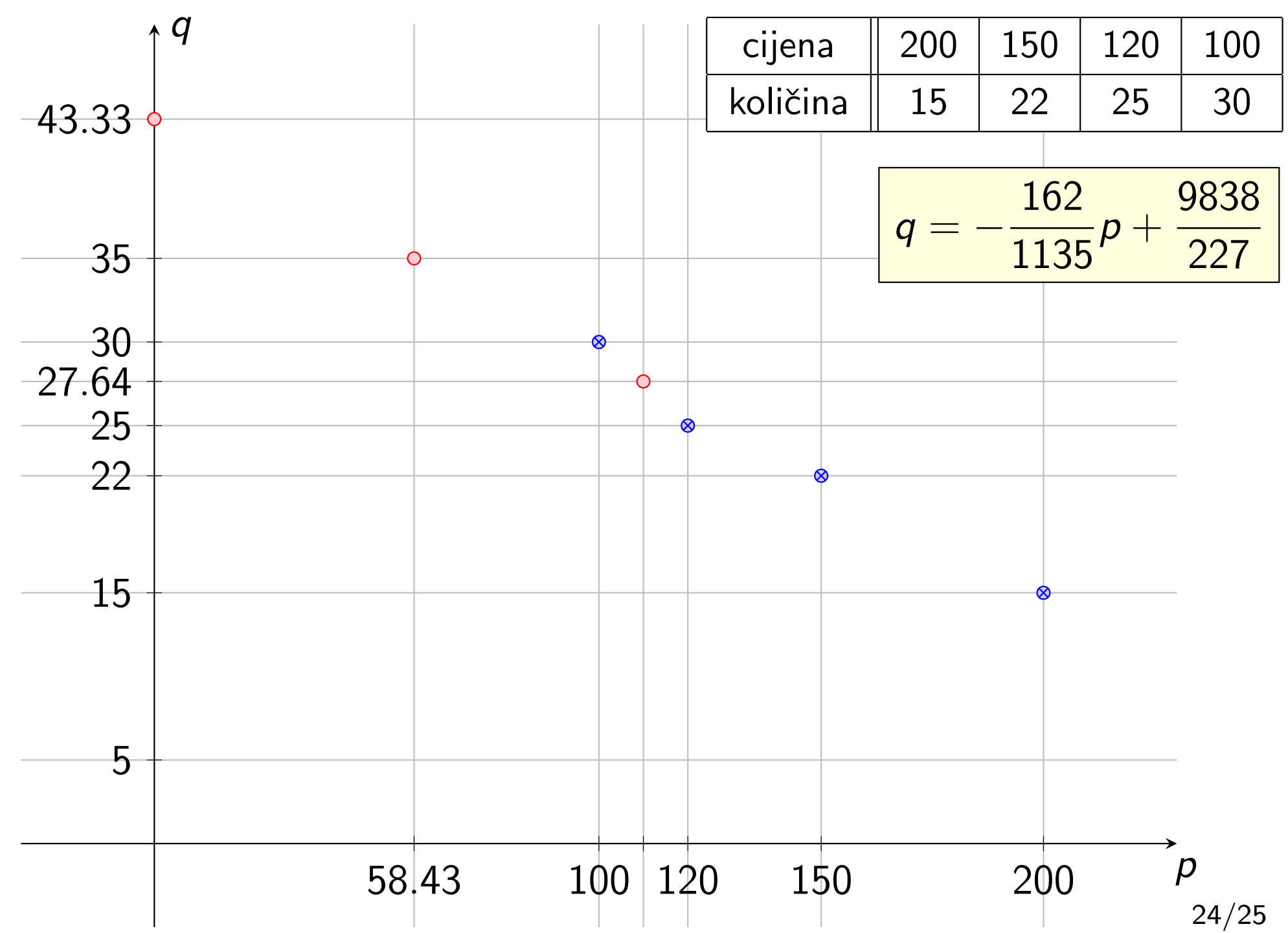


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