Seminari 12

Matematičke metode za informatičare

Damir Horvat

FOI, Varaždin

Sadržaj

prvi zadatak

Eliminacija cjelobrojnih i racionalnih kandidata

Teorem

Ako je $f(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$ polinom s cjelobrojnim koeficijentima i α njegova cjelobrojna nultočka, tada je za svaki $k \in \mathbb{Z}$ broj $f(k)$ djeljiv s $\alpha - k$.

Teorem

Ako je $M(p, q) = 1$ i $\alpha = \frac{p}{q}$ racionalna nultočka polinoma $f(x)$ s cjelobrojnim koeficijentima, tada je za svaki cijeli broj k broj $f(k)$ djeljiv s $p - kq$.

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

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Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

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$$\Big(\qquad\qquad \Big)^2$$

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Rješenje

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$$\left(x^2 \qquad\qquad\qquad\right)^2$$

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$$\left(x^2 - \frac{1}{2}x \qquad \right)^2$$

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$$\boxed{b^2 - 4ac = 0}$$

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$$(-y + 13)^2 - \left(8y - 35\right)$$

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$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)^2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y+13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y+13)^2 - (8y - 35)\left(y^2 - 24\right)$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24$.

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)^2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}} \qquad \boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y + 13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y + 13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)^2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y+13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y+13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

y^2

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)^2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}} \qquad \boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y + 13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y + 13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

$y^2 - 26y$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24$.

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \frac{1}{2}x + y\right)}^2 - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \frac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y+13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y+13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

$$y^2 - 26y + 169$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)^2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + \underline{y^2} - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y + 13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y + 13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

$$y^2 - 26y + 169 - 8y^3$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24$.

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)^2}_{x^4 + \frac{1}{4}x^2 + y^2 - x^3 + 2x^2y - xy} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y+13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y+13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

$$y^2 - 26y + 169 - 8y^3 + 192y$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \frac{1}{2}x + y\right)^2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \frac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y+13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y+13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

$$y^2 - 26y + 169 - 8y^3 + 192y + 35y^2$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)}^{2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y + 13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y + 13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

$$y^2 - 26y + 169 - 8y^3 + 192y + 35y^2 - 840$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(\tfrac{1}{4} + 2y - 9\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \frac{1}{4}x^2 + y^2 - x^3 + 2x^2y - xy$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

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$$y^2 - 26y + 169 - 8y^3 + 192y + 35y^2 - 840 = 0$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)^2} - \left[\left(\tfrac{1}{4} + 2y - 9\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y + 13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y + 13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

$$y^2 - 26y + 169 - 8y^3 + 192y + 35y^2 - 840 = 0$$

$$-8y^3$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \frac{1}{2}x + y\right)^2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2 y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \frac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y + 13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y + 13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

$$y^2 - 26y + 169 - 8y^3 + 192y + 35y^2 - 840 = 0$$

$$-8y^3 + 36y^2$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)^2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y+13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y+13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

$$y^2 - 26y + 169 - 8y^3 + 192y + 35y^2 - 840 = 0$$

$$-8y^3 + 36y^2 + 166y$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)^2}_{} - \left[\left(\tfrac{1}{4} + 2y - 9\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y + 13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y + 13)^2 - \left(8y - 35\right)\left(y^2 - 24\right) = 0$$

$$y^2 - 26y + 169 - 8y^3 + 192y + 35y^2 - 840 = 0$$

$$-8y^3 + 36y^2 + 166y - 671$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \tfrac{1}{2}x + y\right)}^2 - \left[\left(\tfrac{1}{4} + 2y - 9\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + \underline{y^2} - x^3 + \underline{2x^2y} - \underline{\underline{xy}} \qquad \boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

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$$y^2 - 26y + 169 - 8y^3 + 192y + 35y^2 - 840 = 0$$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \frac{1}{2}x + y\right)^2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + y^2 - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \frac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

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$$y^2 - 26y + 169 - 8y^3 + 192y + 35y^2 - 840 = 0$$

$$\boxed{-8y^3 + 36y^2 + 166y - 671 = 0}$$

Zadatak 1

Ferrarijevom metodom riješite jednadžbu $x^4 - x^3 + 9x^2 - 13x = -24.$

Rješenje

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\underbrace{\left(x^2 - \frac{1}{2}x + y\right)^2} - \left[\left(\frac{1}{4} + 2y - 9\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$x^4 + \underline{\frac{1}{4}x^2} + \underline{y^2} - x^3 + \underline{2x^2y} - \underline{\underline{xy}}$$

$$\boxed{b^2 - 4ac = 0}$$

$$\left(x^2 - \frac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

$$(-y + 13)^2 - 4\left(2y - \frac{35}{4}\right)\left(y^2 - 24\right) = 0$$

$$(-y + 13)^2 - (8y - 35)\left(y^2 - 24\right) = 0$$

Ferrarijeva rezolventa

$$y^2 - 26y + 169 - 8y^3 + 192y + 35y^2 - 840 = 0$$

$$\boxed{-8y^3 + 36y^2 + 166y - 671 = 0}$$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$-8y^3+36y^2+166y-671=0$$

$\frac{p}{q}$:

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$\frac{p}{q}$:

p :

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$\frac{p}{q}$:

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$p : 1, -1,$

$\frac{p}{q}$:

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$p : 1, -1, 11, -11,$

$$671 = 11 \cdot 61$$

$\dfrac{p}{q}$:

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$p : 1, -1, 11, -11, 61, -61,$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q} :$$

$$p : 1, -1, 11, -11, 61, -61, 671, -671$$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q} :$$

$q:$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$\frac{p}{q}:$

$q: 1,$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$\frac{p}{q}:$

$q : 1, 2,$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q} :$$

$q : 1, 2, 4,$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q} :$$

$q : 1, 2, 4, 8$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$\frac{p}{q}$:

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q}: \quad \frac{1}{1},$$

$q : 1, 2, 4, 8$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q} : \quad \frac{1}{1}, \quad \frac{1}{2},$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4},$$

$q : 1, 2, 4, 8$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q} : \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8},$$

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$$-8y^3 + 36y^2 + 166y - 671 = 0$$

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$$\frac{p}{q} : \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1},$$

$$q : 1, 2, 4, 8$$
$$p : 1, -1, 11, -11, 61, -61, 671, -671$$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

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$$\frac{p}{q} : \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2},$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4},$$

$q : 1, 2, 4, 8$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q} : \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8},$$

$q : 1, 2, 4, 8$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

$$671 = 11 \cdot 61$$

$$\frac{p}{q} : \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1},$$

$q : 1, 2, 4, 8$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

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$$\frac{p}{q}: \quad \frac{11}{8},$$

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$p : 1, -1, 11, -11, 61, -61, 671, -671$

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$$\frac{p}{q} : \quad \frac{11}{8}, \quad \frac{-11}{1},$$

$q : 1, 2, 4, 8$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

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$$\frac{p}{q} : \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2},$$

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$$\frac{p}{q} : \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8},$$

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$$\frac{p}{q} : \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1},$$

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$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2},$$

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$$\frac{p}{q} : \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4},$$

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$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8},$$

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$$\frac{p}{q} : \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

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$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2},$$

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$$\frac{p}{q} : \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$\frac{p}{q} : \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1},$$

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$$\frac{p}{q} : \ \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$

$$\frac{p}{q} : \ \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4},$$

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$$\frac{p}{q} : \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q} : \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8},$$

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$$\frac{p}{q} : \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q} : \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

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$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

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$$\frac{p}{q} : \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

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$$\frac{p}{q} : \frac{-671}{2},$$

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$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4},$$

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$$\frac{p}{q} : \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q} : \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q} : \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$$q : 1, 2, 4, 8$$
$$p : 1, -1, 11, -11, 61, -61, 671, -671$$

$$-8y^3 + 36y^2 + 166y - 671 = 0$$

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$$p - kq \xrightarrow{k=-1} p + q$$

$$\frac{p}{q} : \frac{1}{1}, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{-1}{1}, \frac{-1}{2}, \frac{-1}{4}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$

$$\frac{p}{q} : \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$\frac{p}{q} : \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$\frac{p}{q} : \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) =$$

$$\frac{p}{q}: \ \frac{1}{1}, \ \frac{1}{2}, \ \frac{1}{4}, \ \frac{1}{8}, \ \frac{-1}{1}, \ \frac{-1}{2}, \ \frac{-1}{4}, \ \frac{-1}{8}, \ \frac{11}{1}, \ \frac{11}{2}, \ \frac{11}{4},$$

$$\frac{p}{q}: \ \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$

$$\frac{p}{q}: \ \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4}, \ \frac{671}{8}, \ \frac{-671}{1},$$

$$\frac{p}{q}: \ \frac{-671}{2}, \ \frac{-671}{4}, \ \frac{-671}{8}$$

$q: 1, 2, 4, 8$
$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \ \frac{1}{1}, \ \frac{1}{2}, \ \frac{1}{4}, \ \frac{1}{8}, \ \frac{-1}{1}, \ \frac{-1}{2}, \ \frac{-1}{4}, \ \frac{-1}{8}, \ \frac{11}{1}, \ \frac{11}{2}, \ \frac{11}{4},$$

$$\frac{p}{q}: \ \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$

$$\frac{p}{q}: \ \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4}, \ \frac{671}{8}, \ \frac{-671}{1},$$

$$\frac{p}{q}: \ \frac{-671}{2}, \ \frac{-671}{4}, \ \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

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$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$p + q:$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p + q: \quad 2,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$$q: 1, 2, 4, 8$$
$$p: 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p + q: \quad 2, \quad 3,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p + q: \quad 2, \quad 3, \quad 5,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$$q: 1, 2, 4, 8$$
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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$
$$p + q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

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$$\frac{p}{q}: \quad \frac{1}{1}, \ \frac{1}{2}, \ \frac{1}{4}, \ \frac{1}{8}, \ \frac{-1}{1}, \ \frac{-1}{2}, \ \frac{-1}{4}, \ \frac{-1}{8}, \ \frac{11}{1}, \ \frac{11}{2}, \ \frac{11}{4},$$

$$p + q: \quad 2, \ 3, \ 5, \ 9, \ 0, \ 1, \ 3, \ 7, \ 12,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4}, \ \frac{671}{8}, \ \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \ \frac{-671}{4}, \ \frac{-671}{8}$$

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$$\frac{p}{q}: \quad \frac{1}{1}, \ \frac{1}{2}, \ \frac{1}{4}, \ \frac{1}{8}, \ \frac{-1}{1}, \ \frac{-1}{2}, \ \frac{-1}{4}, \ \frac{-1}{8}, \ \frac{11}{1}, \ \frac{11}{2}, \ \frac{11}{4},$$
$$p+q: \quad 2, \ 3, \ 5, \ 9, \ 0, \ 1, \ 3, \ 7, \ 12, \ 13,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4}, \ \frac{671}{8}, \ \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \ \frac{-671}{4}, \ \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$p+q:$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$p+q: \quad 19,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$$\boxed{\begin{array}{l} q: 1, 2, 4, 8 \\ p: 1, -1, 11, -11, 61, -61, 671, -671 \end{array}}$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$p+q: \quad 19, \quad -10,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

