Realne funkcije realne varijable – 1. dio

MATEMATIKA 2

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Sadržaj

prvi zadatak

Zadatak 1

Odredite domene i nultočke sljedećih funkcija:

a) $f(x) = \sqrt[4]{\frac{x-3}{x+2} - 2} - 1$

b) $g(x) = (2 + x - x^2)^{\frac{1}{5}}$

c) $h(x) = \log\left(10^{x-1} - 5\right)$

d) $k(x) = \sqrt{\log_{\frac{1}{2}}(x+2)}$

$$\boxed{f(x) = \sqrt[4]{\frac{x-3}{x+2}} - 2 - 1}$$

Rješenje

a) domena

$$f(x) = \sqrt[4]{\frac{x-3}{x+2} - 2} - 1$$

Rješenje

a) domena

$$\frac{x-3}{x+2} - 2 \geqslant 0$$

$$f(x) = \sqrt[4]{\frac{x-3}{x+2} - 2} - 1$$

$$x + 2 \neq 0$$

Rješenje

a) $\boxed{\text{domena}}$

uključeno u ovom uvjetu

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$$\frac{x - 3 - 2(x+2)}{x+2}$$

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RJEŠENJE: $x \in [-7, -2\rangle$

$$f(x) = \sqrt[4]{\frac{x-3}{x+2} - 2} - 1$$

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RJEŠENJE: $x \in [-7, -2\rangle$

$$D_f = [-7, -2\rangle$$

nultočke

$$\boxed{f(x) = \sqrt[4]{\frac{x-3}{x+2} - 2} - 1}$$

$$\boxed{D_f = [-7, -2\rangle}$$

nultočke

$$\sqrt[4]{\frac{x-3}{x+2}-2}-1=0$$

$$\boxed{f(x)=\sqrt[4]{\frac{x-3}{x+2}-2}-1}$$

$$\boxed{D_f=[-7,-2\rangle}$$

nultočke

$$\sqrt[4]{\frac{x-3}{x+2}-2}-1=0$$

$$\sqrt[4]{\frac{x-3}{x+2}-2}=1$$

$$f(x)=\sqrt[4]{\frac{x-3}{x+2}-2}-1$$

$$D_f=[-7,-2\rangle$$

nultočke

$$f(x) = \sqrt[4]{\frac{x-3}{x+2}} - 2 - 1$$

$$D_f = [-7, -2\rangle$$

$$\sqrt[4]{\frac{x-3}{x+2}} - 2 - 1 = 0$$

$$\sqrt[4]{\frac{x-3}{x+2}} - 2 = 1 \quad \Big/^{4}$$

nultočke

$$\sqrt[4]{\frac{x-3}{x+2}-2}-1=0$$

$$\sqrt[4]{\frac{x-3}{x+2}-2}=1 \quad /^{4}$$

$$\frac{x-3}{x+2}-2$$

$$f(x)=\sqrt[4]{\frac{x-3}{x+2}-2}-1$$

$$D_f=[-7,-2\rangle$$

nultočke

$$f(x) = \sqrt[4]{\frac{x-3}{x+2} - 2} - 1$$

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$$\sqrt[4]{\frac{x-3}{x+2} - 2} - 1 = 0$$

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$$\frac{x-3}{x+2} - 2 =$$

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$$f(x) = \sqrt[4]{\frac{x-3}{x+2} - 2} - 1$$

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$$\frac{x-3}{x+2}-2=1$$

$$\frac{x-3}{x+2}=3$$

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$$\frac{x-3}{x+2} = 3 \quad \Big/ \cdot (x+2)$$

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$$x - 3$$

nultočke

$$f(x) = \sqrt[4]{\frac{x-3}{x+2} - 2} - 1$$

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$$x - 3 =$$

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$$\frac{x-3}{x+2} = 3 \Big/ \cdot (x+2)$$

$$x - 3 = 3x + 6$$

nultočke

$$f(x) = \sqrt[4]{\frac{x-3}{x+2} - 2} - 1$$

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$$x - 3 = 3x + 6$$

$$-2x = 9$$

nultočke

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$$\frac{x-3}{x+2} - 2 = 1$$

$$\frac{x-3}{x+2} = 3 \quad \Big/ \cdot (x+2)$$

$$x - 3 = 3x + 6$$

$$-2x = 9$$

$$x = -\frac{9}{2}$$

nultočke

$$f(x) = \sqrt[4]{\frac{x-3}{x+2} - 2} - 1$$

$$D_f = [-7, -2\rangle$$

$$\sqrt[4]{\frac{x-3}{x+2} - 2} - 1 = 0$$

$$\sqrt[4]{\frac{x-3}{x+2} - 2} = 1 \quad \Big/^{4}$$

$$\frac{x-3}{x+2} - 2 = 1$$

$$\frac{x-3}{x+2} = 3 \quad \Big/ \cdot (x+2)$$

$$x - 3 = 3x + 6$$

$$-2x = 9$$

$$\boxed{x = -\frac{9}{2}}$$

nultočke

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jest nultočka
jer pripada domeni

b) domena

$$g(x) = (2 + x - x^2)^{\frac{1}{5}}$$

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nultočke

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

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

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jest nultočka jer pripada domeni

$\log_a x = b \rightsquigarrow x = a^b$

$a^x = b \rightsquigarrow x = \log_a b$

$$\boxed{k(x) = \sqrt{\log_{\frac{1}{2}}(x+2)}}$$

d) domena

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d) domena

- $x + 2 > 0$

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d) $\boxed{\text{domena}}$

- $x + 2 > 0 \leftsquigarrow$ zbog $\log_{\frac{1}{2}}$

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- $x + 2 > 0 \leftsquigarrow$ zbog $\log_{\frac{1}{2}}$
- $\log_{\frac{1}{2}}(x+2) \geqslant 0$

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d) $\boxed{\text{domena}}$

- $x + 2 > 0 \leftarrow$ zbog $\log_{\frac{1}{2}}$
- $\log_{\frac{1}{2}}(x+2) \geqslant 0 \leftarrow$ zbog $\sqrt{}$

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$\boxed{\log_a a^x = x}$ $\boxed{k(x) = \sqrt{\log_{\frac{1}{2}}(x+2)}}$

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nultočke

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jest nultočka
jer pripada domeni

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drugi zadatak

Zadatak 2

Odredite nultočke funkcija

$f(x) = 2^{5-x} + 50 \;\; i \;\; g(x) = 2^{5-x} - 50.$

Zadatak 2

Odredite nultočke funkcija

$f(x) = 2^{5-x} + 50 \;\; i \;\; g(x) = 2^{5-x} - 50.$

Rješenje

nultočke od f

Zadatak 2

Odredite nultočke funkcija

$f(x) = 2^{5-x} + 50 \;\; i \;\; g(x) = 2^{5-x} - 50.$

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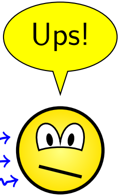

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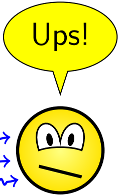

funkcija f nema nultočki

$$a^x = b \rightsquigarrow x = \log_a b$$

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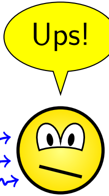

funkcija f nema nultočki

nultočke od g

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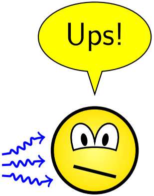

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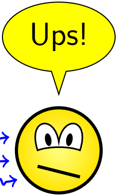

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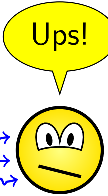

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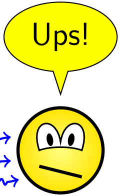

funkcija f nema nultočki

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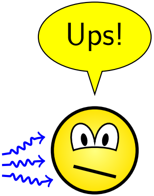

funkcija f nema nultočki

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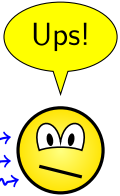

funkcija f nema nultočki

$\boxed{\text{nultočke od } g}$

$$2^{5-x} - 50 = 0$$

$$2^{5-x} = 50$$

$$5 - x = \log_2 50$$

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$$a^x = b \rightsquigarrow x = \log_a b$$

Zadatak 2

Odredite nultočke funkcija

$$f(x) = 2^{5-x} + 50 \;\; i \;\; g(x) = 2^{5-x} - 50.$$

Rješenje

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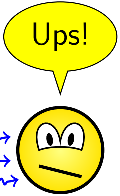

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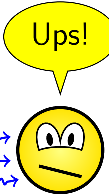

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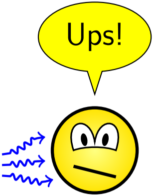

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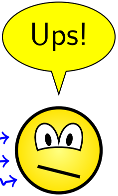

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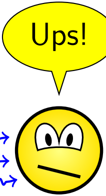

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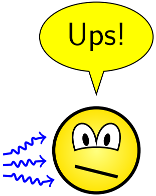

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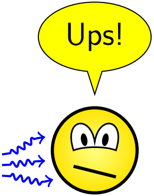

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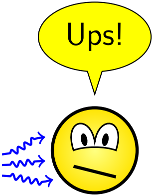

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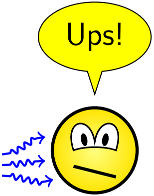

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aproksimacija nultočke na 5 decimala

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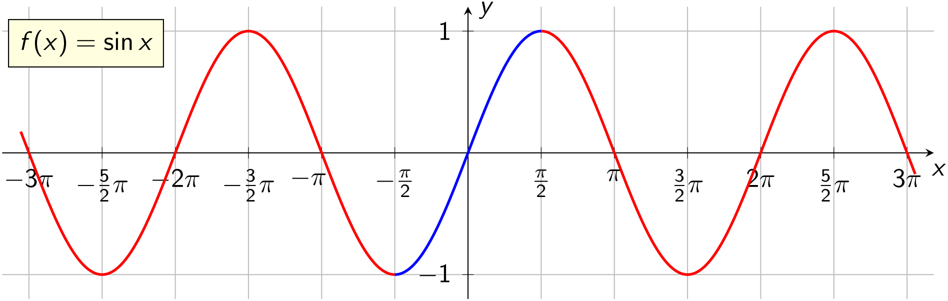
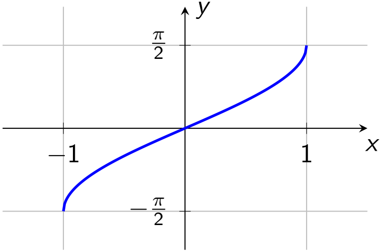
Trigonometrijske i ciklometrijske funkcije

$f(x) = \sin x$

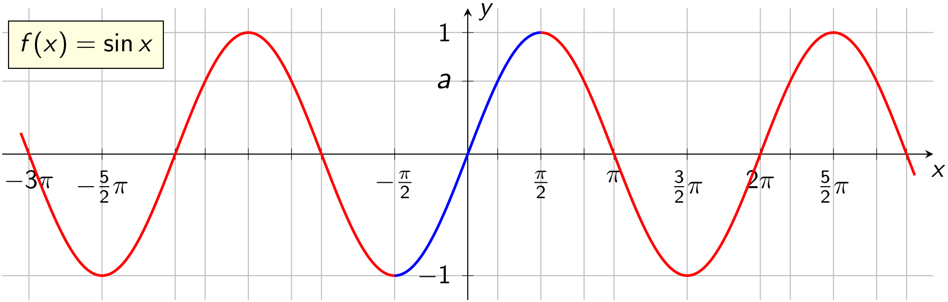


$f^{-1}(x) = \arcsin x$

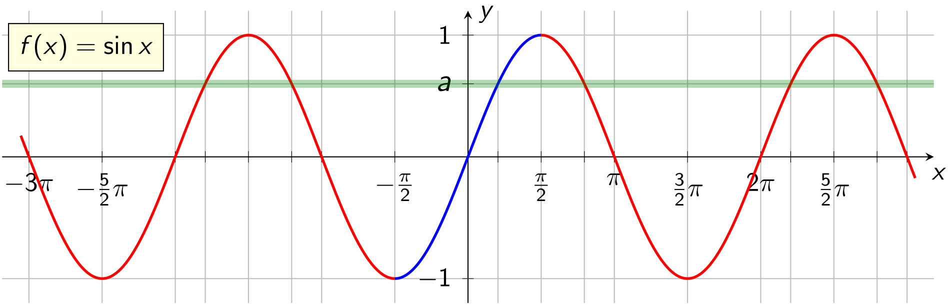


$\sin x = 0 \;\Leftrightarrow\; x = k\pi,\ k \in \mathbb{Z}$

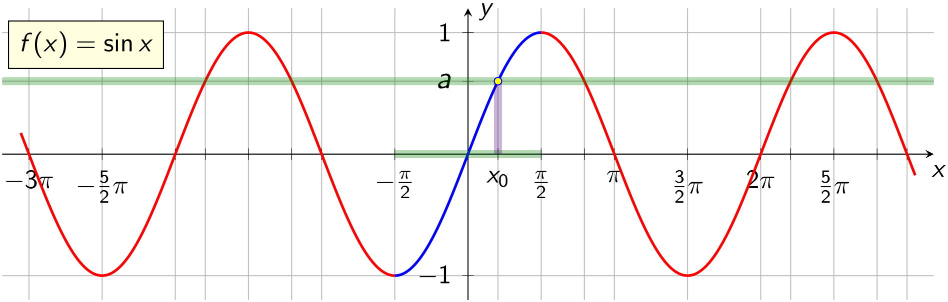
$\arcsin x = 0 \;\Leftrightarrow\; x = 0$