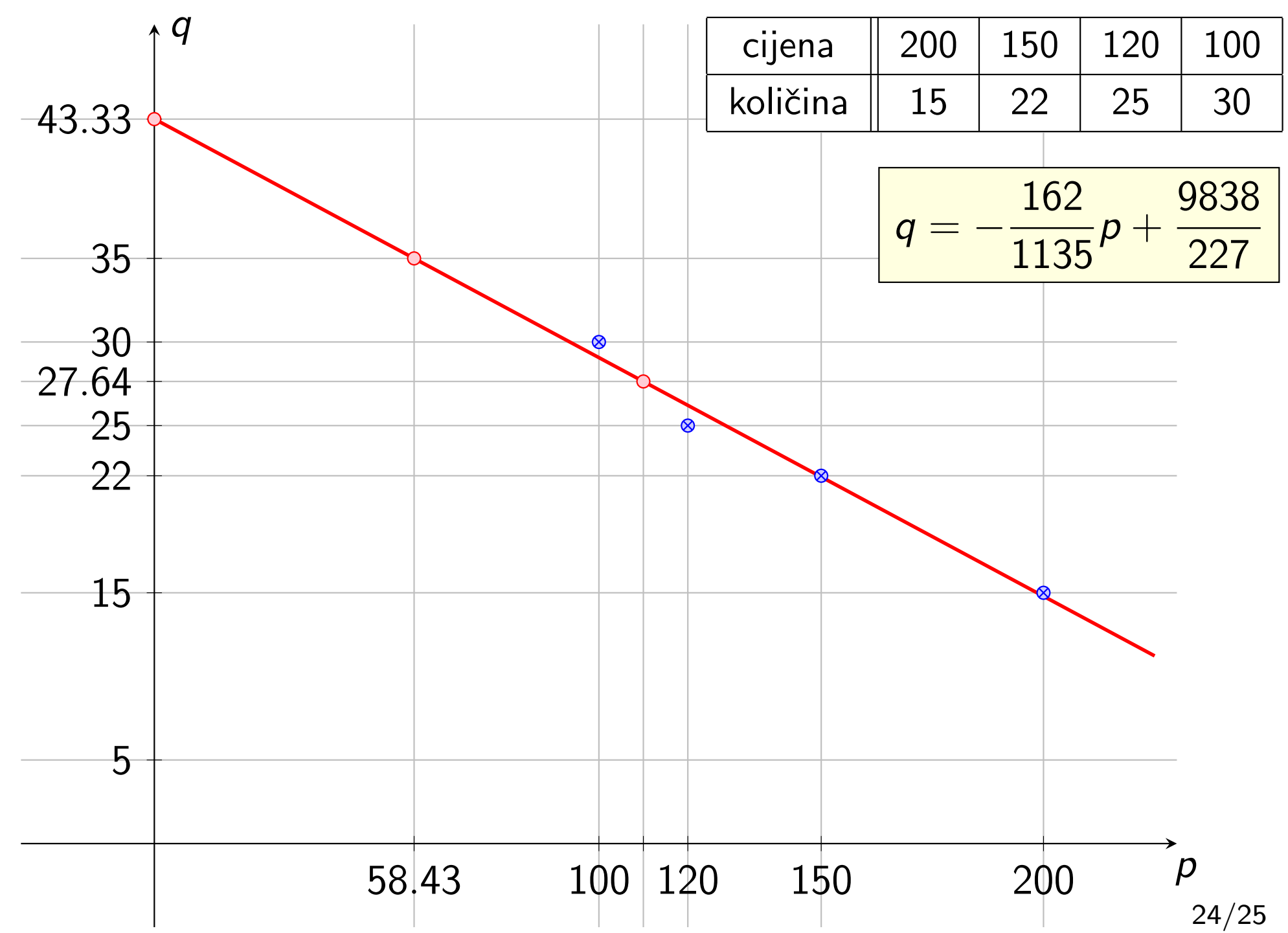