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$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$p+q: \quad 19, \quad -10, \quad -9,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$$q : 1, 2, 4, 8$$
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$$\frac{p}{q} : \frac{1}{1}, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{-1}{1}, \frac{-1}{2}, \frac{-1}{4}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$
$$p + q : 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q} : \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$
$$p + q : 19, -10, -9, -7,$$

$$\frac{p}{q} : \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$\frac{p}{q} : \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\begin{array}{lccccccccccc} \dfrac{p}{q}: & \dfrac{1}{1}, & \dfrac{1}{2}, & \dfrac{1}{4}, & \dfrac{1}{8}, & \dfrac{-1}{1}, & \dfrac{-1}{2}, & \dfrac{-1}{4}, & \dfrac{-1}{8}, & \dfrac{11}{1}, & \dfrac{11}{2}, & \dfrac{11}{4}, \\ p+q: & 2, & 3, & 5, & 9, & 0, & 1, & 3, & 7, & 12, & 13, & 15, \end{array}$$

$$\begin{array}{lcccccccccc} \dfrac{p}{q}: & \dfrac{11}{8}, & \dfrac{-11}{1}, & \dfrac{-11}{2}, & \dfrac{-11}{4}, & \dfrac{-11}{8}, & \dfrac{61}{1}, & \dfrac{61}{2}, & \dfrac{61}{4}, & \dfrac{61}{8}, & \dfrac{-61}{1}, \\ p+q: & 19, & -10, & -9, & -7, & -3, & & & & & \end{array}$$

$$\dfrac{p}{q}: \quad \dfrac{-61}{2}, \quad \dfrac{-61}{4}, \quad \dfrac{-61}{8}, \quad \dfrac{671}{1}, \quad \dfrac{671}{2}, \quad \dfrac{671}{4}, \quad \dfrac{671}{8}, \quad \dfrac{-671}{1},$$

$$\dfrac{p}{q}: \quad \dfrac{-671}{2}, \quad \dfrac{-671}{4}, \quad \dfrac{-671}{8}$$

$$q: 1, 2, 4, 8$$
$$p: 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$
$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$
$$p+q: \quad 19, \quad -10, \quad -9, \quad -7, \quad -3, \quad 62,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p + q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$p + q: \quad 19, \quad -10, \quad -9, \quad -7, \quad -3, \quad 62, \quad 63,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$$q: 1, 2, 4, 8$$
$$p: 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$
$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$
$$p+q: \quad 19, \quad -10, \quad -9, \quad -7, \quad -3, \quad 62, \quad 63, \quad 65,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q : 1, 2, 4, 8$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q$$

$$f(-1) = -793$$

$$\frac{p}{q} : \frac{1}{1}, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{-1}{1}, \frac{-1}{2}, \frac{-1}{4}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$

$$p + q : 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q} : \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$p + q : 19, -10, -9, -7, -3, 62, 63, 65, 69,$$

$$\frac{p}{q} : \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$\frac{p}{q} : \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$$q: 1, 2, 4, 8$$
$$p: 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{-1}{1}, \frac{-1}{2}, \frac{-1}{4}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$
$$p+q: \quad 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$
$$p+q: \quad 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$q : 1, 2, 4, 8$

$p : 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$

$$\frac{p}{q} : \frac{1}{1}, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{-1}{1}, \frac{-1}{2}, \frac{-1}{4}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$

$$p + q : 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q} : \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$p + q : 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q} : \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$p + q :$$

$$\frac{p}{q} : \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$$q : 1, 2, 4, 8$$
$$p : 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q} : \quad \frac{1}{1}, \ \frac{1}{2}, \ \frac{1}{4}, \ \frac{1}{8}, \ \frac{-1}{1}, \ \frac{-1}{2}, \ \frac{-1}{4}, \ \frac{-1}{8}, \ \frac{11}{1}, \ \frac{11}{2}, \ \frac{11}{4},$$
$$p + q : \quad 2, \ 3, \ 5, \ 9, \ 0, \ 1, \ 3, \ 7, \ 12, \ 13, \ 15,$$

$$\frac{p}{q} : \quad \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$
$$p + q : \quad 19, \ -10, \ -9, \ -7, \ -3, \ 62, \ 63, \ 65, \ 69, \ -60,$$

$$\frac{p}{q} : \quad \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4}, \ \frac{671}{8}, \ \frac{-671}{1},$$
$$p + q : \quad -59,$$

$$\frac{p}{q} : \quad \frac{-671}{2}, \ \frac{-671}{4}, \ \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$p+q: \quad 19, \quad -10, \quad -9, \quad -7, \quad -3, \quad 62, \quad 63, \quad 65, \quad 69, \quad -60,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$p+q: \quad -59, \quad -57,$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$p+q: \quad 19, \quad -10, \quad -9, \quad -7, \quad -3, \quad 62, \quad 63, \quad 65, \quad 69, \quad -60,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$p+q: \quad -59, \quad -57, \quad -53,$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$$q: 1, 2, 4, 8$$
$$p: 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \ \frac{1}{1}, \ \frac{1}{2}, \ \frac{1}{4}, \ \frac{1}{8}, \ \frac{-1}{1}, \ \frac{-1}{2}, \ \frac{-1}{4}, \ \frac{-1}{8}, \ \frac{11}{1}, \ \frac{11}{2}, \ \frac{11}{4},$$
$$p+q: \ 2, \ 3, \ 5, \ 9, \ 0, \ 1, \ 3, \ 7, \ 12, \ 13, \ 15,$$

$$\frac{p}{q}: \ \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$
$$p+q: \ 19, \ -10, \ -9, \ -7, \ -3, \ 62, \ 63, \ 65, \ 69, \ -60,$$

$$\frac{p}{q}: \ \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4}, \ \frac{671}{8}, \ \frac{-671}{1},$$
$$p+q: \ -59, \ -57, \ -53, \ 672,$$

$$\frac{p}{q}: \ \frac{-671}{2}, \ \frac{-671}{4}, \ \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$

$$p + q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$

$$p + q: \quad 19, \quad -10, \quad -9, \quad -7, \quad -3, \quad 62, \quad 63, \quad 65, \quad 69, \quad -60,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$

$$p + q: \quad -59, \quad -57, \quad -53, \quad 672, \quad 673,$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\begin{array}{llllllllllll} \frac{p}{q}: & \frac{1}{1}, & \frac{1}{2}, & \frac{1}{4}, & \frac{1}{8}, & \frac{-1}{1}, & \frac{-1}{2}, & \frac{-1}{4}, & \frac{-1}{8}, & \frac{11}{1}, & \frac{11}{2}, & \frac{11}{4}, \\ p+q: & 2, & 3, & 5, & 9, & 0, & 1, & 3, & 7, & 12, & 13, & 15, \end{array}$$

$$\begin{array}{lllllllllll} \frac{p}{q}: & \frac{11}{8}, & \frac{-11}{1}, & \frac{-11}{2}, & \frac{-11}{4}, & \frac{-11}{8}, & \frac{61}{1}, & \frac{61}{2}, & \frac{61}{4}, & \frac{61}{8}, & \frac{-61}{1}, \\ p+q: & 19, & -10, & -9, & -7, & -3, & 62, & 63, & 65, & 69, & -60, \end{array}$$

$$\begin{array}{lllllllll} \frac{p}{q}: & \frac{-61}{2}, & \frac{-61}{4}, & \frac{-61}{8}, & \frac{671}{1}, & \frac{671}{2}, & \frac{671}{4}, & \frac{671}{8}, & \frac{-671}{1}, \\ p+q: & -59, & -57, & -53, & 672, & 673, & 675, & & \end{array}$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \ \frac{1}{2}, \ \frac{1}{4}, \ \frac{1}{8}, \ \frac{-1}{1}, \ \frac{-1}{2}, \ \frac{-1}{4}, \ \frac{-1}{8}, \ \frac{11}{1}, \ \frac{11}{2}, \ \frac{11}{4},$$

$$p + q: \quad 2, \ 3, \ 5, \ 9, \ 0, \ 1, \ 3, \ 7, \ 12, \ 13, \ 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$

$$p + q: \quad 19, \ -10, \ -9, \ -7, \ -3, \ 62, \ 63, \ 65, \ 69, \ -60,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4}, \ \frac{671}{8}, \ \frac{-671}{1},$$

$$p + q: \quad -59, \ -57, \ -53, \ 672, \ 673, \ 675, \ 679,$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \ \frac{-671}{4}, \ \frac{-671}{8}$$

$$q: 1, 2, 4, 8$$
$$p: 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\begin{array}{rccccccccccc}
\frac{p}{q}: & \frac{1}{1}, & \frac{1}{2}, & \frac{1}{4}, & \frac{1}{8}, & \frac{-1}{1}, & \frac{-1}{2}, & \frac{-1}{4}, & \frac{-1}{8}, & \frac{11}{1}, & \frac{11}{2}, & \frac{11}{4}, \\
p+q: & 2, & 3, & 5, & 9, & 0, & 1, & 3, & 7, & 12, & 13, & 15,
\end{array}$$

$$\begin{array}{rcccccccccc}
\frac{p}{q}: & \frac{11}{8}, & \frac{-11}{1}, & \frac{-11}{2}, & \frac{-11}{4}, & \frac{-11}{8}, & \frac{61}{1}, & \frac{61}{2}, & \frac{61}{4}, & \frac{61}{8}, & \frac{-61}{1}, \\
p+q: & 19, & -10, & -9, & -7, & -3, & 62, & 63, & 65, & 69, & -60,
\end{array}$$

$$\begin{array}{rcccccccc}
\frac{p}{q}: & \frac{-61}{2}, & \frac{-61}{4}, & \frac{-61}{8}, & \frac{671}{1}, & \frac{671}{2}, & \frac{671}{4}, & \frac{671}{8}, & \frac{-671}{1}, \\
p+q: & -59, & -57, & -53, & 672, & 673, & 675, & 679, & -670,
\end{array}$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$

$$q: 1, 2, 4, 8$$
$$p: 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \ \frac{1}{2}, \ \frac{1}{4}, \ \frac{1}{8}, \ \frac{-1}{1}, \ \frac{-1}{2}, \ \frac{-1}{4}, \ \frac{-1}{8}, \ \frac{11}{1}, \ \frac{11}{2}, \ \frac{11}{4},$$
$$p+q: \quad 2, \ 3, \ 5, \ 9, \ 0, \ 1, \ 3, \ 7, \ 12, \ 13, \ 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$
$$p+q: \quad 19, \ -10, \ -9, \ -7, \ -3, \ 62, \ 63, \ 65, \ 69, \ -60,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4}, \ \frac{671}{8}, \ \frac{-671}{1},$$
$$p+q: \quad -59, \ -57, \ -53, \ 672, \ 673, \ 675, \ 679, \ -670,$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \ \frac{-671}{4}, \ \frac{-671}{8}$$
$$p+q:$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$