Rješenja jednadžbe $\sin x = a$ za $|a| \leqslant 1$

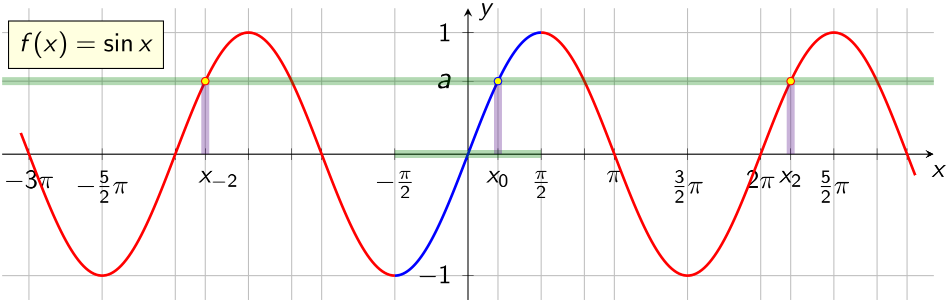


Rješenja jednadžbe $\sin x = a$ za $|a| \leqslant 1$



Rješenja jednadžbe $\sin x = a$ za $|a| \leqslant 1$

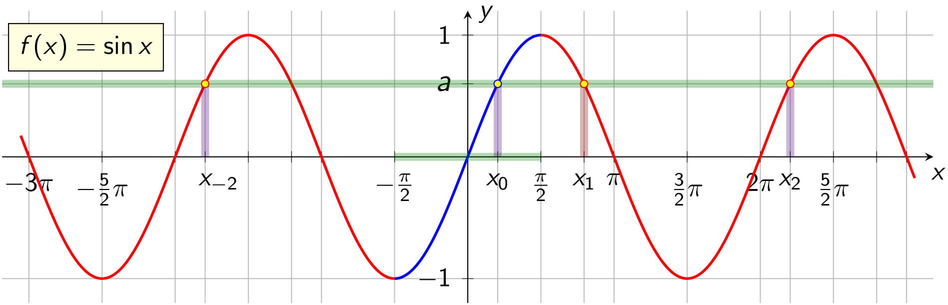
$$x_0 = \arcsin a$$



Rješenja jednadžbe $\sin x = a$ za $|a| \leqslant 1$

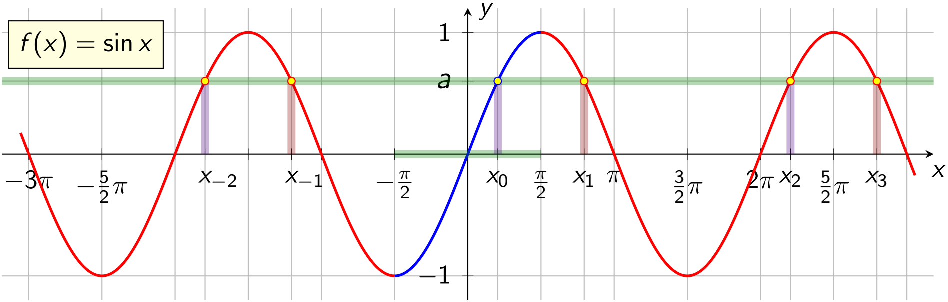
$$x_0 = \arcsin a$$

$$x_{2k} = x_0 + 2k\pi$$



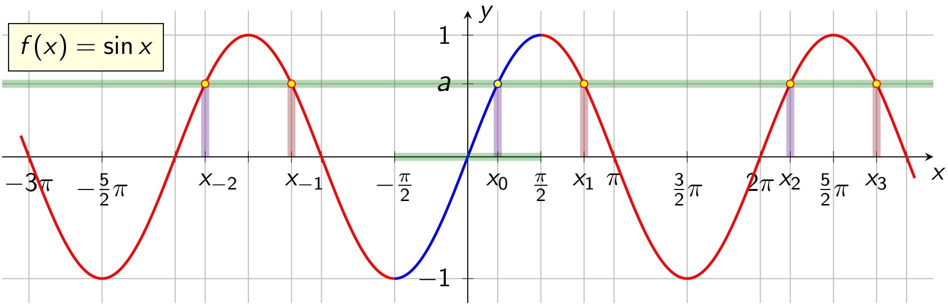
Rješenja jednadžbe $\sin x = a$ za $|a| \leqslant 1$

$$x_0 = \arcsin a$$
$$x_1 = \pi - \arcsin a$$
$$x_{2k} = x_0 + 2k\pi$$



Rješenja jednadžbe $\sin x = a$ za $|a| \leqslant 1$

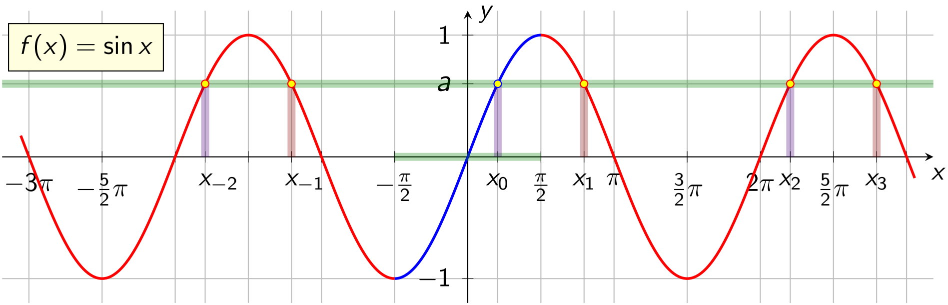
$$
\begin{aligned}
x_0 &= \arcsin a \\
x_1 &= \pi - \arcsin a \\
x_{2k} &= x_0 + 2k\pi \\
x_{2k+1} &= x_1 + 2k\pi
\end{aligned}
$$



Rješenja jednadžbe $\sin x = a$ za $|a| \leqslant 1$

- $x_k^{(1)} = \arcsin a + 2k\pi, \ \ k \in \mathbb{Z}$

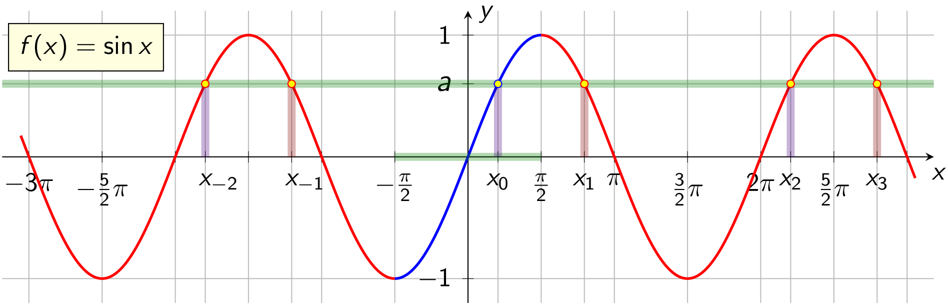
$$\begin{aligned} x_0 &= \arcsin a \\ x_1 &= \pi - \arcsin a \\ x_k^{(1)} = x_{2k} &= x_0 + 2k\pi \\ x_{2k+1} &= x_1 + 2k\pi \end{aligned}$$



Rješenja jednadžbe $\sin x = a$ za $|a| \leqslant 1$

- $x_k^{(1)} = \arcsin a + 2k\pi,\ \ k \in \mathbb{Z}$
- $x_k^{(2)} = \pi - \arcsin a + 2k\pi,\ \ k \in \mathbb{Z}$

$$x_0 = \arcsin a$$
$$x_1 = \pi - \arcsin a$$
$$x_k^{(1)} = x_{2k} = x_0 + 2k\pi$$
$$x_k^{(2)} = x_{2k+1} = x_1 + 2k\pi$$



Rješenja jednadžbe $\sin x = a$ za $|a| \leqslant 1$

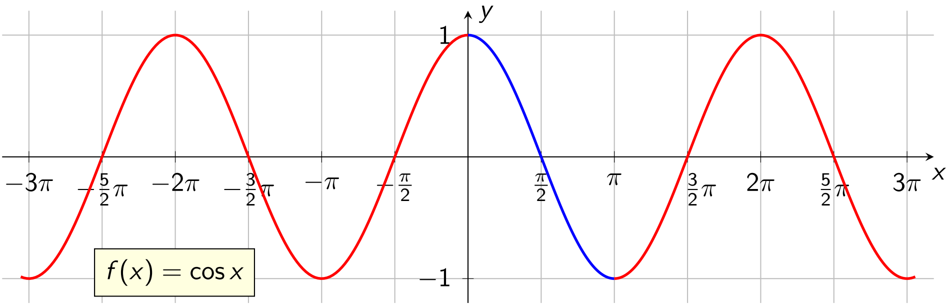
$$x_0 = \arcsin a$$
$$x_1 = \pi - \arcsin a$$

- $x_k^{(1)} = \arcsin a + 2k\pi, \;\; k \in \mathbb{Z}$
- $x_k^{(2)} = \pi - \arcsin a + 2k\pi, \;\; k \in \mathbb{Z}$

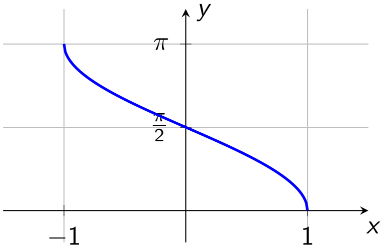
$$x_k^{(1)} = x_{2k} = x_0 + 2k\pi$$
$$x_k^{(2)} = x_{2k+1} = x_1 + 2k\pi$$

Možemo sva rješenja zapisati pomoću jedne formule

$$\boxed{x_k = (-1)^k \arcsin a + k\pi, \;\; k \in \mathbb{Z}}$$

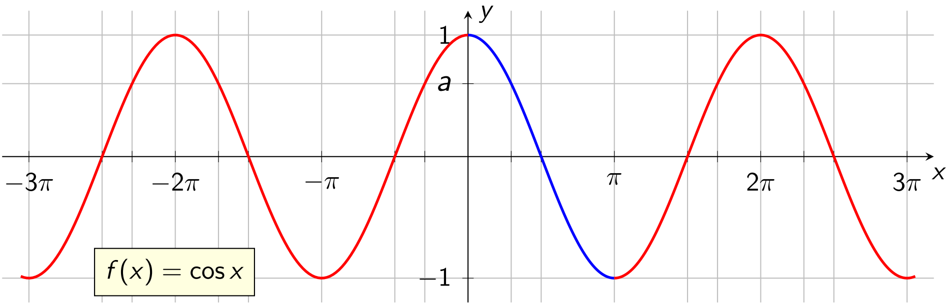


$f^{-1}(x) = \arccos x$

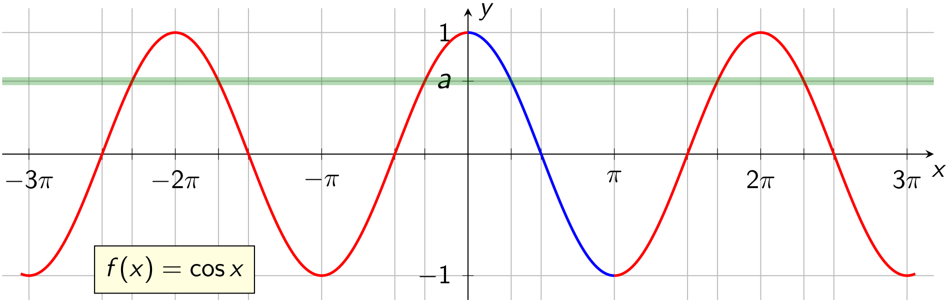


$$\cos x = 0 \;\Leftrightarrow\; x = \frac{2k+1}{2}\pi,\; k \in \mathbb{Z}$$

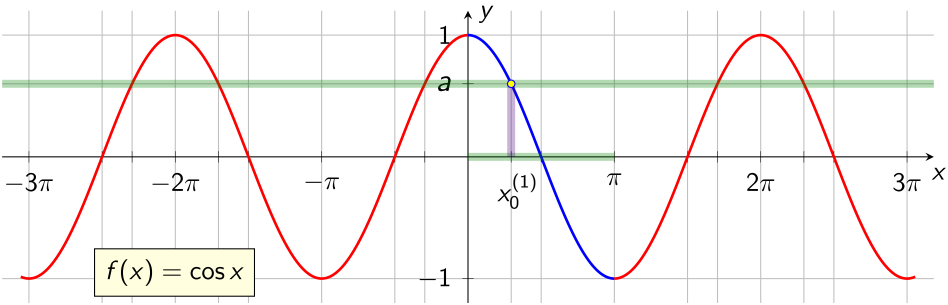
$$\arccos x = 0 \;\Leftrightarrow\; x = 1$$