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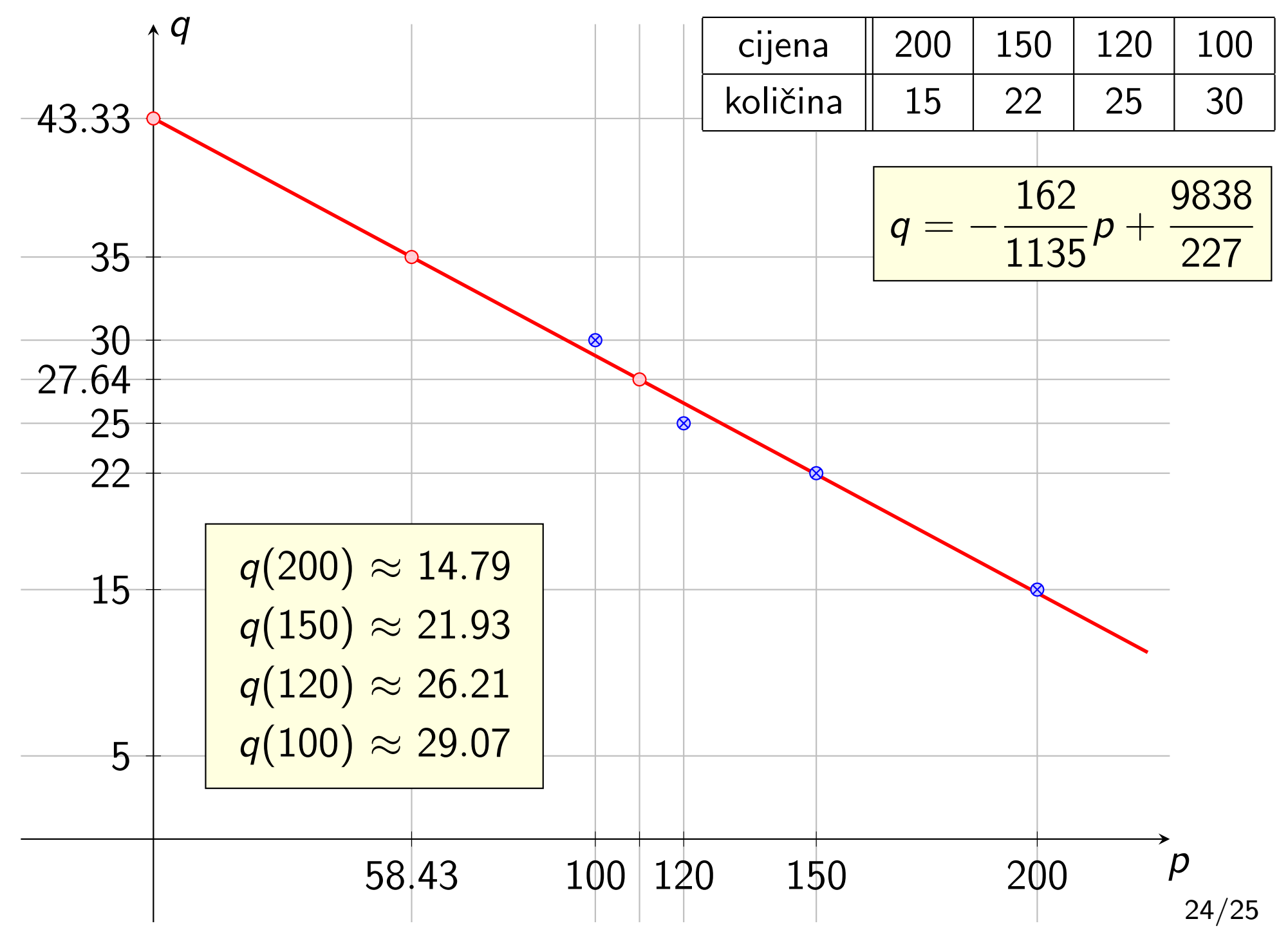


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$$q = -\frac{162}{1135}p + \frac{9838}{227}$$

$q(200) \approx 14.79$
$q(150) \approx 21.93$
$q(120) \approx 26.21$
$q(100) \approx 29.07$

b)

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- Da bi se prodale dvije jakne više dnevno, cijenu jakne treba smanjiti za 14 kuna i jednu lipu. (ne ovisi o trenutnoj cijeni jakne)

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$$E_{q,p}(110) \approx -0.57$$

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- Ako se cijena jakne na razini $p = 110$ poveća za 1%, potražnja za jaknama se smanji za 0.57%.

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- Ako se cijena jakne na razini $p = 110$ poveća za 1%, potražnja za jaknama se smanji za 0.57%.
- Kako je $|E_{q,p}(110)| < 1$, povećanjem cijene za 1% na razini $p = 110$, ukupni prihod će se povećati.