$$\frac{p}{q}: \quad \frac{1}{1}, \ \frac{1}{2}, \ \frac{1}{4}, \ \frac{1}{8}, \ \frac{-1}{1}, \ \frac{-1}{2}, \ \frac{-1}{4}, \ \frac{-1}{8}, \ \frac{11}{1}, \ \frac{11}{2}, \ \frac{11}{4},$$

$$p+q: \quad 2, \ 3, \ 5, \ 9, \ 0, \ 1, \ 3, \ 7, \ 12, \ 13, \ 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$

$$p+q: \quad 19, \ -10, \ -9, \ -7, \ -3, \ 62, \ 63, \ 65, \ 69, \ -60,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4}, \ \frac{671}{8}, \ \frac{-671}{1},$$

$$p+q: \quad -59, \ -57, \ -53, \ 672, \ 673, \ 675, \ 679, \ -670,$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \ \frac{-671}{4}, \ \frac{-671}{8}$$

$$p+q: \quad -669,$$

$$q: 1, 2, 4, 8$$
$$p: 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \quad \frac{1}{2}, \quad \frac{1}{4}, \quad \frac{1}{8}, \quad \frac{-1}{1}, \quad \frac{-1}{2}, \quad \frac{-1}{4}, \quad \frac{-1}{8}, \quad \frac{11}{1}, \quad \frac{11}{2}, \quad \frac{11}{4},$$
$$p+q: \quad 2, \quad 3, \quad 5, \quad 9, \quad 0, \quad 1, \quad 3, \quad 7, \quad 12, \quad 13, \quad 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \quad \frac{-11}{1}, \quad \frac{-11}{2}, \quad \frac{-11}{4}, \quad \frac{-11}{8}, \quad \frac{61}{1}, \quad \frac{61}{2}, \quad \frac{61}{4}, \quad \frac{61}{8}, \quad \frac{-61}{1},$$
$$p+q: \quad 19, \quad -10, \quad -9, \quad -7, \quad -3, \quad 62, \quad 63, \quad 65, \quad 69, \quad -60,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \quad \frac{-61}{4}, \quad \frac{-61}{8}, \quad \frac{671}{1}, \quad \frac{671}{2}, \quad \frac{671}{4}, \quad \frac{671}{8}, \quad \frac{-671}{1},$$
$$p+q: \quad -59, \quad -57, \quad -53, \quad 672, \quad 673, \quad 675, \quad 679, \quad -670,$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \quad \frac{-671}{4}, \quad \frac{-671}{8}$$
$$p+q: \quad -669, \quad -667,$$

$$q: 1, 2, 4, 8$$
$$p: 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \frac{1}{1}, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{-1}{1}, \frac{-1}{2}, \frac{-1}{4}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$
$$p+q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$
$$p+q: 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q}: \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$
$$p+q: -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q}: \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$
$$p+q: -669, -667, -663$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$793 = 13 \cdot 61$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \quad \frac{1}{1}, \ \frac{1}{2}, \ \frac{1}{4}, \ \frac{1}{8}, \ \frac{-1}{1}, \ \frac{-1}{2}, \ \frac{-1}{4}, \ \frac{-1}{8}, \ \frac{11}{1}, \ \frac{11}{2}, \ \frac{11}{4},$$

$$p + q: \quad 2, \ 3, \ 5, \ 9, \ 0, \ 1, \ 3, \ 7, \ 12, \ 13, \ 15,$$

$$\frac{p}{q}: \quad \frac{11}{8}, \ \frac{-11}{1}, \ \frac{-11}{2}, \ \frac{-11}{4}, \ \frac{-11}{8}, \ \frac{61}{1}, \ \frac{61}{2}, \ \frac{61}{4}, \ \frac{61}{8}, \ \frac{-61}{1},$$

$$p + q: \quad 19, \ -10, \ -9, \ -7, \ -3, \ 62, \ 63, \ 65, \ 69, \ -60,$$

$$\frac{p}{q}: \quad \frac{-61}{2}, \ \frac{-61}{4}, \ \frac{-61}{8}, \ \frac{671}{1}, \ \frac{671}{2}, \ \frac{671}{4}, \ \frac{671}{8}, \ \frac{-671}{1},$$

$$p + q: \quad -59, \ -57, \ -53, \ 672, \ 673, \ 675, \ 679, \ -670,$$

$$\frac{p}{q}: \quad \frac{-671}{2}, \ \frac{-671}{4}, \ \frac{-671}{8}$$

$$p + q: \quad -669, \ -667, \ -663$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$793 = 13 \cdot 61$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \cancel{\frac{1}{1}}, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{-1}{1}, \frac{-1}{2}, \frac{-1}{4}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$

$$p+q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$p+q: 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q}: \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$p+q: -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q}: \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$$p+q: -669, -667, -663$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$793 = 13 \cdot 61$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \cancel{\frac{1}{1}}, \cancel{\frac{1}{2}}, \frac{1}{4}, \frac{1}{8}, \frac{-1}{1}, \frac{-1}{2}, \frac{-1}{4}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$

$$p+q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$p+q: 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q}: \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$p+q: -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q}: \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$$p+q: -669, -667, -663$$

$$\boxed{\begin{aligned} &q: 1, 2, 4, 8 \\ &p: 1, -1, 11, -11, 61, -61, 671, -671 \end{aligned}}$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$793 = 13 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\begin{array}{cccccccccccc} \frac{p}{q}: & \cancel{\frac{1}{1}}, & \cancel{\frac{1}{2}}, & \cancel{\frac{1}{4}}, & \frac{1}{8}, & \frac{-1}{1}, & \frac{-1}{2}, & \frac{-1}{4}, & \frac{-1}{8}, & \frac{11}{1}, & \frac{11}{2}, & \frac{11}{4}, \\ p+q: & 2, & 3, & 5, & 9, & 0, & 1, & 3, & 7, & 12, & 13, & 15, \end{array}$$

$$\begin{array}{ccccccccccc} \frac{p}{q}: & \frac{11}{8}, & \frac{-11}{1}, & \frac{-11}{2}, & \frac{-11}{4}, & \frac{-11}{8}, & \frac{61}{1}, & \frac{61}{2}, & \frac{61}{4}, & \frac{61}{8}, & \frac{-61}{1}, \\ p+q: & 19, & -10, & -9, & -7, & -3, & 62, & 63, & 65, & 69, & -60, \end{array}$$

$$\begin{array}{ccccccccc} \frac{p}{q}: & \frac{-61}{2}, & \frac{-61}{4}, & \frac{-61}{8}, & \frac{671}{1}, & \frac{671}{2}, & \frac{671}{4}, & \frac{671}{8}, & \frac{-671}{1}, \\ p+q: & -59, & -57, & -53, & 672, & 673, & 675, & 679, & -670, \end{array}$$

$$\begin{array}{cccc} \frac{p}{q}: & \frac{-671}{2}, & \frac{-671}{4}, & \frac{-671}{8} \\ p+q: & -669, & -667, & -663 \end{array}$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$793 = 13 \cdot 61$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \cancel{\frac{1}{1}}, \cancel{\frac{1}{2}}, \cancel{\frac{1}{4}}, \cancel{\frac{1}{8}}, \frac{-1}{1}, \frac{-1}{2}, \frac{-1}{4}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$

$$p+q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$p+q: 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q}: \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$p+q: -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q}: \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$$p+q: -669, -667, -663$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

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$793 = 13 \cdot 61$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \cancel{\frac{1}{1}}, \cancel{\frac{1}{2}}, \cancel{\frac{1}{4}}, \cancel{\frac{1}{8}}, \cancel{\frac{-1}{1}}, \frac{-1}{2}, \frac{-1}{4}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$

$$p+q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$p+q: 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q}: \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$p+q: -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q}: \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$$p+q: -669, -667, -663$$

$$q : 1, 2, 4, 8$$
$$p : 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$
$$793 = 13 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q} : \cancel{\frac{1}{1}}, \cancel{\frac{1}{2}}, \cancel{\frac{1}{4}}, \cancel{\frac{1}{8}}, \cancel{\frac{-1}{1}}, \frac{-1}{2}, \cancel{\frac{-1}{4}}, \frac{-1}{8}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$
$$p + q : 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q} : \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$
$$p + q : 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q} : \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$
$$p + q : -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q} : \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$
$$p + q : -669, -667, -663$$

$$q: 1, 2, 4, 8$$
$$p: 1, -1, 11, -11, 61, -61, 671, -671$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$
$$793 = 13 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \cancel{\frac{1}{1}}, \cancel{\frac{1}{2}}, \cancel{\frac{1}{4}}, \cancel{\frac{1}{8}}, \cancel{\frac{-1}{1}}, \frac{-1}{2}, \cancel{\frac{-1}{4}}, \cancel{\frac{-1}{8}}, \frac{11}{1}, \frac{11}{2}, \frac{11}{4},$$
$$p+q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$
$$p+q: 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q}: \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$
$$p+q: -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q}: \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$
$$p+q: -669, -667, -663$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793 \qquad 793 = 13 \cdot 61$$

$$\frac{p}{q}: \cancel{\frac{1}{1}}, \cancel{\frac{1}{2}}, \cancel{\frac{1}{4}}, \cancel{\frac{1}{8}}, \cancel{\frac{-1}{1}}, \frac{-1}{2}, \cancel{\frac{-1}{4}}, \cancel{\frac{-1}{8}}, \cancel{\frac{11}{1}}, \frac{11}{2}, \frac{11}{4},$$

$$p+q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$p+q: 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

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$$p+q: -59, -57, -53, 672, 673, 675, 679, -670,$$

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$$p+q: -669, -667, -663$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

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$$793 = 13 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \cancel{\frac{1}{1}}, \cancel{\frac{1}{2}}, \cancel{\frac{1}{4}}, \cancel{\frac{1}{8}}, \cancel{\frac{-1}{1}}, \frac{-1}{2}, \cancel{\frac{-1}{4}}, \cancel{\frac{-1}{8}}, \cancel{\frac{11}{1}}, \frac{11}{2}, \cancel{\frac{11}{4}},$$

$$p+q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \frac{11}{8}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$p+q: 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q}: \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$p+q: -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q}: \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$$p+q: -669, -667, -663$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$793 = 13 \cdot 61$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \cancel{\frac{1}{1}}, \cancel{\frac{1}{2}}, \cancel{\frac{1}{4}}, \cancel{\frac{1}{8}}, \cancel{\frac{-1}{1}}, \frac{-1}{2}, \cancel{\frac{-1}{4}}, \cancel{\frac{-1}{8}}, \cancel{\frac{11}{1}}, \frac{11}{2}, \cancel{\frac{11}{4}},$$

$$p + q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \cancel{\frac{11}{8}}, \frac{-11}{1}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$p + q: 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q}: \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$p + q: -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q}: \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$$p + q: -669, -667, -663$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$671 = 11 \cdot 61$