Rješenja jednadžbe $\cos x = a$ za $|a| \leqslant 1$

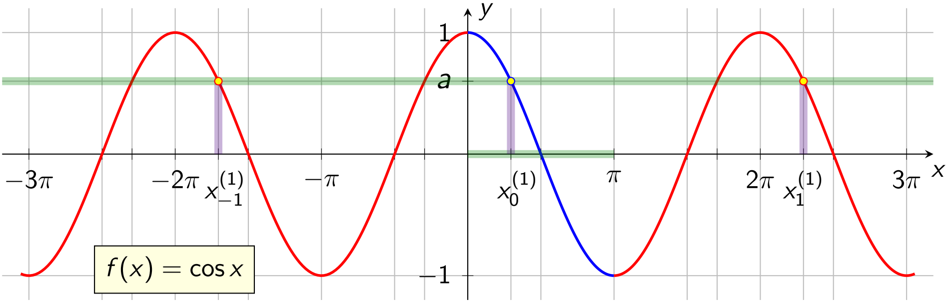


Rješenja jednadžbe $\cos x = a$ za $|a| \leqslant 1$



Rješenja jednadžbe $\cos x = a$ za $|a| \leqslant 1$

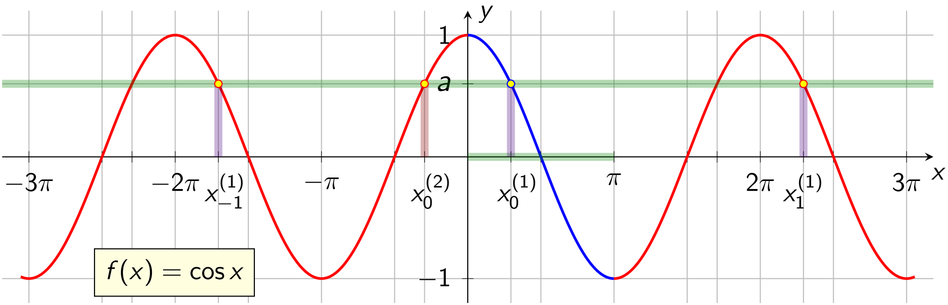
$$x_0^{(1)} = \arccos a$$



Rješenja jednadžbe $\cos x = a$ za $|a| \leqslant 1$

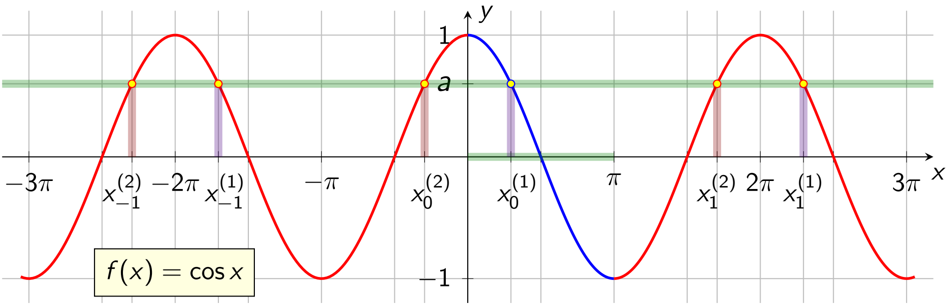
$$x_0^{(1)} = \arccos a$$

$$x_k^{(1)} = x_0^{(1)} + 2k\pi$$



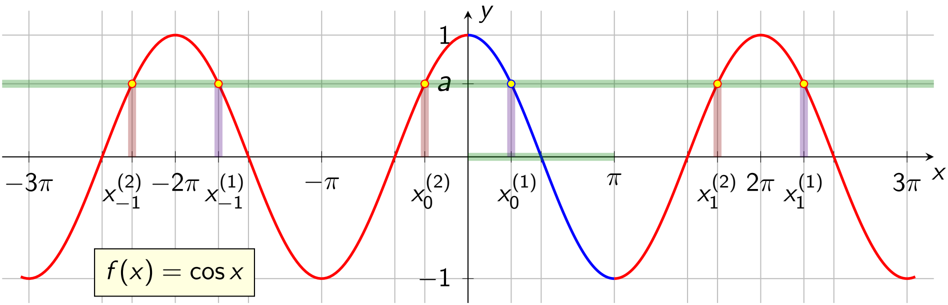
Rješenja jednadžbe $\cos x = a$ za $|a| \leqslant 1$

$$x_0^{(1)} = \arccos a$$
$$x_0^{(2)} = -\arccos a$$
$$x_k^{(1)} = x_0^{(1)} + 2k\pi$$



Rješenja jednadžbe $\cos x = a$ za $|a| \leqslant 1$

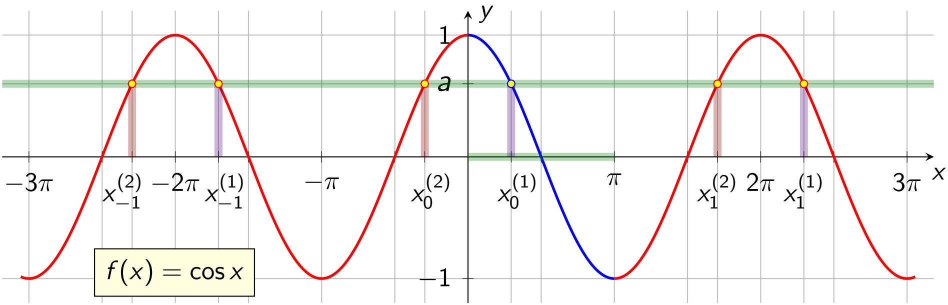
$$
\begin{aligned}
x_0^{(1)} &= \arccos a \\
x_0^{(2)} &= -\arccos a \\
x_k^{(1)} &= x_0^{(1)} + 2k\pi \\
x_k^{(2)} &= x_0^{(2)} + 2k\pi
\end{aligned}
$$



Rješenja jednadžbe $\cos x = a$ za $|a| \leqslant 1$

$$x_0^{(1)} = \arccos a$$
$$x_0^{(2)} = -\arccos a$$
$$x_k^{(1)} = x_0^{(1)} + 2k\pi$$
$$x_k^{(2)} = x_0^{(2)} + 2k\pi$$

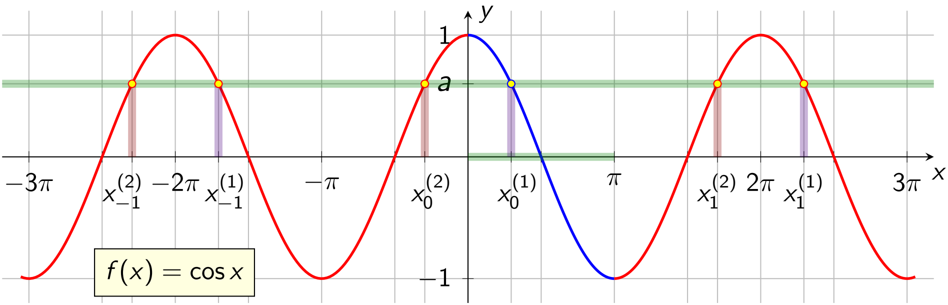
- $x_k^{(1)} = \arccos a + 2k\pi, \;\; k \in \mathbb{Z}$



Rješenja jednadžbe $\cos x = a$ za $|a| \leqslant 1$

- $x_k^{(1)} = \arccos a + 2k\pi, \;\; k \in \mathbb{Z}$
- $x_k^{(2)} = -\arccos a + 2k\pi, \;\; k \in \mathbb{Z}$

$$x_0^{(1)} = \arccos a$$
$$x_0^{(2)} = -\arccos a$$
$$x_k^{(1)} = x_0^{(1)} + 2k\pi$$
$$x_k^{(2)} = x_0^{(2)} + 2k\pi$$



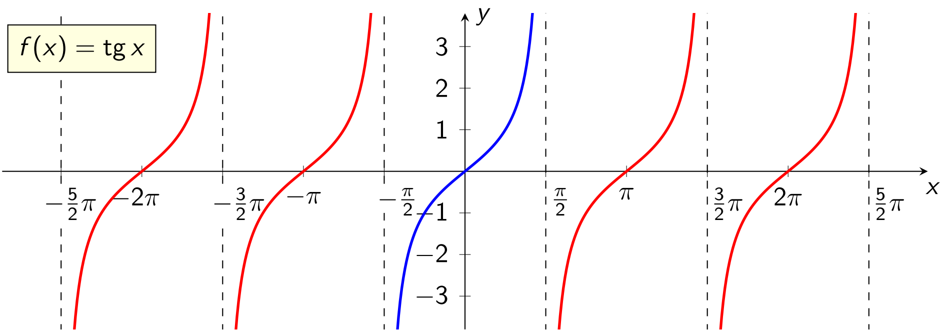
Rješenja jednadžbe $\cos x = a$ za $|a| \leqslant 1$

- $x_k^{(1)} = \arccos a + 2k\pi,\ \ k \in \mathbb{Z}$
- $x_k^{(2)} = -\arccos a + 2k\pi,\ \ k \in \mathbb{Z}$

$$x_0^{(1)} = \arccos a$$
$$x_0^{(2)} = -\arccos a$$
$$x_k^{(1)} = x_0^{(1)} + 2k\pi$$
$$x_k^{(2)} = x_0^{(2)} + 2k\pi$$

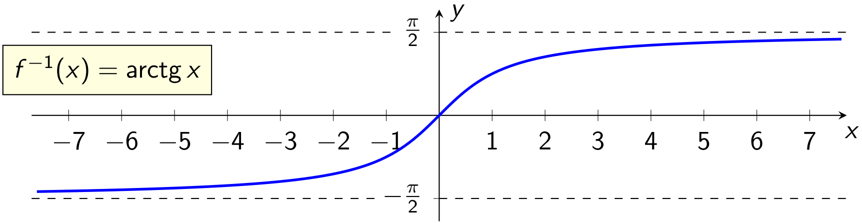
Bez indeksiranja možemo sva rješenja kratko zapisati

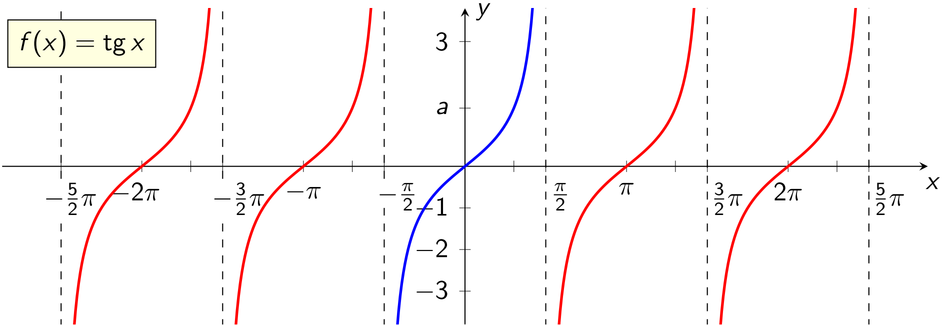
$$\boxed{x = \pm \arccos a + 2k\pi,\ \ k \in \mathbb{Z}}$$



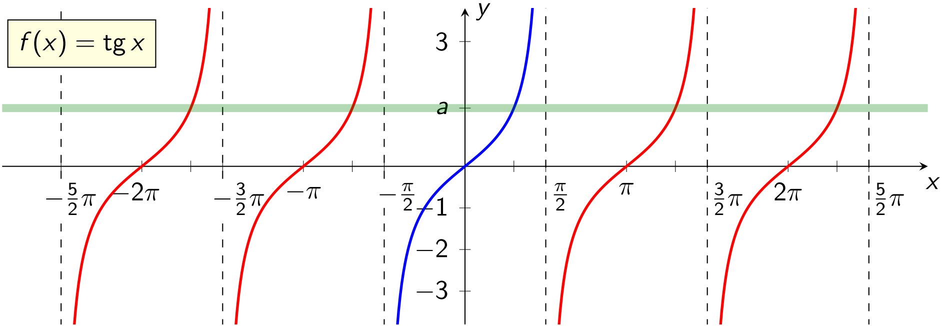
$$\operatorname{tg} x = 0 \;\Leftrightarrow\; x = k\pi,\ k \in \mathbb{Z}$$