$793 = 13 \cdot 61$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q}: \cancel{\frac{1}{1}}, \cancel{\frac{1}{2}}, \cancel{\frac{1}{4}}, \cancel{\frac{1}{8}}, \cancel{\frac{-1}{1}}, \frac{-1}{2}, \cancel{\frac{-1}{4}}, \cancel{\frac{-1}{8}}, \cancel{\frac{11}{1}}, \frac{11}{2}, \cancel{\frac{11}{4}},$$

$$p + q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

$$\frac{p}{q}: \cancel{\frac{11}{8}}, \cancel{\frac{-11}{1}}, \frac{-11}{2}, \frac{-11}{4}, \frac{-11}{8}, \frac{61}{1}, \frac{61}{2}, \frac{61}{4}, \frac{61}{8}, \frac{-61}{1},$$

$$p + q: 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q}: \frac{-61}{2}, \frac{-61}{4}, \frac{-61}{8}, \frac{671}{1}, \frac{671}{2}, \frac{671}{4}, \frac{671}{8}, \frac{-671}{1},$$

$$p + q: -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q}: \frac{-671}{2}, \frac{-671}{4}, \frac{-671}{8}$$

$$p + q: -669, -667, -663$$

$q: 1, 2, 4, 8$

$p: 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

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$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\begin{array}{lccccccccccc}
\dfrac{p}{q}: & \cancel{\dfrac{1}{1}}, & \cancel{\dfrac{1}{2}}, & \cancel{\dfrac{1}{4}}, & \cancel{\dfrac{1}{8}}, & \cancel{\dfrac{-1}{1}}, & \dfrac{-1}{2}, & \cancel{\dfrac{-1}{4}}, & \cancel{\dfrac{-1}{8}}, & \cancel{\dfrac{11}{1}}, & \dfrac{11}{2}, & \cancel{\dfrac{11}{4}}, \\
p+q: & 2, & 3, & 5, & 9, & 0, & 1, & 3, & 7, & 12, & 13, & 15,
\end{array}$$

$$\begin{array}{lcccccccccc}
\dfrac{p}{q}: & \cancel{\dfrac{11}{8}}, & \cancel{\dfrac{-11}{1}}, & \cancel{\dfrac{-11}{2}}, & \dfrac{-11}{4}, & \dfrac{-11}{8}, & \dfrac{61}{1}, & \dfrac{61}{2}, & \dfrac{61}{4}, & \dfrac{61}{8}, & \dfrac{-61}{1}, \\
p+q: & 19, & -10, & -9, & -7, & -3, & 62, & 63, & 65, & 69, & -60,
\end{array}$$

$$\begin{array}{lcccccccc}
\dfrac{p}{q}: & \dfrac{-61}{2}, & \dfrac{-61}{4}, & \dfrac{-61}{8}, & \dfrac{671}{1}, & \dfrac{671}{2}, & \dfrac{671}{4}, & \dfrac{671}{8}, & \dfrac{-671}{1}, \\
p+q: & -59, & -57, & -53, & 672, & 673, & 675, & 679, & -670,
\end{array}$$

$$\begin{array}{lccc}
\dfrac{p}{q}: & \dfrac{-671}{2}, & \dfrac{-671}{4}, & \dfrac{-671}{8} \\
p+q: & -669, & -667, & -663
\end{array}$$

$$\boxed{\begin{array}{l} q: 1, 2, 4, 8 \\ p: 1, -1, 11, -11, 61, -61, 671, -671 \end{array}}$$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$793 = 13 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\begin{array}{llllllllllll} \frac{p}{q}: & \cancel{\frac{1}{1}}, & \cancel{\frac{1}{2}}, & \cancel{\frac{1}{4}}, & \cancel{\frac{1}{8}}, & \cancel{\frac{-1}{1}}, & \frac{-1}{2}, & \cancel{\frac{-1}{4}}, & \cancel{\frac{-1}{8}}, & \cancel{\frac{11}{1}}, & \frac{11}{2}, & \cancel{\frac{11}{4}}, \\ p+q: & 2, & 3, & 5, & 9, & 0, & 1, & 3, & 7, & 12, & 13, & 15, \end{array}$$

$$\begin{array}{lllllllllll} \frac{p}{q}: & \cancel{\frac{11}{8}}, & \cancel{\frac{-11}{1}}, & \cancel{\frac{-11}{2}}, & \cancel{\frac{-11}{4}}, & \frac{-11}{8}, & \frac{61}{1}, & \frac{61}{2}, & \frac{61}{4}, & \frac{61}{8}, & \frac{-61}{1}, \\ p+q: & 19, & -10, & -9, & -7, & -3, & 62, & 63, & 65, & 69, & -60, \end{array}$$

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$$p + q: 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

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	-8			

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$p : 1, -1, 11, -11, 61, -61, 671, -671$

$$\underbrace{-8y^3 + 36y^2 + 166y - 671}_{f(y)} = 0$$

$$671 = 11 \cdot 61$$

$$793 = 13 \cdot 61$$

$$p - kq \xrightarrow{k=-1} p + q \qquad f(-1) = -793$$

$$\frac{p}{q} : \cancel{\frac{1}{1}}, \cancel{\frac{1}{2}}, \cancel{\frac{1}{4}}, \cancel{\frac{1}{8}}, \cancel{\frac{-1}{1}}, \frac{-1}{2}, \cancel{\frac{-1}{4}}, \cancel{\frac{-1}{8}}, \cancel{\frac{11}{1}}, \frac{11}{2}, \cancel{\frac{11}{4}},$$

$$p + q : 2, 3, 5, 9, 0, 1, 3, 7, 12, 13, 15,$$

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$$p + q : 19, -10, -9, -7, -3, 62, 63, 65, 69, -60,$$

$$\frac{p}{q} : \cancel{\frac{-61}{2}}, \cancel{\frac{-61}{4}}, \cancel{\frac{-61}{8}}, \cancel{\frac{671}{1}}, \cancel{\frac{671}{2}}, \cancel{\frac{671}{4}}, \cancel{\frac{671}{8}}, \cancel{\frac{-671}{1}},$$

$$p + q : -59, -57, -53, 672, 673, 675, 679, -670,$$

$$\frac{p}{q} : \cancel{\frac{-671}{2}}, \cancel{\frac{-671}{4}}, \cancel{\frac{-671}{8}}$$

$$p + q : -669, -667, -663$$

	-8	36		

$$\boxed{\begin{aligned} q &: 1, 2, 4, 8 \\ p &: 1, -1, 11, -11, 61, -61, 671, -671 \end{aligned}}$$

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$$\begin{array}{c|c|c|c|c} & -8 & 36 & 166 & \\ \hline & & & & \end{array}$$

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	-8	36	166	-671
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$\frac{11}{2}$	-8			

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$$\begin{array}{c|c|c|c|c}
 & -8 & 36 & 166 & -671 \\ \hline
\frac{11}{2} & -8 & -8 & 122 &
\end{array}$$

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	-8	36	166	-671
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	-8	36	166	-671
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$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\left(x^2 - \frac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y + 13)x + \left(y^2 - 24\right)\right] = 0$$

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$$\left(x^2 - \frac{1}{2}x + \frac{11}{2}\right)^2 - \Big[$$

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$$\boxed{a^2 - b^2 = (a+b)(a-b)}$$

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$$\left(x^2 - \frac{1}{2}x + \frac{11}{2}\right)^2 - \left(\frac{3}{2}x + \frac{5}{2}\right)^2 = 0$$

$$\left[\left(x^2 - \frac{1}{2}x + \frac{11}{2}\right) + \left(\frac{3}{2}x + \frac{5}{2}\right)\right]$$

$$a^2 - b^2 = (a + b)(a - b)$$

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\left(x^2 - \tfrac{1}{2}x + y\right)^2 - \left[\left(2y - \frac{35}{4}\right)x^2 + (-y+13)x + \left(y^2 - 24\right)\right] = 0$$

$$y = \frac{11}{2}$$

$$\left(x^2 - \frac{1}{2}x + \frac{11}{2}\right)^2 - \left[\frac{9}{4}x^2 + \frac{15}{2}x + \frac{25}{4}\right] = 0$$

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$$\left(x^2 + x + 8\right)$$

$$\boxed{a^2 - b^2 = (a+b)(a-b)}$$

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$$\left(x^2 + x + 8\right)\left(x^2 - 2x + 3\right)$$

$$\boxed{a^2 - b^2 = (a + b)(a - b)}$$

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$$\left(x^2 + x + 8\right)\left(x^2 - 2x + 3\right) = 0$$

$$x^2 + x + 8 = 0$$

$$x_{1,2} = \frac{-1 \pm \sqrt{1 - 32}}{2}$$

$\sqrt{-31} = \sqrt{31}i$

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

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$$x_1 = -\frac{1}{2} + \frac{\sqrt{31}}{2}i$$

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$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\left(x^2 + x + 8\right)\left(x^2 - 2x + 3\right) = 0$$

$$x^2 + x + 8 = 0 \qquad\qquad x^2 - 2x + 3 = 0$$

$$x_{1,2} = \frac{-1 \pm \sqrt{1 - 32}}{2}$$

$$x_1 = -\frac{1}{2} + \frac{\sqrt{31}}{2}i$$

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$$x^2 + x + 8 = 0$$

$$x^2 - 2x + 3 = 0$$

$$x_{1,2} = \frac{-1 \pm \sqrt{1 - 32}}{2}$$

$$x_{3,4} = \frac{2 \pm \sqrt{4 - 12}}{2}$$

$$x_1 = -\frac{1}{2} + \frac{\sqrt{31}}{2}i$$

$$x_2 = -\frac{1}{2} - \frac{\sqrt{31}}{2}i$$

$\sqrt{-31} = \sqrt{31}i$

$\sqrt{-8} = \sqrt{8}i = 2\sqrt{2}i$

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\left(x^2 + x + 8\right)\left(x^2 - 2x + 3\right) = 0$$