$$\operatorname{arctg} x = 0 \;\Leftrightarrow\; x = 0$$

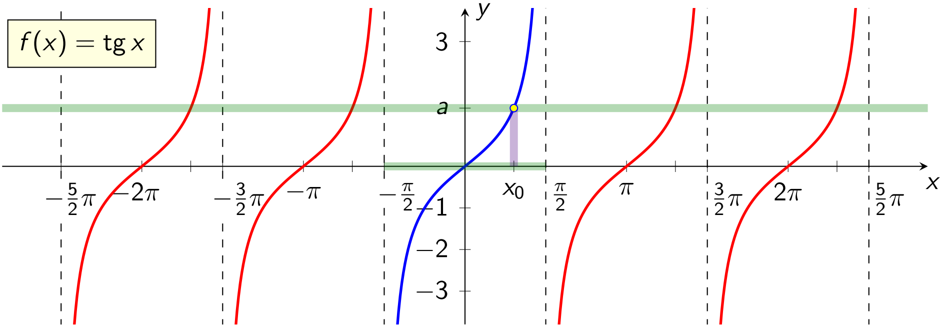




Rješenja jednadžbe $\operatorname{tg} x = a$

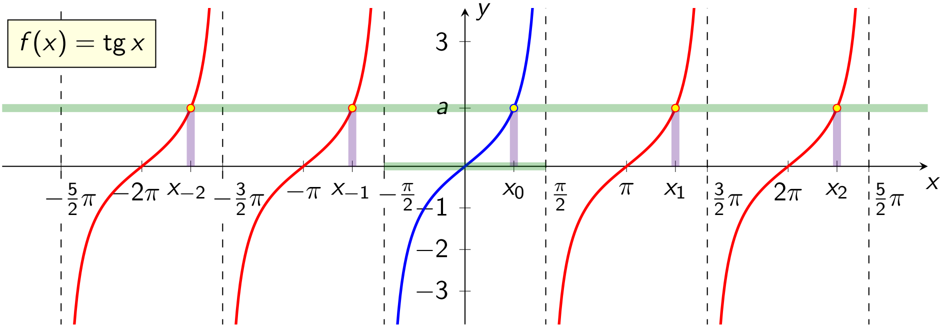


Rješenja jednadžbe $\operatorname{tg} x = a$



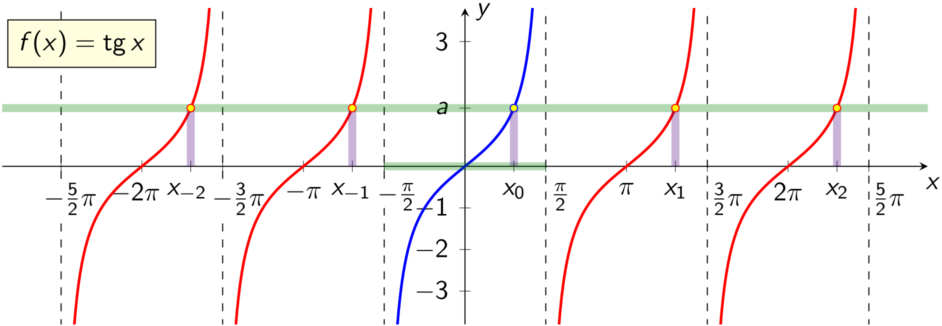
Rješenja jednadžbe $\operatorname{tg} x = a$

- $x_0 = \operatorname{arctg} a$



Rješenja jednadžbe $\operatorname{tg} x = a$

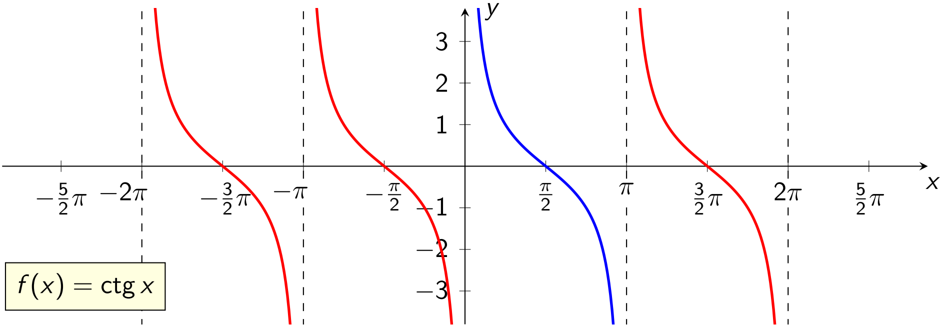
- $x_0 = \operatorname{arctg} a$
- $x_k = x_0 + k\pi, \; k \in \mathbb{Z}$



Rješenja jednadžbe $\operatorname{tg} x = a$

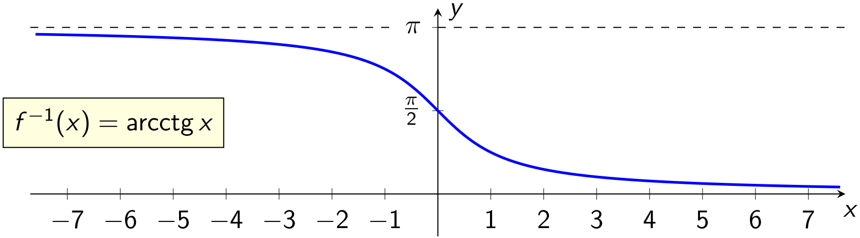
- $x_0 = \operatorname{arctg} a$
- $x_k = x_0 + k\pi, \ \ k \in \mathbb{Z}$

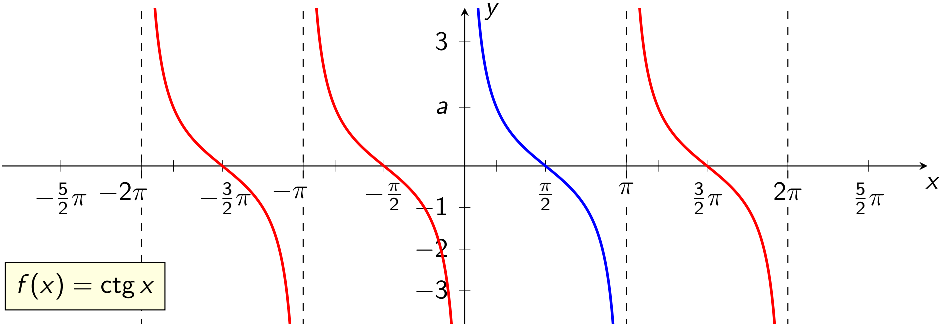
$$x_k = \operatorname{arctg} a + k\pi, \ \ k \in \mathbb{Z}$$



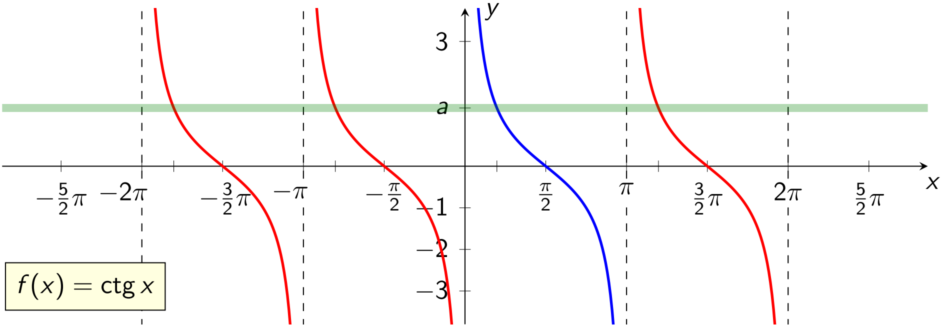
$$\operatorname{ctg} x = 0 \iff x = \frac{2k+1}{2}\pi,\ k \in \mathbb{Z}$$

$$(\forall x \in \mathbb{R})\left(\operatorname{arcctg} x \neq 0\right)$$

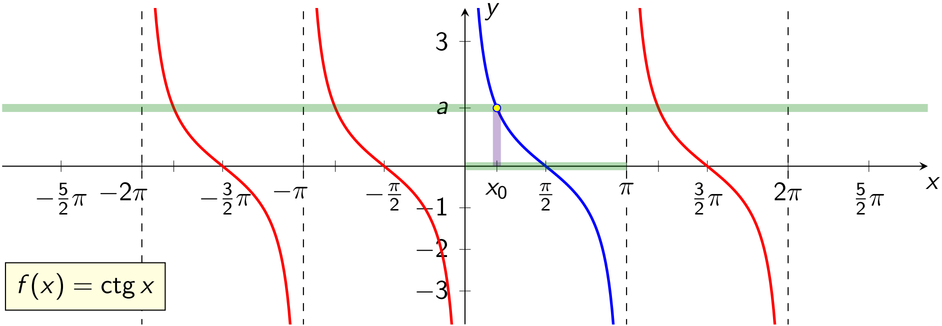




Rješenja jednadžbe $\operatorname{ctg} x = a$

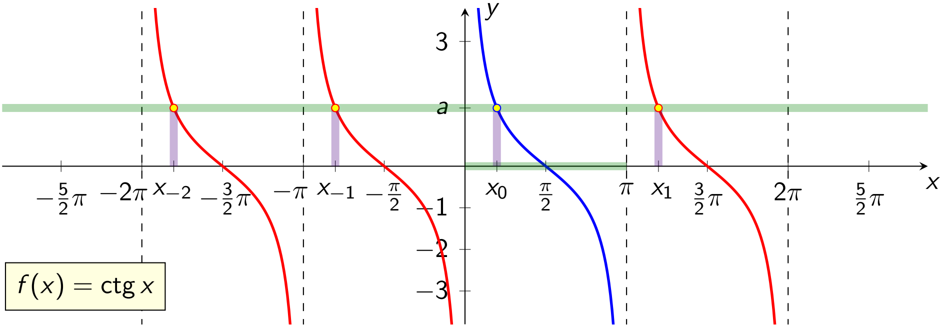


Rješenja jednadžbe $\operatorname{ctg} x = a$



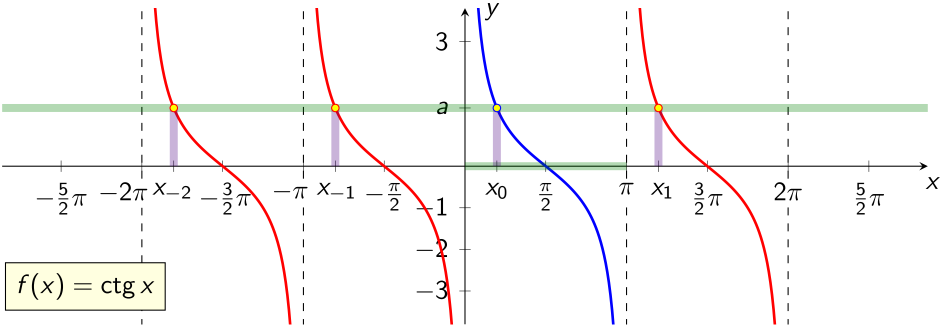
Rješenja jednadžbe $\operatorname{ctg} x = a$

- $x_0 = \operatorname{arcctg} a$



Rješenja jednadžbe $\operatorname{ctg} x = a$

- $x_0 = \operatorname{arcctg} a$
- $x_k = x_0 + k\pi, \;\; k \in \mathbb{Z}$



Rješenja jednadžbe $\operatorname{ctg} x = a$

- $x_0 = \operatorname{arcctg} a$
- $x_k = x_0 + k\pi, \ k \in \mathbb{Z}$

$$\boxed{x_k = \operatorname{arcctg} a + k\pi, \ k \in \mathbb{Z}}$$

treći zadatak

Zadatak 3

Odredite domenu i nultočke sljedećih funkcija:

a) $h(x) = \operatorname{ctg}(\pi x + 2)$

b) $f(x) = \sqrt{\sin 3x + \frac{1}{2}}$

c) $g(x) = \dfrac{\arccos(x^2 - 3)}{x - 2}$

Rješenje

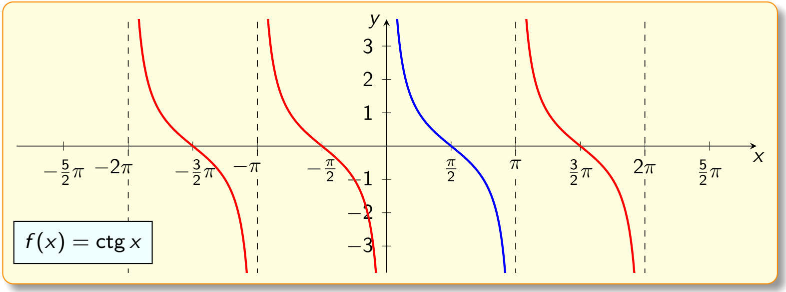
$h(x) = \operatorname{ctg}(\pi x + 2)$

a) domena

Rješenje

$$h(x) = \operatorname{ctg}(\pi x + 2)$$

a) domena

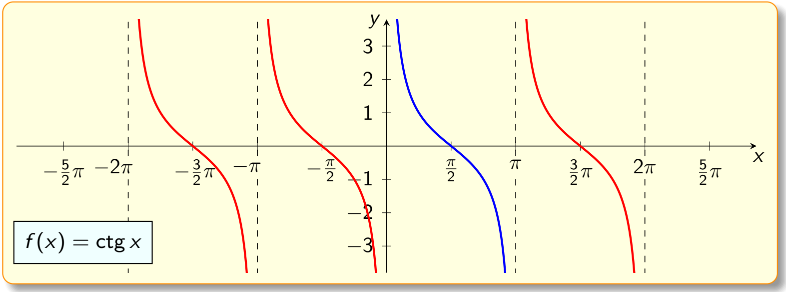


Rješenje

$\boxed{h(x) = \operatorname{ctg}(\pi x + 2)}$

a) $\boxed{\text{domena}}$

$\pi x + 2 \neq k\pi, \;\; k \in \mathbb{Z}$



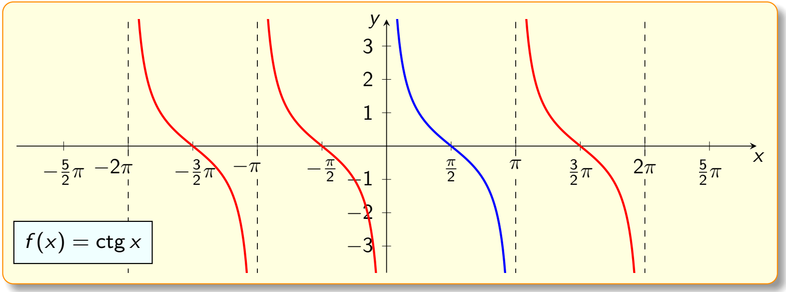
Rješenje

$$\boxed{h(x) = \operatorname{ctg}\left(\pi x + 2\right)}$$

a) $\boxed{\text{domena}}$

$$\pi x + 2 \neq k\pi, \;\; k \in \mathbb{Z}$$

$$\pi x \neq k\pi - 2$$



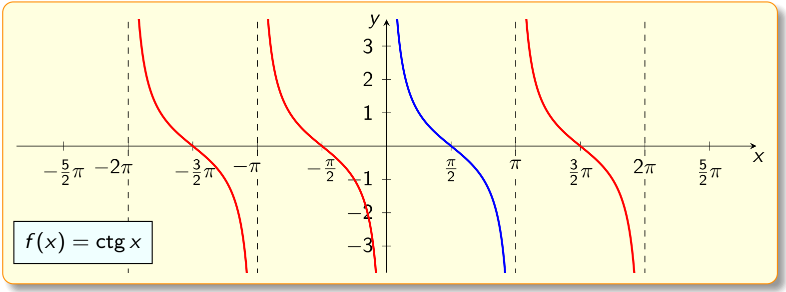
Rješenje

$$h(x) = \operatorname{ctg}(\pi x + 2)$$

a) domena

$$\pi x + 2 \neq k\pi,\ \ k \in \mathbb{Z}$$

$$\pi x \neq k\pi - 2 \,\Big/ : \pi$$



Rješenje

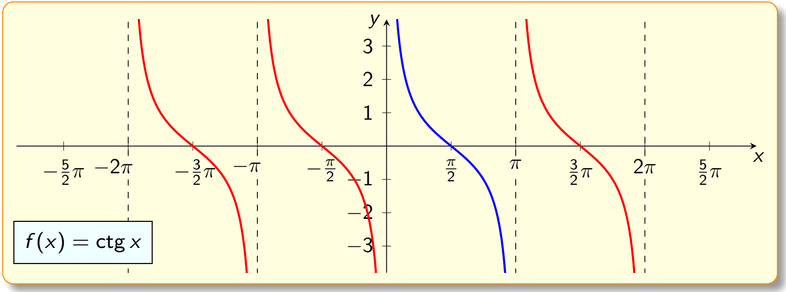
$$h(x) = \operatorname{ctg}(\pi x + 2)$$

a) domena

$$\pi x + 2 \neq k\pi, \;\; k \in \mathbb{Z}$$

$$\pi x \neq k\pi - 2 \,/ : \pi$$

$$x \neq \frac{k\pi - 2}{\pi}$$



Rješenje

$h(x) = \text{ctg}\,(\pi x + 2)$

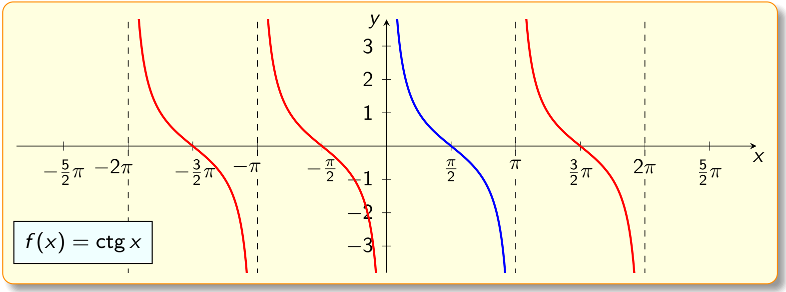
a) domena

$$\pi x + 2 \neq k\pi, \;\; k \in \mathbb{Z}$$

$$\pi x \neq k\pi - 2 \,/ : \pi$$

$$x \neq \frac{k\pi - 2}{\pi}$$

$$x \neq k - \frac{2}{\pi}$$



Rješenje

$h(x) = \text{ctg}\,(\pi x + 2)$

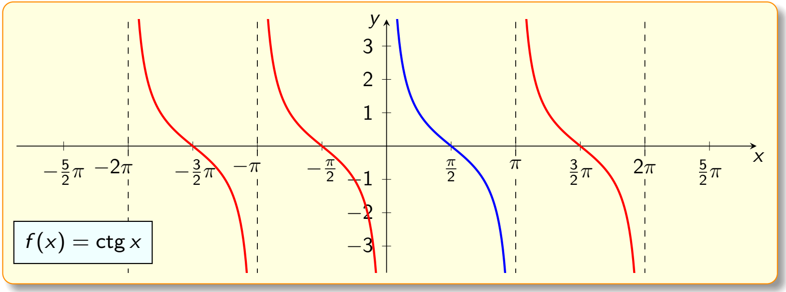
a) domena

$$\pi x + 2 \neq k\pi, \;\; k \in \mathbb{Z}$$

$$\pi x \neq k\pi - 2 \,/ : \pi$$

$$x \neq \frac{k\pi - 2}{\pi}$$

$$x \neq k - \frac{2}{\pi}, \;\; k \in \mathbb{Z}$$



Rješenje

$$\boxed{h(x) = \operatorname{ctg}\left(\pi x + 2\right)}$$

a) domena

$$\pi x + 2 \neq k\pi, \ \ k \in \mathbb{Z}$$

$$\pi x \neq k\pi - 2 \,\Big/ : \pi$$

$$x \neq \frac{k\pi - 2}{\pi}$$

$$x \neq k - \frac{2}{\pi}, \ \ k \in \mathbb{Z}$$

$$D_h = \mathbb{R} \setminus \left\{k - \frac{2}{\pi} : k \in \mathbb{Z}\right\}$$

Rješenje

$$h(x) = \operatorname{ctg}(\pi x + 2)$$

a) domena

$$\pi x + 2 \neq k\pi, \ \ k \in \mathbb{Z}$$

$$\pi x \neq k\pi - 2 \, / : \pi$$

$$x \neq \frac{k\pi - 2}{\pi}$$

$$x \neq k - \frac{2}{\pi}, \ \ k \in \mathbb{Z}$$

$$\boxed{D_h = \mathbb{R} \setminus \left\{ k - \frac{2}{\pi} : k \in \mathbb{Z} \right\}}$$

Rješenje

$\boxed{h(x) = \operatorname{ctg}(\pi x + 2)}$

a) domena

$$\pi x + 2 \neq k\pi, \ \ k \in \mathbb{Z}$$

$$\pi x \neq k\pi - 2 \,/ : \pi$$

$$x \neq \frac{k\pi - 2}{\pi}$$

$$x \neq k - \frac{2}{\pi}, \ \ k \in \mathbb{Z}$$

$$\boxed{D_h = \mathbb{R} \setminus \left\{k - \frac{2}{\pi} : k \in \mathbb{Z}\right\}}$$

ekvivalentni zapis

$$D_h = \bigcup_{k \in \mathbb{Z}} \left\langle k - \frac{2}{\pi}, \, k + 1 - \frac{2}{\pi} \right\rangle$$

Rješenje

$\boxed{h(x) = \text{ctg}\left(\pi x + 2\right)}$

a) domena

$$\pi x + 2 \neq k\pi, \ \ k \in \mathbb{Z}$$

$$\pi x \neq k\pi - 2 \, / : \pi$$

$$x \neq \frac{k\pi - 2}{\pi}$$

$$x \neq k - \frac{2}{\pi}, \ \ k \in \mathbb{Z}$$

$$\boxed{D_h = \mathbb{R} \setminus \left\{k - \frac{2}{\pi} : k \in \mathbb{Z}\right\}}$$

ekvivalentni zapis

$$D_h = \bigcup_{k \in \mathbb{Z}} \left\langle k - \frac{2}{\pi}, \, k + 1 - \frac{2}{\pi} \right\rangle$$

nultočke

Rješenje

$\boxed{h(x) = \operatorname{ctg}(\pi x + 2)}$

a) domena

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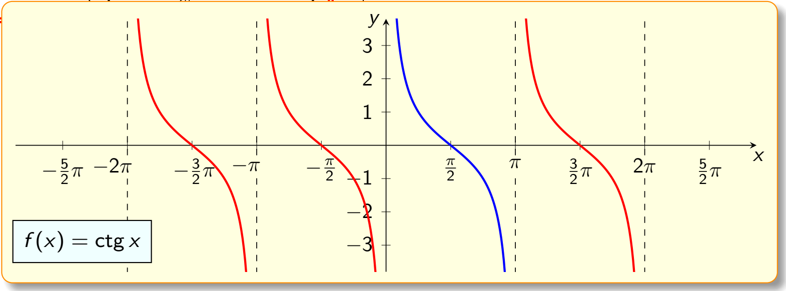

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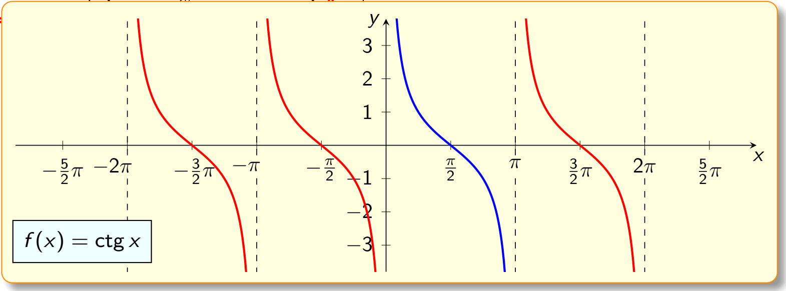

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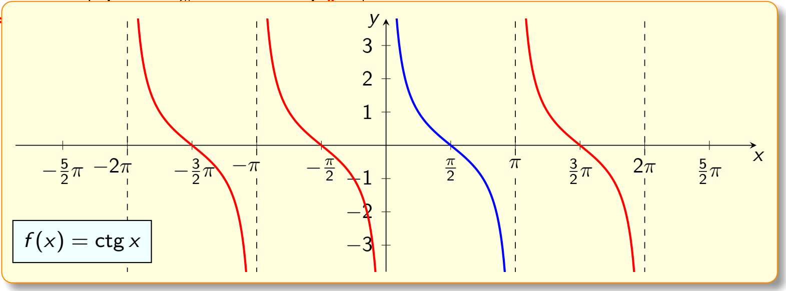

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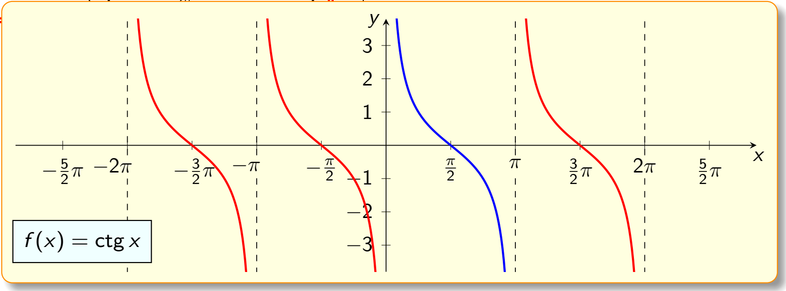

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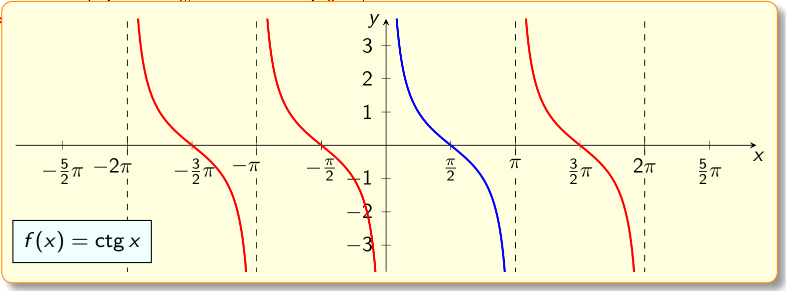

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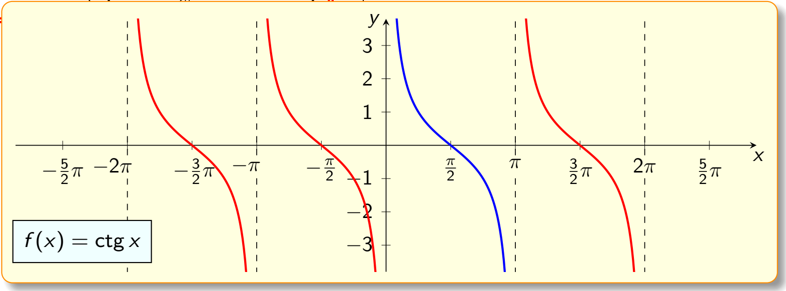