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$$x_{1,2} = \frac{-1 \pm \sqrt{1 - 32}}{2}$$

$$x_1 = -\frac{1}{2} + \frac{\sqrt{31}}{2}i$$

$$x_2 = -\frac{1}{2} - \frac{\sqrt{31}}{2}i$$

$$x^2 - 2x + 3 = 0$$

$$x_{3,4} = \frac{2 \pm \sqrt{4 - 12}}{2}$$

$$x_{3,4} = \frac{2 \pm 2\sqrt{2}i}{2}$$

$\sqrt{-31} = \sqrt{31}i$

$x^4 - x^3 + 9x^2 - 13x + 24 = 0$

$\sqrt{-8} = \sqrt{8}i = 2\sqrt{2}i$

$$\left(x^2 + x + 8\right)\left(x^2 - 2x + 3\right) = 0$$

$$x^2 + x + 8 = 0$$

$$x_{1,2} = \frac{-1 \pm \sqrt{1 - 32}}{2}$$

$$x_1 = -\frac{1}{2} + \frac{\sqrt{31}}{2}i$$

$$x_2 = -\frac{1}{2} - \frac{\sqrt{31}}{2}i$$

$$x^2 - 2x + 3 = 0$$

$$x_{3,4} = \frac{2 \pm \sqrt{4 - 12}}{2}$$

$$x_{3,4} = \frac{2 \pm 2\sqrt{2}i}{2}$$

$$x_3 = 1 + \sqrt{2}i$$

$\sqrt{-31} = \sqrt{31}i$

$\sqrt{-8} = \sqrt{8}i = 2\sqrt{2}i$

$$x^4 - x^3 + 9x^2 - 13x + 24 = 0$$

$$\left(x^2 + x + 8\right)\left(x^2 - 2x + 3\right) = 0$$

$$x^2 + x + 8 = 0$$

$$x_{1,2} = \frac{-1 \pm \sqrt{1 - 32}}{2}$$

$$x_1 = -\frac{1}{2} + \frac{\sqrt{31}}{2}i$$

$$x_2 = -\frac{1}{2} - \frac{\sqrt{31}}{2}i$$

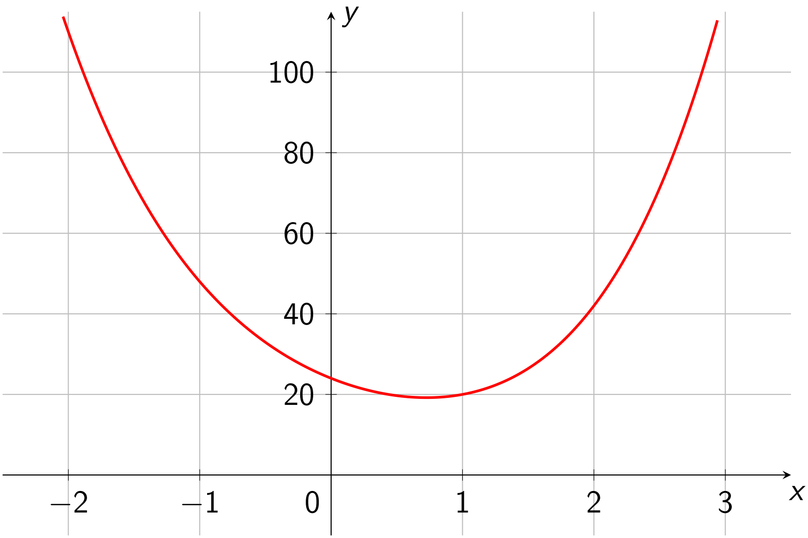
$$x^2 - 2x + 3 = 0$$

$$x_{3,4} = \frac{2 \pm \sqrt{4 - 12}}{2}$$

$$x_{3,4} = \frac{2 \pm 2\sqrt{2}i}{2}$$

$$x_3 = 1 + \sqrt{2}i$$

$$x_4 = 1 - \sqrt{2}i$$



$$f(x) = x^4 - x^3 + 9x^2 - 13x + 24$$

drugi zadatak

Zadatak 2

Zadana je jednadžba $x^3 + 6x - 2 = 0$.

a) *Bez direktnog rješavanja jednadžbe komentirajte koliko ima realnih, a koliko pravih kompleksnih rješenja.*

b) *Pomoću Cardanove formule riješite zadanu jednadžbu.*

Rješenje

$$x^3 + 6x - 2 = 0$$

a)

Rješenje

$$x^3 + 6x - 2 = 0$$

a)

$$x^3 + px + q = 0$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta =$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = \left(\frac{-2}{2}\right)^2$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = \left(\frac{-2}{2}\right)^2 +$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = \left(\frac{-2}{2}\right)^2 + \left(\frac{6}{3}\right)^3$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = \left(\frac{-2}{2}\right)^2 + \left(\frac{6}{3}\right)^3$$

$$\Delta =$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = \left(\frac{-2}{2}\right)^2 + \left(\frac{6}{3}\right)^3$$

$$\Delta = 1$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = \left(\frac{-2}{2}\right)^2 + \left(\frac{6}{3}\right)^3$$

$$\Delta = 1 + 8$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = \left(\frac{-2}{2}\right)^2 + \left(\frac{6}{3}\right)^3$$

$$\Delta = 1 + 8 = 9$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = \left(\frac{-2}{2}\right)^2 + \left(\frac{6}{3}\right)^3$$

$$\Delta = 1 + 8 = 9$$

$$\Delta > 0$$

Rješenje

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

a)

$$x^3 + px + q = 0$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = \left(\frac{-2}{2}\right)^2 + \left(\frac{6}{3}\right)^3$$

$$\Delta = 1 + 8 = 9$$

$\Delta > 0 \rightsquigarrow$ jednadžba ima jedno realno i dva konjugirano kompleksna rješenja

b)

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

b)

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

b)

$$x^3 + 6x - 2 = 0$$

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$p = 6, \quad q = -2$$

$$u_0 =$$

b)

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$u_0 = \sqrt[3]{}$$

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$$u_0 = \sqrt[3]{-\frac{-2}{2}}$$

b)

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$$u_0 = \sqrt[3]{-\frac{-2}{2} + }$$

b)

$$x^3 + 6x - 2 = 0$$

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$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

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b)

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$$p = 6, \quad q = -2$$

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$u_0 = \sqrt[3]{-\frac{-2}{2} +}$$

$$\Delta = 9$$

b)

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = 9$$

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$u_0 = \sqrt[3]{-\frac{-2}{2} + \sqrt{9}}$$

b)

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = 9$$

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$u_0 = \sqrt[3]{-\frac{-2}{2} + \sqrt{9}}$$

$$u_0 =$$

b)

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = 9$$

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$u_0 = \sqrt[3]{-\frac{-2}{2} + \sqrt{9}}$$

$$u_0 = \sqrt[3]{1 + 3}$$

b)

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = 9$$

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$u_0 = \sqrt[3]{-\frac{-2}{2} + \sqrt{9}}$$

$$u_0 = \sqrt[3]{1 + 3} \qquad u_0 = \sqrt[3]{4}$$

b)

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = 9$$

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$u_0 = \sqrt[3]{-\frac{-2}{2} + \sqrt{9}}$$

$$u_0 = \sqrt[3]{1+3} \qquad \boxed{u_0 = \sqrt[3]{4}}$$

b)

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$u_0 = \sqrt[3]{-\frac{-2}{2} + \sqrt{9}}$$

$$u_0 = \sqrt[3]{1+3} \qquad \boxed{u_0 = \sqrt[3]{4}}$$

$$v_0 = -\frac{p}{3u_0}$$

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = 9$$

b)

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$u_0 = \sqrt[3]{-\frac{-2}{2} + \sqrt{9}}$$

$$u_0 = \sqrt[3]{1+3} \qquad \boxed{u_0 = \sqrt[3]{4}}$$

$$v_0 = -\frac{p}{3u_0}$$

$$v_0 =$$

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = 9$$

b)

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$u_0 = \sqrt[3]{-\frac{-2}{2} + \sqrt{9}}$$

$$u_0 = \sqrt[3]{1+3} \qquad \boxed{u_0 = \sqrt[3]{4}}$$

$$v_0 = -\frac{p}{3u_0}$$

$$v_0 = -\frac{6}{3\sqrt[3]{4}}$$

$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = 9$$

b)

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

$$u_0 = \sqrt[3]{-\frac{-2}{2} + \sqrt{9}}$$

$$u_0 = \sqrt[3]{1+3} \qquad \boxed{u_0 = \sqrt[3]{4}}$$

$$v_0 = -\frac{p}{3u_0}$$

$$v_0 = -\frac{6}{3\sqrt[3]{4}}$$

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$$x^3 + 6x - 2 = 0$$

$$p = 6, \quad q = -2$$

$$\Delta = \left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3$$

$$\Delta = 9$$

b)

$$u_0 = \sqrt[3]{-\frac{q}{2} + \sqrt{\left(\frac{q}{2}\right)^2 + \left(\frac{p}{3}\right)^3}}$$

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$$x_1 = u_0 + v_0$$

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$$\Delta = 9$$

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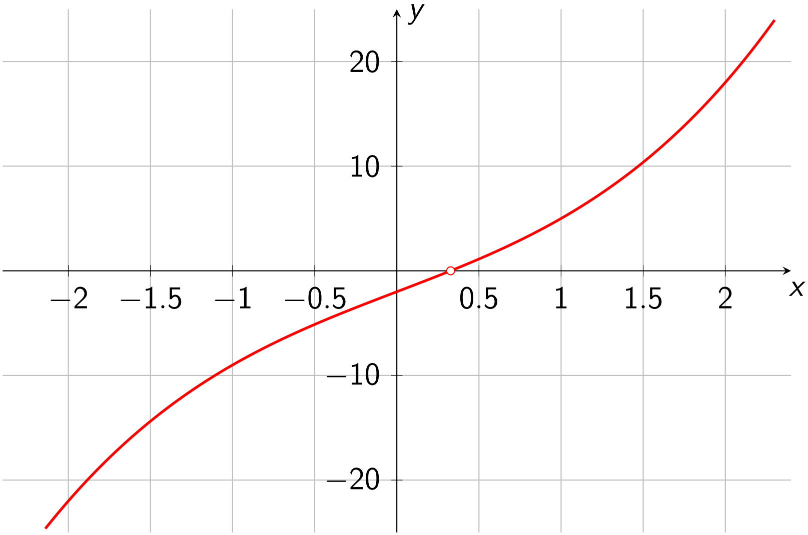

$$\boxed{f(x) = x^3 + 6x - 2}$$

treći zadatak

Zadatak 3

Riješite jednadžbu $5x^5 - 3x^4 + 2x^3 + 2x^2 - 3x + 5 = 0.$

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Rješenje

$$=$$

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Rješenje

simetrična jednadžba neparnog stupnja

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Rješenje

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	5					

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	5	-3				

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	5	-3	2			

Zadatak 3

Riješite jednadžbu $5x^5 - 3x^4 + 2x^3 + 2x^2 - 3x + 5 = 0.$

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	5	-3	2	2		

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Riješite jednadžbu $5x^5 - 3x^4 + 2x^3 + 2x^2 - 3x + 5 = 0.$

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	5	-3	2	2	-3	

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Riješite jednadžbu $5x^5 - 3x^4 + 2x^3 + 2x^2 - 3x + 5 = 0.$

Rješenje

simetrična jednadžba neparnog stupnja $\rightsquigarrow$ jedno rješenje je $\boxed{x_1 = -1}$

	5	-3	2	2	-3	5

Zadatak 3

Riješite jednadžbu $5x^5 - 3x^4 + 2x^3 + 2x^2 - 3x + 5 = 0.$

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	5	−3	2	2	−3	5
−1	5	−8				

Zadatak 3

Riješite jednadžbu $5x^5 - 3x^4 + 2x^3 + 2x^2 - 3x + 5 = 0.$

Rješenje

simetrična jednadžba neparnog stupnja $\rightsquigarrow$ jedno rješenje je $\boxed{x_1 = -1}$