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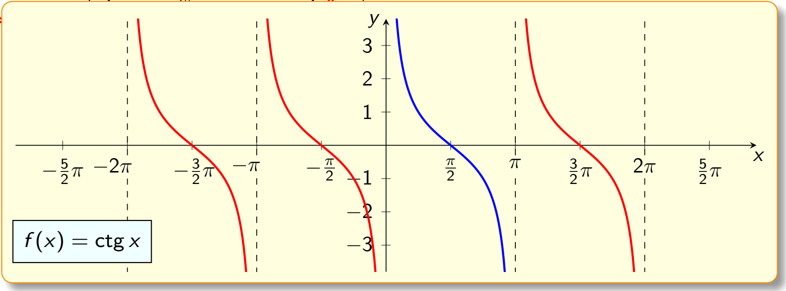

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jesu nultočke

jer pripadaju domeni

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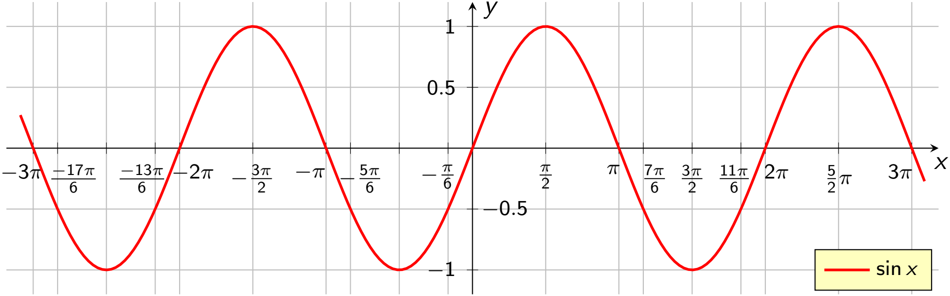

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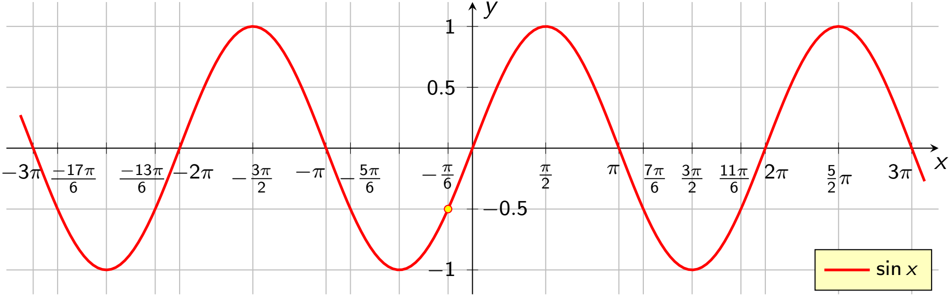

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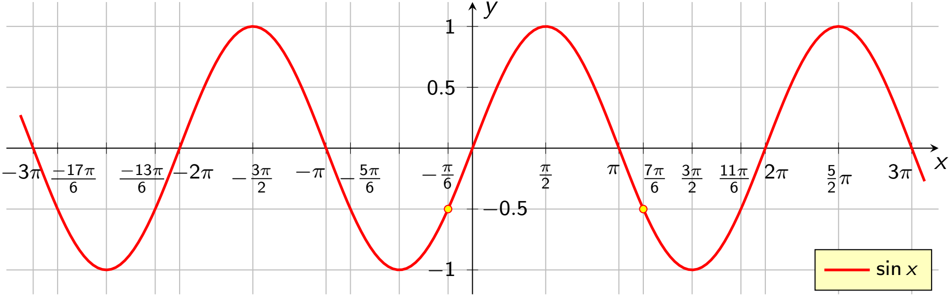

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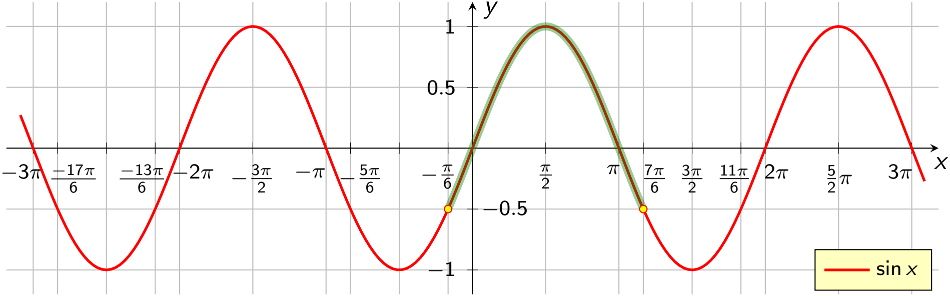

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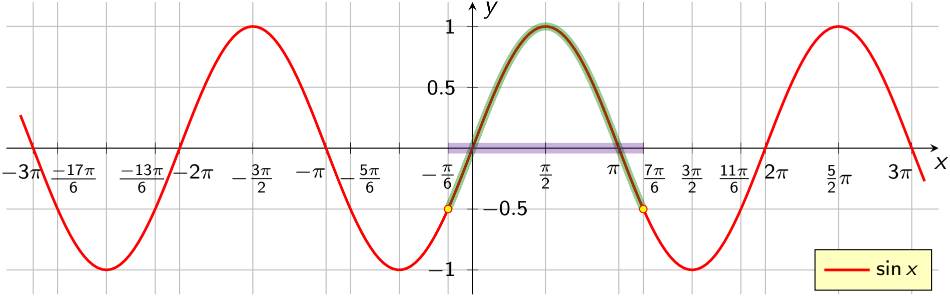

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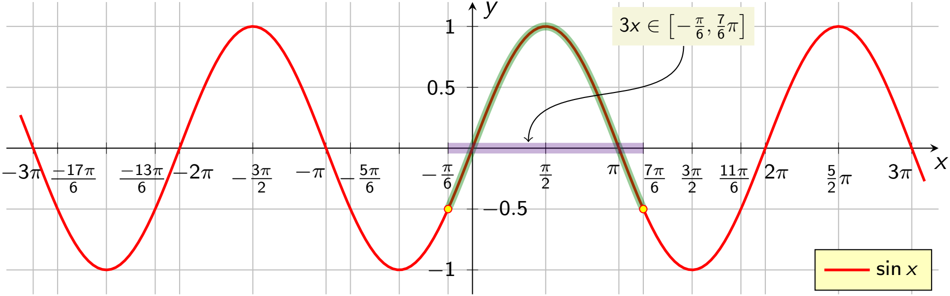

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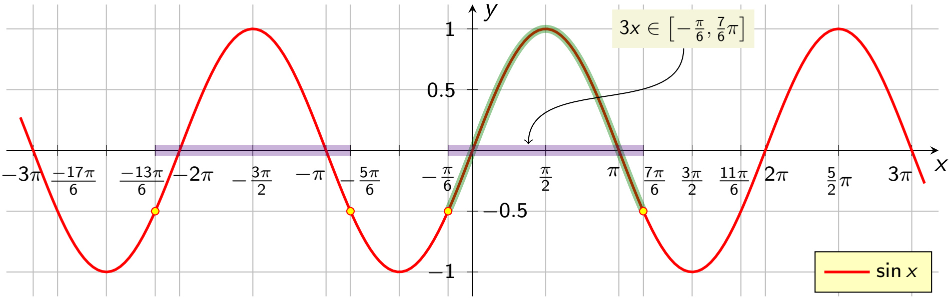

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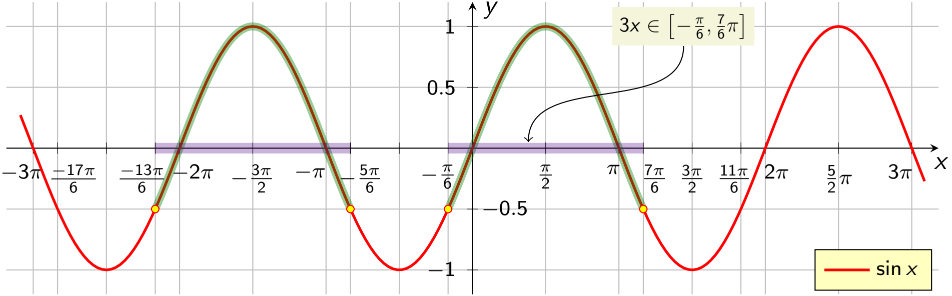

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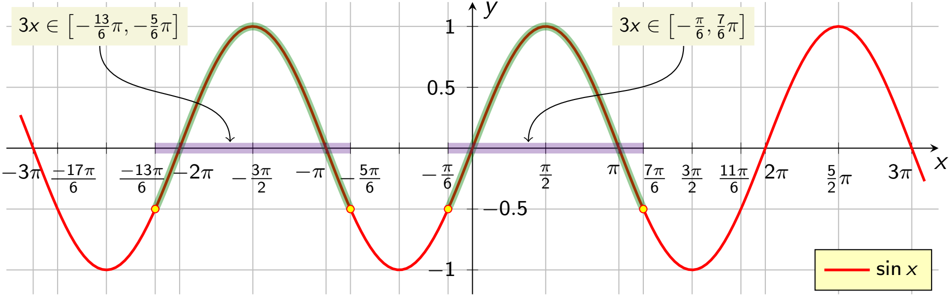

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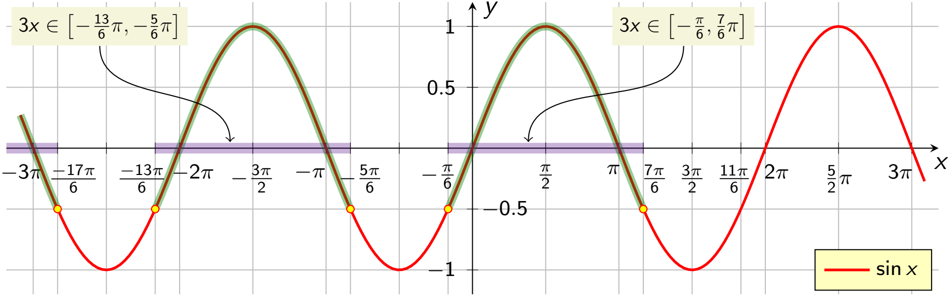

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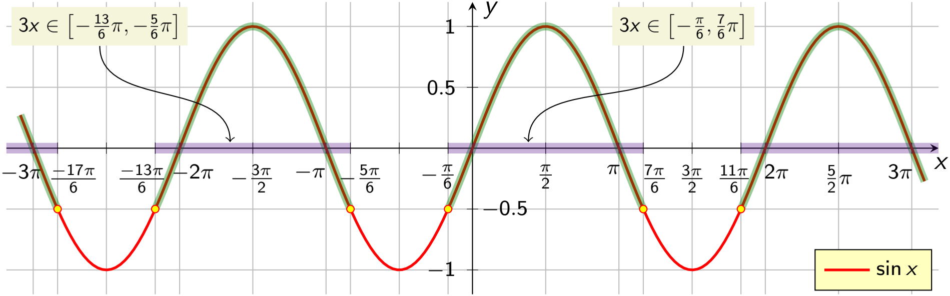

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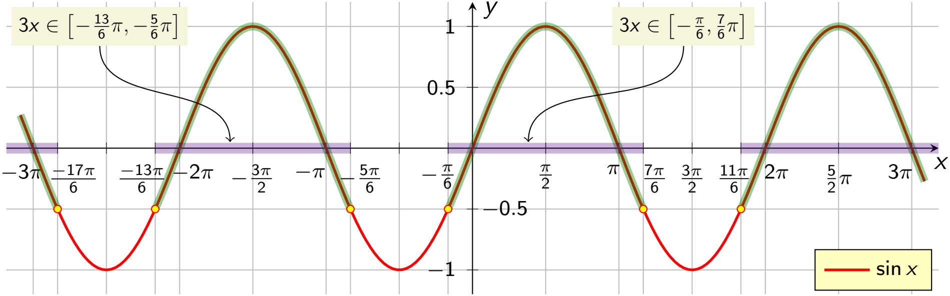

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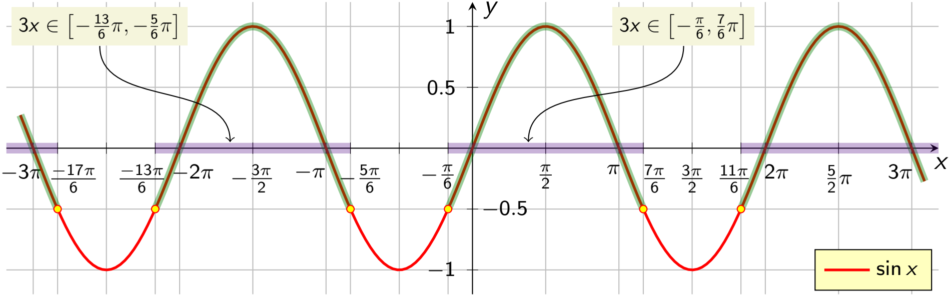

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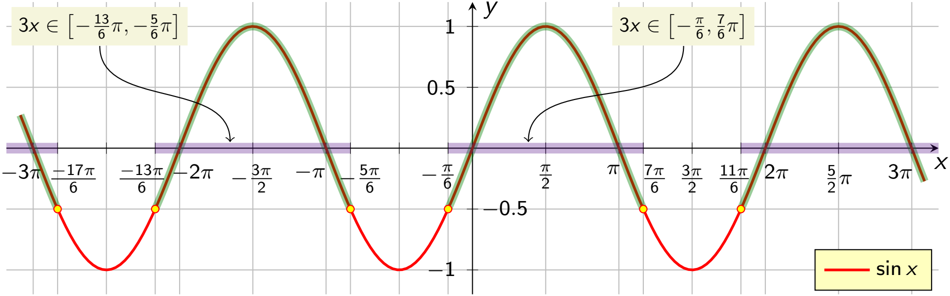