	5	-3	2	2	-3	5
-1	5	-8	10			

Zadatak 3

Riješite jednadžbu $5x^5 - 3x^4 + 2x^3 + 2x^2 - 3x + 5 = 0.$

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$(x+1)$

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$$(x+1)\left(5x^4 - 8x^3 + 10x^2 - 8x + 5\right)$$

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simetrična jednadžba parnog stupnja

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \,/ : x^2$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;/ : x^2$$

$5x^2$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \,/ : x^2$$

$$5x^2 - 8x$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \; / : x^2$$

$$5x^2 - 8x + 10$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x}$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2}$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \,/: x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

$$5\left(x^2 + \frac{1}{x^2}\right)$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

$$5\left(x^2 + \frac{1}{x^2}\right) - 8\left(x + \frac{1}{x}\right)$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

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$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

$$5\left(x^2 + \frac{1}{x^2}\right) - 8\left(x + \frac{1}{x}\right) + 10 = 0$$

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$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

$$5\left(x^2 + \frac{1}{x^2}\right) - 8\left(x + \frac{1}{x}\right) + 10 = 0$$

$$x + \frac{1}{x} = t$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

$$5\left(x^2 + \frac{1}{x^2}\right) - 8\left(x + \frac{1}{x}\right) + 10 = 0$$

$$\boxed{x + \frac{1}{x} = t}$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;\Big/ : x^2$$

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$$\boxed{x + \frac{1}{x} = t} \Big/^{2}$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \,/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

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$$\boxed{x + \frac{1}{x} = t} \,\Big/^{2}$$

x^2

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

$$5\left(x^2 + \frac{1}{x^2}\right) - 8\left(x + \frac{1}{x}\right) + 10 = 0$$

$$\boxed{x + \frac{1}{x} = t} \Big/^{2}$$

$x^2 + 2$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \,/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

$$5\left(x^2 + \frac{1}{x^2}\right) - 8\left(x + \frac{1}{x}\right) + 10 = 0$$

$$\boxed{x + \frac{1}{x} = t} \Big/^2$$

$$x^2 + 2 + \frac{1}{x^2}$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;\Big/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

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$$x^2 + 2 + \frac{1}{x^2} = t^2$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \; \Big/ : x^2$$

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$$x^2 + 2 + \frac{1}{x^2} = t^2 \rightsquigarrow \boxed{x^2 + \frac{1}{x^2} = t^2 - 2}$$

$$5\left(t^2 - 2\right)$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;\Big/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

$$5\left(x^2 + \frac{1}{x^2}\right) - 8\left(x + \frac{1}{x}\right) + 10 = 0$$

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$$5\left(t^2 - 2\right) - 8t$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \; / : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

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$$\boxed{x + \frac{1}{x} = t} \; \Big/^{2}$$

$$x^2 + 2 + \frac{1}{x^2} = t^2 \rightsquigarrow \boxed{x^2 + \frac{1}{x^2} = t^2 - 2}$$

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$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

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$$t_1 = 0,$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \, \Big/ : x^2$$

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$$t_1 = 0, \quad t_2 = \frac{8}{5}$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \,/ : x^2$$

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$$\boxed{t_1 = 0, \quad t_2 = \frac{8}{5}}$$

$$5x^4-8x^3+10x^2-8x+5=0\ \Big/ : x^2$$

$$5x^2-8x+10-\frac{8}{x}+\frac{5}{x^2}=0$$

$$5\left(x^2+\frac{1}{x^2}\right)-8\left(x+\frac{1}{x}\right)+10=0$$

$$\boxed{x+\frac{1}{x}=t}\ \Big/^2$$

$$x^2+2+\frac{1}{x^2}=t^2 \rightsquigarrow \boxed{x^2+\frac{1}{x^2}=t^2-2}$$

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$$t(5t-8)=0$$

$$\boxed{t_1=0, \quad t_2=\frac{8}{5}}$$

$$x+\frac{1}{x}=0$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \Big/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

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$$\boxed{t_1 = 0, \quad t_2 = \frac{8}{5}}$$

$$x + \frac{1}{x} = 0 \Big/ \cdot x$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;\Big/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

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$$5\left(t^2 - 2\right) - 8t + 10 = 0$$

$$5t^2 - 8t = 0$$

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$$\boxed{t_1 = 0, \quad t_2 = \frac{8}{5}}$$

$$x + \frac{1}{x} = 0 \;\Big/ \cdot x$$

$$x^2 + 1 = 0$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;\Big/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

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$$\boxed{t_1 = 0, \quad t_2 = \frac{8}{5}}$$

$$x + \frac{1}{x} = 0 \;\Big/ \cdot x$$

$$x^2 + 1 = 0$$

$$x^2 = -1$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;\Big/ : x^2$$

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$$5\left(t^2 - 2\right) - 8t + 10 = 0$$

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$$t(5t - 8) = 0$$

$$\boxed{t_1 = 0, \quad t_2 = \frac{8}{5}}$$

$$x + \frac{1}{x} = 0 \;\Big/ \cdot x$$

$$x^2 + 1 = 0$$

$$x^2 = -1$$

$$x_2 = i, \quad x_3 = -i$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;\Big/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

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$$\boxed{t_1 = 0, \quad t_2 = \frac{8}{5}}$$

$$x + \frac{1}{x} = 0 \;\Big/ \cdot x$$

$$x^2 + 1 = 0$$

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$$\boxed{x_2 = i, \quad x_3 = -i}$$

$$5x^4 - 8x^3 + 10x^2 - 8x + 5 = 0 \;\Big/ : x^2$$

$$5x^2 - 8x + 10 - \frac{8}{x} + \frac{5}{x^2} = 0$$

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$$x_5 = \frac{4}{5} - \frac{3}{5}i$$

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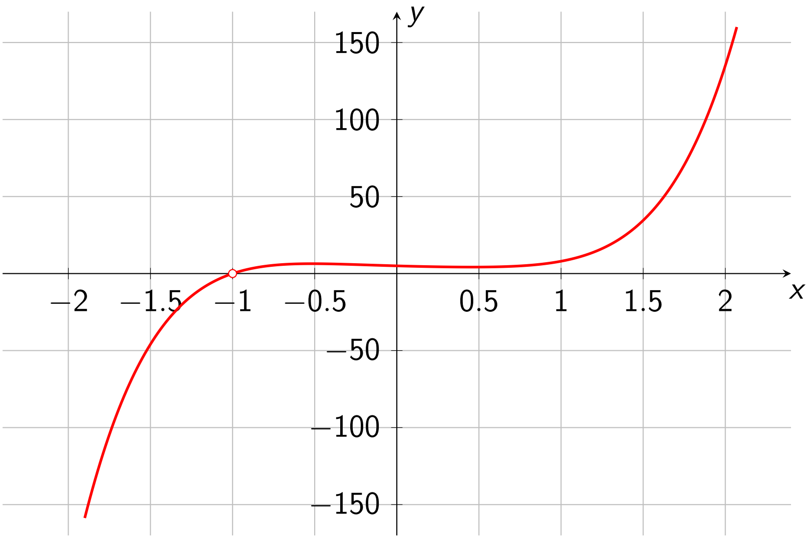
$$\boxed{\begin{aligned} x_4 &= \frac{4}{5} + \frac{3}{5}i \\ x_5 &= \frac{4}{5} - \frac{3}{5}i \end{aligned}}$$



$$\boxed{f(x) = 5x^5 - 3x^4 + 2x^3 + 2x^2 - 3x + 5}$$

četvrti zadatak

Oznake

- Funkcija dvije varijable: $z = z(x, y)$
- Parcijalna derivacija po varijabli x

$$z_x \qquad z'_x \qquad \frac{\partial z}{\partial x}$$

- Parcijalna derivacija po varijabli y

$$z_y \qquad z'_y \qquad \frac{\partial z}{\partial y}$$

Parcijalne derivacije drugog reda – oznake

- Funkcija dvije varijable: $z = z(x, y)$

$$z_{xx} \qquad z'_{xx} \qquad \frac{\partial^2 z}{\partial x^2}$$

$$z_{xy} \qquad z'_{xy} \qquad \frac{\partial^2 z}{\partial x \partial y}$$

$$z_{yx} \qquad z'_{yx} \qquad \frac{\partial^2 z}{\partial y \partial x}$$

$$z_{yy} \qquad z'_{yy} \qquad \frac{\partial^2 z}{\partial y^2}$$

Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

a) $f(x, y) = x^2 + y^2$

b) $g(x, y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

Zadatak 4

$$(x^n)' = nx^{n-1}$$

Odredite parcijalne derivacije sljedećih funkcija:

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Rješenje

a) $f_x =$

Zadatak 4

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Rješenje

a) $f_x = 2x$

Zadatak 4

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Rješenje

a) $f_x = 2x +$

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c) $z = \dfrac{y}{x}$

Rješenje

a) $f_x = 2x + 0$

Zadatak 4

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Odredite parcijalne derivacije sljedećih funkcija:

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c) $z = \dfrac{y}{x}$

Rješenje

a) $f_x = 2x + 0 = 2x$

Zadatak 4

$$(x^n)' = nx^{n-1}$$

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Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y =$

Zadatak 4

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Rješenje

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Zadatak 4

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Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad$ $f_y = 0 + 2y = 2y$

Zadatak 4

$$(x^n)' = nx^{n-1}$$

$$(cu)'(x) = c \cdot u'(x)$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $f(x, y) = x^2 + y^2$

b) $g(x, y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad$ $f_y = 0 + 2y = 2y$

b) $g_x =$

Zadatak 4

$$(x^n)' = nx^{n-1}$$

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Odredite parcijalne derivacije sljedećih funkcija:

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b) $g(x, y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad$ $f_y = 0 + 2y = 2y$

b) $g_x = 6x$

Zadatak 4

$$\boxed{(x^n)' = nx^{n-1}}$$

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Odredite parcijalne derivacije sljedećih funkcija:

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a) $f_x = 2x + 0 = 2x$ $\qquad$ $f_y = 0 + 2y = 2y$

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Rješenje

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Rješenje

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c) $z = \dfrac{y}{x}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad g_y =$

Zadatak 4

$$(x^n)' = nx^{n-1}$$

$$(cu)'(x) = c \cdot u'(x)$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $f(x, y) = x^2 + y^2$

b) $g(x, y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad$ $f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad$ $g_y = 0$

Zadatak 4

$$(x^n)' = nx^{n-1}$$

$$(cu)'(x) = c \cdot u'(x)$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $f(x, y) = x^2 + y^2$

b) $g(x, y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad$ $f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad$ $g_y = 0 +$

Zadatak 4

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Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad g_y = 0 + x$

Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

$$\boxed{(x^n)' = nx^{n-1}}$$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

$$\boxed{\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}}$$

a) $f(x,y) = x^2 + y^2$

b) $g(x,y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad$ $f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad$ $g_y = 0 + x +$

Zadatak 4

$$(x^n)' = nx^{n-1}$$

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c) $z = \dfrac{y}{x}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad g_y = 0 + x + \dfrac{1}{2\sqrt{y}}$

Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

$$(x^n)' = nx^{n-1}$$

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Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

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Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

$$\boxed{(x^n)' = nx^{n-1}}$$

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a) $f(x, y) = x^2 + y^2$

b) $g(x, y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

$z = yx^{-1}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad g_y = 0 + x + \dfrac{1}{2\sqrt{y}} = x + \dfrac{1}{2\sqrt{y}}$

c) $z_x =$

Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

$$\boxed{(x^n)' = nx^{n-1}}$$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

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c) $z = \dfrac{y}{x}$

$z = yx^{-1}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad g_y = 0 + x + \dfrac{1}{2\sqrt{y}} = x + \dfrac{1}{2\sqrt{y}}$

c) $z_x = y$

Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

$$\boxed{(x^n)' = nx^{n-1}}$$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

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c) $z = \dfrac{y}{x}$

$z = yx^{-1}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad g_y = 0 + x + \dfrac{1}{2\sqrt{y}} = x + \dfrac{1}{2\sqrt{y}}$

c) $z_x = y \cdot$

Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

$$\boxed{(x^n)' = nx^{n-1}}$$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

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c) $z = \dfrac{y}{x}$

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Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad g_y = 0 + x + \dfrac{1}{2\sqrt{y}} = x + \dfrac{1}{2\sqrt{y}}$

c) $z_x = y \cdot \left(-x^{-2}\right)$

Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

$$(x^n)' = nx^{n-1}$$

$$(cu)'(x) = c \cdot u'(x)$$

$$\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}$$

a) $f(x, y) = x^2 + y^2$

b) $g(x, y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

$z = yx^{-1}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad$ $f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad$ $g_y = 0 + x + \dfrac{1}{2\sqrt{y}} = x + \dfrac{1}{2\sqrt{y}}$

c) $z_x = y \cdot \left(-x^{-2}\right) = -\dfrac{y}{x^2}$

Zadatak 4

$$\boxed{(x^n)' = nx^{n-1}}$$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

$$\boxed{\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}}$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $f(x, y) = x^2 + y^2$

b) $g(x, y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

$z = yx^{-1}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad$ $f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad$ $g_y = 0 + x + \dfrac{1}{2\sqrt{y}} = x + \dfrac{1}{2\sqrt{y}}$

c) $z_x = y \cdot \left(-x^{-2}\right) = -\dfrac{y}{x^2}$ $\qquad$ $z_y =$

Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

$$\boxed{(x^n)' = nx^{n-1}}$$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

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a) $f(x, y) = x^2 + y^2$

b) $g(x, y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

$z = yx^{-1}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad g_y = 0 + x + \dfrac{1}{2\sqrt{y}} = x + \dfrac{1}{2\sqrt{y}}$

c) $z_x = y \cdot \left(-x^{-2}\right) = -\dfrac{y}{x^2}$ $\qquad z_y = x^{-1}$

Zadatak 4

$$(x^n)' = nx^{n-1}$$

$$(cu)'(x) = c \cdot u'(x)$$

$$\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $f(x, y) = x^2 + y^2$

b) $g(x, y) = 3x^2 + xy + \sqrt{y}$

c) $z = \dfrac{y}{x}$

$z = yx^{-1}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad g_y = 0 + x + \dfrac{1}{2\sqrt{y}} = x + \dfrac{1}{2\sqrt{y}}$

c) $z_x = y \cdot \left(-x^{-2}\right) = -\dfrac{y}{x^2}$ $\qquad z_y = x^{-1} \cdot$

Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

$$\boxed{(x^n)' = nx^{n-1}}$$

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c) $z = \dfrac{y}{x}$

$z = yx^{-1}$

Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad$ $f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad$ $g_y = 0 + x + \dfrac{1}{2\sqrt{y}} = x + \dfrac{1}{2\sqrt{y}}$

c) $z_x = y \cdot \left(-x^{-2}\right) = -\dfrac{y}{x^2}$ $\qquad$ $z_y = x^{-1} \cdot 1$

Zadatak 4

Odredite parcijalne derivacije sljedećih funkcija:

$$(x^n)' = nx^{n-1}$$

$$(cu)'(x) = c \cdot u'(x)$$

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Rješenje

a) $f_x = 2x + 0 = 2x$ $\qquad f_y = 0 + 2y = 2y$

b) $g_x = 6x + y + 0 = 6x + y$ $\qquad g_y = 0 + x + \dfrac{1}{2\sqrt{y}} = x + \dfrac{1}{2\sqrt{y}}$

c) $z_x = y \cdot \left(-x^{-2}\right) = -\dfrac{y}{x^2}$ $\qquad z_y = x^{-1} \cdot 1 = \dfrac{1}{x}$

peti zadatak

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x =$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x,y) = \dfrac{2x-y}{x+y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x,y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y =$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

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Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

$$\boxed{(e^x)' = e^x}$$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

$$\boxed{(e^x)' = e^x}$$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

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Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$ $\boxed{(cu)'(x) = c \cdot u'(x)}$

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Zadatak 5

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Zadatak 5

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a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$ $\boxed{(cu)'(x) = c \cdot u'(x)}$

b) $z_x = 0$

$\boxed{(e^x)' = e^x}$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$

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b) $z_x = 0 +$

$$\boxed{(e^x)' = e^x}$$

$$\boxed{\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}}$$

Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x,y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}}$

$$\boxed{(e^x)' = e^x}$$

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Zadatak 5

Odredite parcijalne derivacije sljedećih funkcija:

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Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$

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b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$

$$\boxed{(e^x)' = e^x}$$

$$\boxed{\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}}$$

Zadatak 5

$$\boxed{(uv)'(x) = u'(x) \cdot v(x) + u(x) \cdot v'(x)}$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x,y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $z_y =$

$$\boxed{(e^x)' = e^x}$$

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Zadatak 5

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Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $z_y = 1$

$$\boxed{(e^x)' = e^x}$$

$$\boxed{\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}}$$

Zadatak 5

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Rješenje

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$$\boxed{(e^x)' = e^x}$$

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Zadatak 5

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a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $z_y = 1 \cdot e^y$

$$\boxed{(e^x)' = e^x}$$

$$\boxed{\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}}$$

Zadatak 5

$\boxed{(uv)'(x) = u'(x) \cdot v(x) + u(x) \cdot v'(x)}$

Odredite parcijalne derivacije sljedećih funkcija:

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Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$ $\boxed{(cu)'(x) = c \cdot u'(x)}$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $z_y = 1 \cdot e^y +$

$\boxed{(e^x)' = e^x}$

$\boxed{\left(\sqrt{x}\right)' = \dfrac{1}{2\sqrt{x}}}$

Zadatak 5

$$\boxed{(uv)'(x) = u'(x) \cdot v(x) + u(x) \cdot v'(x)}$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $z_y = 1 \cdot e^y + y$

$$\boxed{(e^x)' = e^x}$$

$$\boxed{\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}}$$

Zadatak 5

$$\boxed{(uv)'(x) = u'(x) \cdot v(x) + u(x) \cdot v'(x)}$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$

b) $z = ye^y + \sqrt{x}$

c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

a) $z_x = e^y \cdot 1 = e^y$ $\qquad z_y = x \cdot e^y = xe^y$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $\qquad z_y = 1 \cdot e^y + y \cdot$

$$\boxed{(e^x)' = e^x}$$

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Zadatak 5

$$\boxed{(uv)'(x) = u'(x) \cdot v(x) + u(x) \cdot v'(x)}$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x,y) = \dfrac{2x - y}{x + y}$

Rješenje

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$u_y = \dfrac{-1 \cdot (x + y) -}{(x + y)^2}$

Zadatak 5

$$\boxed{(uv)'(x) = u'(x)\cdot v(x) + u(x)\cdot v'(x)}$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x,y) = \dfrac{2x-y}{x+y}$

Rješenje

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

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$

$$\boxed{(cu)'(x) = c\cdot u'(x)}$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $z_y = 1\cdot e^y + y\cdot e^y + 0 = (1+y)e^y$

$$\boxed{(e^x)' = e^x}$$

c) $u_x = \dfrac{2\cdot(x+y) - (2x-y)\cdot 1}{(x+y)^2} = \dfrac{3y}{(x+y)^2}$

$$u_y = \frac{-1\cdot(x+y) - (2x-y)}{(x+y)^2}$$

$$\boxed{\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}}$$

Zadatak 5

$$(uv)'(x) = u'(x) \cdot v(x) + u(x) \cdot v'(x)$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x,y) = \dfrac{2x-y}{x+y}$

Rješenje

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

a) $z_x = e^y \cdot 1 = e^y$ $\quad z_y = x \cdot e^y = xe^y$

$$(cu)'(x) = c \cdot u'(x)$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $\quad z_y = 1 \cdot e^y + y \cdot e^y + 0 = (1+y)e^y$

$$(e^x)' = e^x$$

c) $u_x = \dfrac{2 \cdot (x+y) - (2x-y) \cdot 1}{(x+y)^2} = \dfrac{3y}{(x+y)^2}$

$$(\sqrt{x})' = \frac{1}{2\sqrt{x}}$$

$u_y = \dfrac{-1 \cdot (x+y) - (2x-y) \cdot}{(x+y)^2}$

Zadatak 5

$$(uv)'(x) = u'(x) \cdot v(x) + u(x) \cdot v'(x)$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x,y) = \dfrac{2x - y}{x + y}$

Rješenje

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

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$

$$(cu)'(x) = c \cdot u'(x)$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $z_y = 1 \cdot e^y + y \cdot e^y + 0 = (1 + y)e^y$

$$(e^x)' = e^x$$

c) $u_x = \dfrac{2 \cdot (x + y) - (2x - y) \cdot 1}{(x + y)^2} = \dfrac{3y}{(x + y)^2}$

$$\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}$$

$$u_y = \frac{-1 \cdot (x + y) - (2x - y) \cdot 1}{(x + y)^2}$$

Zadatak 5

$$\boxed{(uv)'(x) = u'(x)\cdot v(x) + u(x)\cdot v'(x)}$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x,y) = \dfrac{2x-y}{x+y}$

Rješenje

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

a) $z_x = e^y \cdot 1 = e^y$ $\qquad z_y = x\cdot e^y = xe^y$

$$\boxed{(cu)'(x) = c\cdot u'(x)}$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $\qquad z_y = 1\cdot e^y + y\cdot e^y + 0 = (1+y)e^y$

$$\boxed{(e^x)' = e^x}$$

c) $$u_x = \frac{2\cdot(x+y) - (2x-y)\cdot 1}{(x+y)^2} = \frac{3y}{(x+y)^2}$$

$$u_y = \frac{-1\cdot(x+y) - (2x-y)\cdot 1}{(x+y)^2} = \frac{}{(x+y)^2}$$

$$\boxed{\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}}$$

Zadatak 5

$$\boxed{(uv)'(x) = u'(x) \cdot v(x) + u(x) \cdot v'(x)}$$

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = xe^y$ b) $z = ye^y + \sqrt{x}$ c) $u(x, y) = \dfrac{2x - y}{x + y}$