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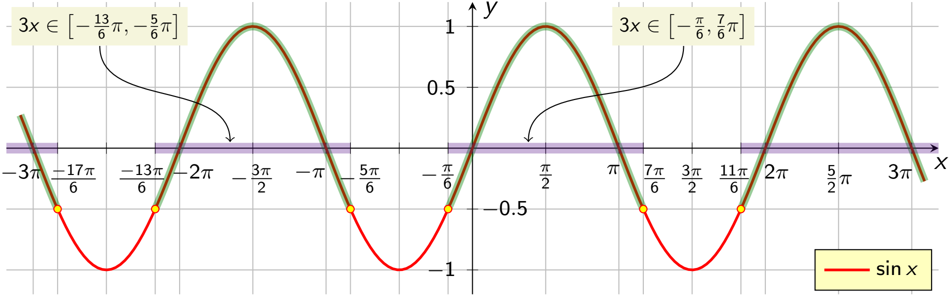

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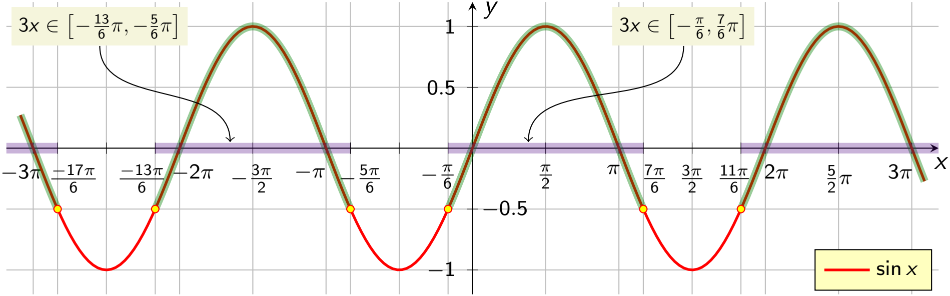

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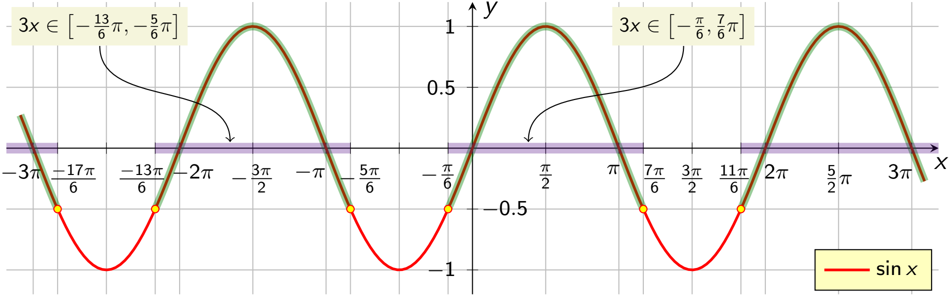

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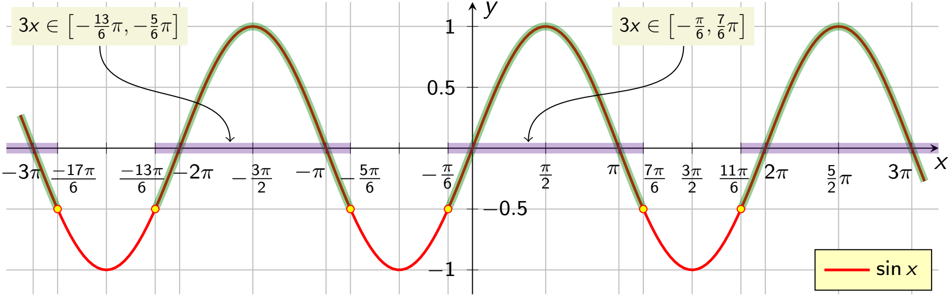

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Domena

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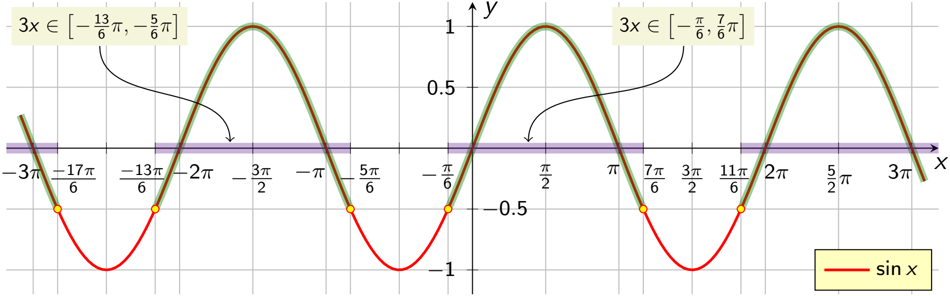

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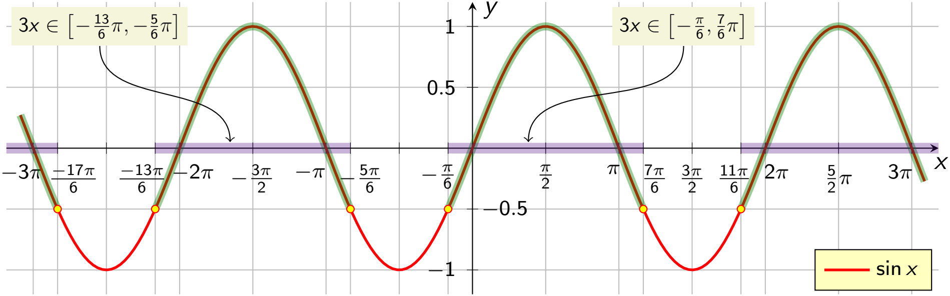

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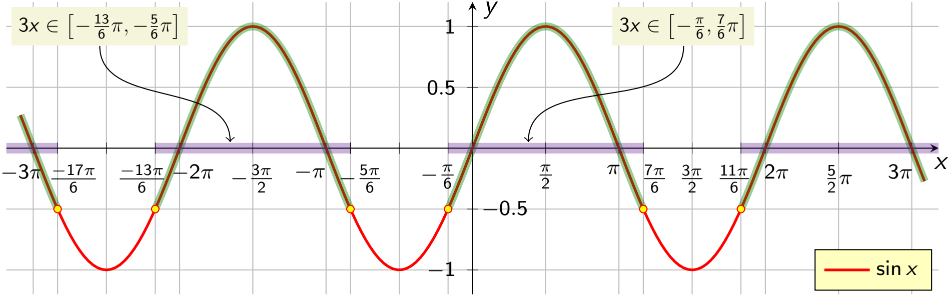

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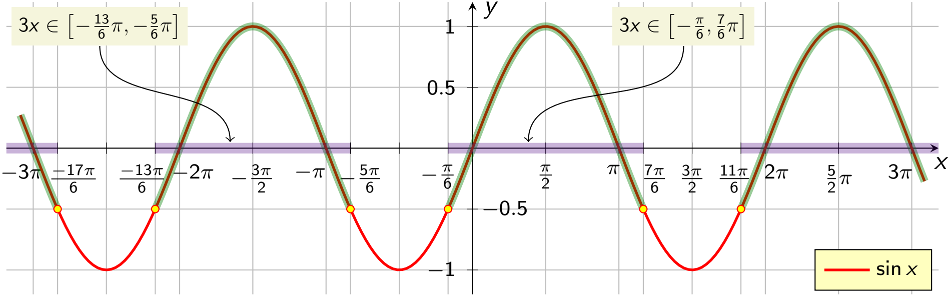

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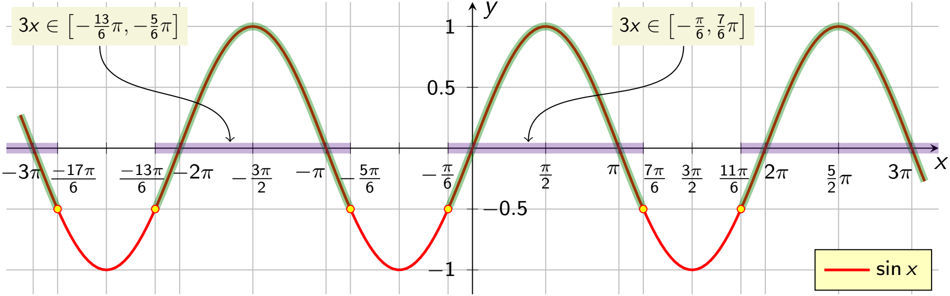

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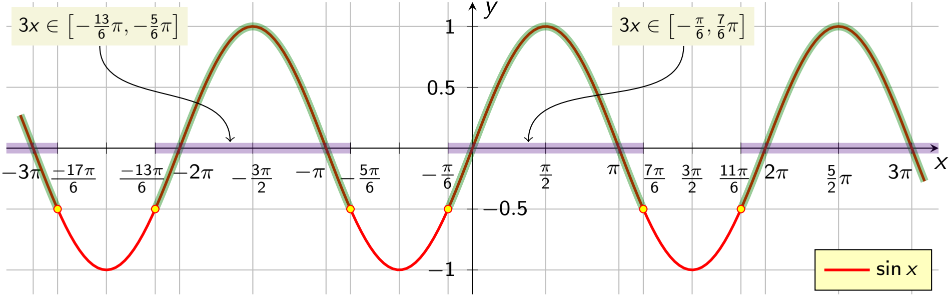

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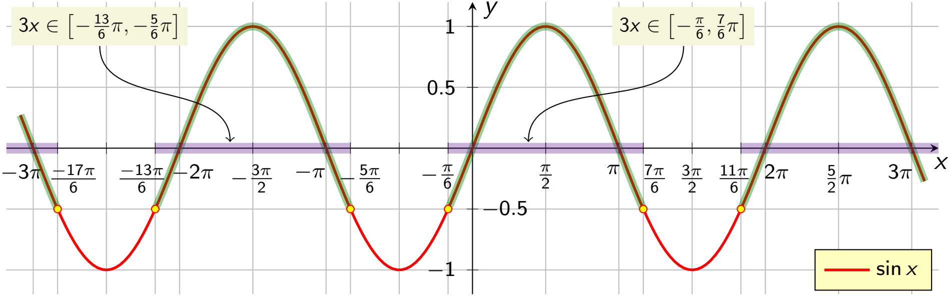

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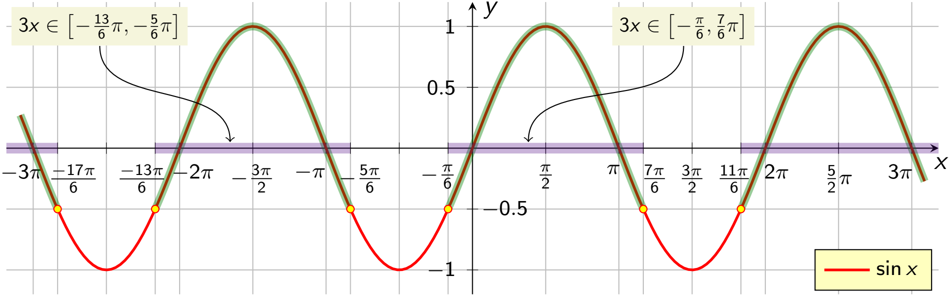