Rješenje

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

a) $z_x = e^y \cdot 1 = e^y$ $z_y = x \cdot e^y = xe^y$

$$\boxed{(cu)'(x) = c \cdot u'(x)}$$

b) $z_x = 0 + \dfrac{1}{2\sqrt{x}} = \dfrac{1}{2\sqrt{x}}$ $z_y = 1 \cdot e^y + y \cdot e^y + 0 = (1 + y)e^y$

$$\boxed{(e^x)' = e^x}$$

c) $u_x = \dfrac{2 \cdot (x + y) - (2x - y) \cdot 1}{(x + y)^2} = \dfrac{3y}{(x + y)^2}$

$$\boxed{\left(\sqrt{x}\right)' = \frac{1}{2\sqrt{x}}}$$

$u_y = \dfrac{-1 \cdot (x + y) - (2x - y) \cdot 1}{(x + y)^2} = \dfrac{-3x}{(x + y)^2}$

šesti zadatak

Zadatak 6

Odredite parcijalne derivacije sljedećih funkcija:

a) $z = 2^{\sin \frac{y}{x}}$

b) $z = x^y$

c) $f(x, y, z) = e^{2xz} - \ln(yz) + 1$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

a) $z_x =$

$\boxed{z = 2^{\sin \frac{y}{x}}}$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

a) $$z_x = 2^{\sin \frac{y}{x}} \ln 2$$

$\boxed{z = 2^{\sin \frac{y}{x}}}$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

a) $z_x = 2^{\sin \frac{y}{x}} \ln 2 \cdot$

$\boxed{z = 2^{\sin \frac{y}{x}}}$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin \frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x$$

$$\boxed{z = 2^{\sin \frac{y}{x}}}$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \qquad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

$\boxed{(\sin x)' = \cos x}$ $\boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$\boxed{z = 2^{\sin\frac{y}{x}}}$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

$\boxed{(\sin x)' = \cos x}$ $\boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot$$

$\boxed{z = 2^{\sin\frac{y}{x}}}$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin \frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x = 2^{\sin \frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin \frac{y}{x}}}$$

$$= 2^{\sin \frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x}$$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

$\boxed{(\sin x)' = \cos x}$ $\boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$\boxed{z = 2^{\sin\frac{y}{x}}}$ $$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}} \qquad = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2}$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}} \qquad = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}} \qquad = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a)

$$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x}$$

$$z_y =$$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

$\boxed{(\sin x)' = \cos x}$ $\boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)_x' = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)_x' =$$

$\boxed{z = 2^{\sin\frac{y}{x}}}$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

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$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \qquad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

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$\boxed{z = 2^{\sin\frac{y}{x}}}$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)_y'$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a)
$$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}} \qquad = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

$\boxed{(\sin x)' = \cos x}$ $\boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$\boxed{z = 2^{\sin\frac{y}{x}}}$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_y$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a)

$$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_y =$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a)

$$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_y =$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot$$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

$\boxed{(\sin x)' = \cos x}$ $\boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$

a)

$$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$\boxed{z = 2^{\sin\frac{y}{x}}}$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_y =$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{1}{x}$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \qquad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \qquad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

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$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_y =$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{1}{x} = \frac{1}{x} \cdot$$

Rješenje

$$\boxed{(a^x)' = a^x \ln a} \quad \boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$$

$$\boxed{(\sin x)' = \cos x} \quad \boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$$

a)

$$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$$\boxed{z = 2^{\sin\frac{y}{x}}}$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_y =$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{1}{x} = \frac{1}{x} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

$\boxed{(x^n)' = nx^{n-1}}$ $\boxed{(\sin x)' = \cos x}$ $\boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$

a)

$$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$\boxed{z = 2^{\sin\frac{y}{x}}}$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_y =$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{1}{x} = \frac{1}{x} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x}$$

$\boxed{z = x^y}$

b) z_x

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

$\boxed{(x^n)' = nx^{n-1}}$ $\boxed{(\sin x)' = \cos x}$ $\boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$\boxed{z = 2^{\sin\frac{y}{x}}}$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin\frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \left(\frac{y}{x}\right)'_y =$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x} \cdot \frac{1}{x} = \frac{1}{x} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos\frac{y}{x}$$

$\boxed{z = x^y}$

b) $z_x = yx^{y-1}$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

$\boxed{(x^n)' = nx^{n-1}}$ $\boxed{(\sin x)' = \cos x}$ $\boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$

a) $$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$\boxed{z = 2^{\sin\frac{y}{x}}}$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_y =$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{1}{x} = \frac{1}{x} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x}$$

$\boxed{z = x^y}$

b) $z_x = yx^{y-1}$ $\quad z_y =$

Rješenje

$\boxed{(a^x)' = a^x \ln a}$ $\boxed{(a^{\text{nešto}})' = a^{\text{nešto}} \ln a \cdot (\text{nešto})'}$

$\boxed{(x^n)' = nx^{n-1}}$ $\boxed{(\sin x)' = \cos x}$ $\boxed{(\sin(\text{nešto}))' = \cos(\text{nešto}) \cdot (\text{nešto})'}$

a)
$$z_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_x = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_x =$$

$\boxed{z = 2^{\sin\frac{y}{x}}}$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{-y}{x^2} = -\frac{y}{x^2} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x}$$

$$z_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \left(\sin \frac{y}{x}\right)'_y = 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \left(\frac{y}{x}\right)'_y =$$

$$= 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x} \cdot \frac{1}{x} = \frac{1}{x} \cdot 2^{\sin\frac{y}{x}} \ln 2 \cdot \cos \frac{y}{x}$$

$\boxed{z = x^y}$

b) $z_x = yx^{y-1}$ $\qquad$ $z_y = x^y \ln x$

c)

$\boxed{(e^{\text{nešto}})' = e^{\text{nešto}} \cdot (\text{nešto})'}$ $\boxed{(e^x)' = e^x}$

$f_x =$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$\boxed{(e^{\text{nešto}})' = e^{\text{nešto}} \cdot (\text{nešto})'}$ $\boxed{(e^x)' = e^x}$

$$f_x = e^{2xz}$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{(e^{\text{nešto}})' = e^{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(e^x)' = e^x}$$

$$f_x = e^{2xz} \cdot (2xz)'_x$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$\boxed{(e^{\text{nešto}})' = e^{\text{nešto}} \cdot (\text{nešto})'}$ $\boxed{(e^x)' = e^x}$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{(e^{\text{nešto}})' = e^{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(e^x)' = e^x}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c) $\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'}$ $\boxed{(e^x)' = e^x}$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz}$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$\boxed{(e^{\text{nešto}})' = e^{\text{nešto}} \cdot (\text{nešto})'}$ $\boxed{(e^x)' = e^x}$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c) $\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'}$ $\boxed{(e^x)' = e^x}$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(e^x)' = e^x}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$\boxed{(e^{\text{nešto}})' = e^{\text{nešto}} \cdot (\text{nešto})'}$ $\boxed{(e^x)' = e^x}$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y =$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c) $\boxed{(e^{\text{nešto}})' = e^{\text{nešto}} \cdot (\text{nešto})'}$ $\boxed{(e^x)' = e^x}$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(e^x)' = e^x}$$

$$\boxed{\left(\ln(\text{nešto})\right)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 -$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(e^x)' = e^x}$$

$$\boxed{\big(\ln(\text{nešto})\big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz}$$

$$\boxed{f(x,y,z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(e^x)' = e^x}$$

$$\boxed{\big(\ln{(\text{nešto})}\big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln{(yz)} + 1}$$

c)

$$\boxed{(e^{\text{nešto}})' = e^{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(e^x)' = e^x}$$

$$\boxed{\left(\ln(\text{nešto})\right)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(e^x)' = e^x}$$

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$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0 = -\frac{1}{yz}$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(e^x)' = e^x}$$

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$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0 = -\frac{1}{yz} \cdot$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(e^x)' = e^x}$$

$$\boxed{\big(\ln(\text{nešto})\big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0 = -\frac{1}{yz} \cdot z$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(e^x)' = e^x}$$

$$\boxed{\big(\ln(\text{nešto})\big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0 = -\frac{1}{yz} \cdot z = -\frac{1}{y}$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(e^x)' = e^x}$$

$$\boxed{\Big(\ln(\text{nešto})\Big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0 = -\frac{1}{yz} \cdot z = -\frac{1}{y}$$

$$f_z =$$

$$\boxed{f(x,y,z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(e^x)' = e^x}$$

$$\boxed{\big(\ln(\text{nešto})\big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0 = -\frac{1}{yz} \cdot z = -\frac{1}{y}$$

$$f_z = e^{2xz}$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(e^x)' = e^x}$$

$$\boxed{\big(\ln(\text{nešto})\big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \quad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0 = -\frac{1}{yz} \cdot z = -\frac{1}{y}$$

$$f_z = e^{2xz} \cdot (2xz)'_z$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(e^x)' = e^x}$$

$$\boxed{\big(\ln(\text{nešto})\big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0 = -\frac{1}{yz} \cdot z = -\frac{1}{y}$$

$$f_z = e^{2xz} \cdot (2xz)'_z -$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(e^x)' = e^x}$$

$$\boxed{\big(\ln(\text{nešto})\big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0 = -\frac{1}{yz} \cdot z = -\frac{1}{y}$$

$$f_z = e^{2xz} \cdot (2xz)'_z - \frac{1}{yz}$$

$$\boxed{f(x,y,z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{\left(e^{x}\right)' = e^{x}}$$

$$\boxed{\Big(\ln(\text{nešto})\Big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

$$f_y = 0 - \frac{1}{yz} \cdot (yz)'_y + 0 = -\frac{1}{yz} \cdot z = -\frac{1}{y}$$

$$f_z = e^{2xz} \cdot (2xz)'_z - \frac{1}{yz} \cdot (yz)'_z$$

$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

c)

$$\boxed{\left(e^{\text{nešto}}\right)' = e^{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{\left(e^{x}\right)' = e^{x}}$$

$$\boxed{\Big(\ln(\text{nešto})\Big)' = \frac{1}{\text{nešto}} \cdot (\text{nešto})'} \qquad \boxed{(\ln x)' = \frac{1}{x}}$$

$$f_x = e^{2xz} \cdot (2xz)'_x - 0 + 0 = e^{2xz} \cdot 2z = 2ze^{2xz}$$

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$$\boxed{f(x, y, z) = e^{2xz} - \ln(yz) + 1}$$

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