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$$\sin x = a \ \Leftrightarrow \ x = (-1)^k \arcsin a + k\pi,\ \ k \in \mathbb{Z}$$

b) $\arcsin\left(-\frac{1}{2}\right) = -\frac{\pi}{6}$ $\quad \pi - \left(-\frac{\pi}{6}\right) = \frac{7}{6}\pi$

$$f(x) = \sqrt{\sin 3x + \frac{1}{2}}$$

✏ k neparan: $k = 2s + 1$ za neki $s \in \mathbb{Z}$

$$x = \frac{6 \cdot (2s+1) + (-1)^{2s+2}}{18}\pi$$

$$x = \frac{12s + 6 + (-1)^{\text{paran}}}{18}\pi$$

Nultočke

$$\sqrt{\sin 3x + \frac{1}{2}} = 0 \ \Big/^2$$

$$\sin 3x + \frac{1}{2} = 0$$

$$\sin 3x = -\frac{1}{2}$$

$$D_f = \bigcup_{k\in\mathbb{Z}} \left[\frac{12k-1}{18}\pi, \ \frac{12k+7}{18}\pi\right]$$

$$x = \frac{(-1)^{k+1}}{18}\pi + \frac{k\pi}{3}$$

jesu nultočke
jer pripadaju domeni

$$\boxed{x = \frac{6k + (-1)^{k+1}}{18}\pi, \ \ k \in \mathbb{Z}}$$

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Nultočke

$$\sqrt{\sin 3x + \frac{1}{2}} = 0 \;\Big/^2$$

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✏ k neparan: $k = 2s + 1$ za neki $s \in \mathbb{Z}$

$$x = \frac{6 \cdot (2s+1) + (-1)^{2s+2}}{18}\pi$$

$$x = \frac{12s + 6 + (-1)^{\text{paran}}}{18}\pi$$

$$x = \frac{12s + 7}{18}\pi$$

$$D_f = \bigcup_{k\in\mathbb{Z}} \left[\frac{12k-1}{18}\pi,\ \frac{12k+7}{18}\pi\right]$$

$$x = \frac{(-1)^{k+1}}{18}\pi + \frac{k\pi}{3}$$

jesu nultočke
jer pripadaju domeni

$$\boxed{x = \frac{6k + (-1)^{k+1}}{18}\pi,\ \ k \in \mathbb{Z}}$$

$$\sin x = a \;\Leftrightarrow\; x = (-1)^k \arcsin a + k\pi,\ \ k \in \mathbb{Z}$$

b) $\arcsin\left(-\frac{1}{2}\right) = -\frac{\pi}{6}$ $\qquad \pi - \left(-\frac{\pi}{6}\right) = \frac{7}{6}\pi$

$$f(x) = \sqrt{\sin 3x + \frac{1}{2}}$$

Nultočke

$$\sqrt{\sin 3x + \frac{1}{2}} = 0 \quad /^2$$

$$\sin 3x + \frac{1}{2} = 0$$

$$\sin 3x = -\frac{1}{2}$$

✏ k neparan: $k = 2s + 1$ za neki $s \in \mathbb{Z}$

$$x = \frac{6 \cdot (2s+1) + (-1)^{2s+2}}{18}\pi$$

$$x = \frac{12s + 6 + (-1)^{\text{paran}}}{18}\pi$$

$$x = \frac{12s+7}{18}\pi$$

$$D_f = \bigcup_{k\in\mathbb{Z}} \left[\frac{12k-1}{18}\pi, \boxed{\frac{12k+7}{18}\pi}\right]$$

$$x = \frac{(-1)^{k+1}}{18}\pi + \frac{k\pi}{3}$$

jesu nultočke

jer pripadaju domeni

$$\boxed{x = \frac{6k + (-1)^{k+1}}{18}\pi, \ k \in \mathbb{Z}}$$

$$\sin x = a \iff x = (-1)^k \arcsin a + k\pi, \ k \in \mathbb{Z}$$

b) $\arcsin\left(-\frac{1}{2}\right) = -\frac{\pi}{6}$ $\qquad \pi - \left(-\frac{\pi}{6}\right) = \frac{7}{6}\pi$

$$f(x) = \sqrt{\sin 3x + \frac{1}{2}}$$

Nultočke

$$\sqrt{\sin 3x + \frac{1}{2}} = 0 \ \Big/^2$$

$$\sin 3x + \frac{1}{2} = 0$$

$$\sin 3x = -\frac{1}{2}$$

$$3x = (-1)^k \arcsin\left(-\frac{1}{2}\right) + k\pi \ \Big/ : 3$$

$$x = \frac{(-1)^k}{3} \cdot \frac{-\pi}{6} + \frac{k\pi}{3}$$

$$x = \frac{(-1)^k \cdot (-1) \cdot \pi}{18} + \frac{k\pi}{3}$$

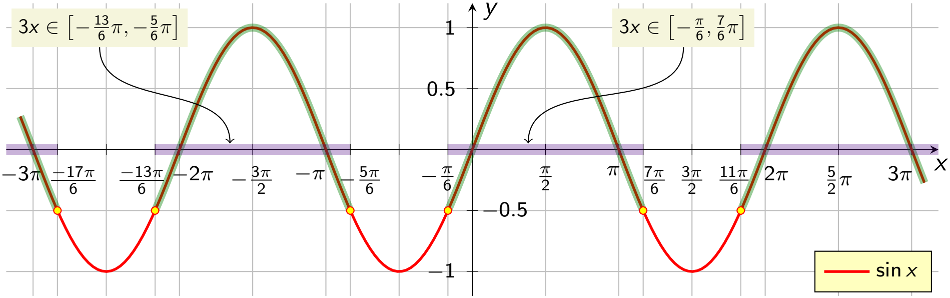
$$x = \frac{(-1)^{k+1}}{18}\pi + \frac{k\pi}{3}$$

$$\boxed{x = \frac{6k + (-1)^{k+1}}{18}\pi, \ k \in \mathbb{Z}}$$

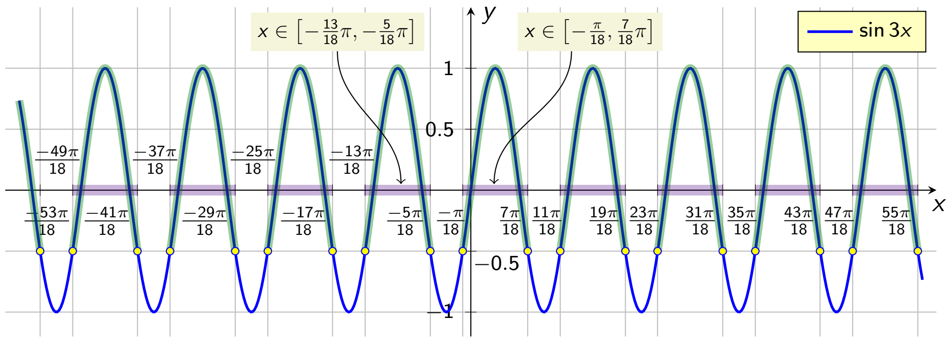
$$D_f = \bigcup_{k\in\mathbb{Z}} \left[\frac{12k-1}{18}\pi, \ \frac{12k+7}{18}\pi\right]$$

jesu nultočke
jer pripadaju domeni

$$\sin x = a \ \Leftrightarrow \ x = (-1)^k \arcsin a + k\pi, \ k \in \mathbb{Z}$$



$3x \in \left[-\frac{13}{6}\pi, -\frac{5}{6}\pi\right]$
$3x \in \left[-\frac{\pi}{6}, \frac{7}{6}\pi\right]$
$\sin x$



$x \in \left[-\frac{13}{18}\pi, -\frac{5}{18}\pi\right]$
$x \in \left[-\frac{\pi}{18}, \frac{7}{18}\pi\right]$
$\sin 3x$

c) Domena

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

c) $\boxed{\text{Domena}}$ ✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

$$\boxed{g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}}$$

c) $\boxed{\text{Domena}}$

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

domena funkcije arccos
je segment $[-1, 1]$

c) $\boxed{\text{Domena}}$

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

domena funkcije arccos
je segment $[-1, 1]$

$$\boxed{g(x) = \frac{\arccos(x^2 - 3)}{x - 2}}$$

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✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

c) $\boxed{\text{Domena}}$

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

domena funkcije arccos

je segment $[-1, 1]$

zbog

nazivnika

$x \neq 2$

c) Domena

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

$$\boxed{x \neq 2}$$

c) Domena

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

$$\boxed{x \neq 2}$$

$$x^2 - 3 \geqslant -1$$

c) Domena

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

$$x^2 - 3 \geqslant -1$$

$$x^2 - 3 + 1 \geqslant 0$$

$$\boxed{x \neq 2}$$

c) Domena

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$

$$\boxed{x \neq 2}$$

c) Domena

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

$$g(x) = \frac{\arccos(x^2-3)}{x-2}$$

domena funkcije arccos

je segment $[-1, 1]$

zbog

nazivnika

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$\boxed{x \neq 2}$$

c) Domena ✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$

$$\boxed{x \neq 2}$$

c) Domena

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

domena funkcije arccos

je segment $[-1, 1]$

zbog

nazivnika

$$\boxed{x \neq 2}$$

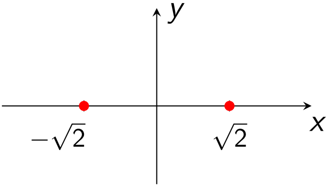
$$x^2 - 3 \geqslant -1$$

$$x^2 - 3 + 1 \geqslant 0$$

$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



c) Domena

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✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

domena funkcije arccos je segment $[-1, 1]$

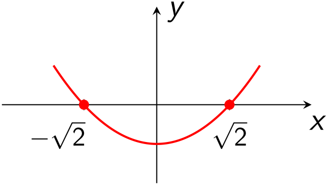
zbog nazivnika

$$\boxed{x \neq 2}$$

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



c) Domena

$$g(x) = \frac{\arccos(x^2-3)}{x-2}$$

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

domena funkcije arccos je segment $[-1, 1]$

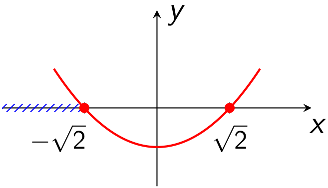
zbog nazivnika

$\boxed{x \neq 2}$

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



c) Domena

$$g(x) = \frac{\arccos\left(x^2-3\right)}{x-2}$$

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

domena funkcije arccos je segment $[-1, 1]$

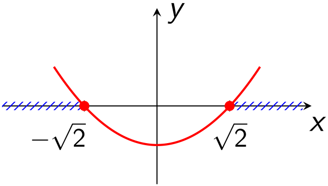
zbog nazivnika

$\boxed{x \neq 2}$

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



c) **Domena**

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

$$\boxed{x \neq 2}$$

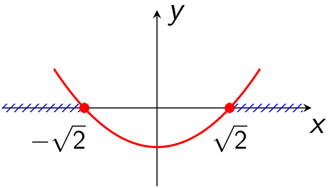
$$x^2 - 3 \geqslant -1$$

$$x^2 - 3 + 1 \geqslant 0$$

$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



$$x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle$$

c) Domena

$$g(x) = \frac{\arccos\left(x^2-3\right)}{x-2}$$

- $x^2 - 3 \geqslant -1$
- $x^2 - 3 \leqslant 1$
- $x - 2 \neq 0$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

$$\boxed{x \neq 2}$$

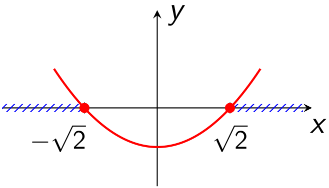
$$x^2 - 3 \geqslant -1$$

$$x^2 - 3 + 1 \geqslant 0$$

$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



$$\boxed{x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle}$$

c) Domena

$$g(x) = \frac{\arccos\left(x^2-3\right)}{x-2}$$

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

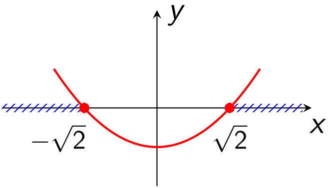
✏ $x - 2 \neq 0$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

$\boxed{x \neq 2}$

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$
$$x^2 - 2 = 0$$
$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



$$\boxed{x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle}$$

$$x^2 - 3 \leqslant 1$$

c) Domena

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

domena funkcije arccos je segment $[-1, 1]$

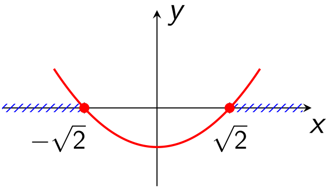
zbog nazivnika

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



$$\boxed{x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle}$$

$$\boxed{x \neq 2}$$

$$x^2 - 3 \leqslant 1$$
$$x^2 - 3 - 1 \leqslant 0$$

c) Domena

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

domena funkcije arccos
je segment $[-1, 1]$

zbog
nazivnika

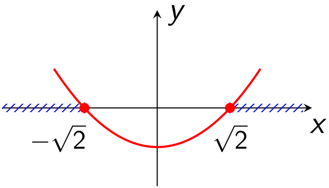
$$\boxed{x \neq 2}$$

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$

$$x^2 - 3 \leqslant 1$$
$$x^2 - 3 - 1 \leqslant 0$$
$$x^2 - 4 \leqslant 0$$



$$\boxed{x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle}$$

c) Domena

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

- $x^2 - 3 \geqslant -1$
- $x^2 - 3 \leqslant 1$
- $x - 2 \neq 0$

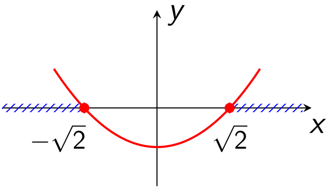
domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$

$$x^2 - 2 = 0$$

$$x_1 = -\sqrt{2},\; x_2 = \sqrt{2}$$



$$\boxed{x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle}$$

$$\boxed{x \neq 2}$$

$$x^2 - 3 \leqslant 1$$
$$x^2 - 3 - 1 \leqslant 0$$
$$x^2 - 4 \leqslant 0$$

$$x^2 - 4 = 0$$

c) Domena

✏ $x^2-3 \geqslant -1$

✏ $x^2-3 \leqslant 1$

✏ $x-2 \neq 0$

$$g(x)=\frac{\arccos\left(x^2-3\right)}{x-2}$$

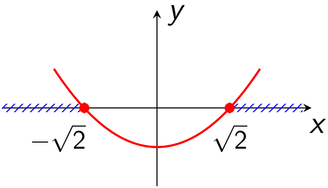
domena funkcije arccos je segment $[-1,1]$

zbog nazivnika

$$\boxed{x \neq 2}$$

$$x^2-3 \geqslant -1$$
$$x^2-3+1 \geqslant 0$$
$$x^2-2 \geqslant 0$$
$$x^2-2=0$$
$$x_1=-\sqrt{2},\ x_2=\sqrt{2}$$

$$x^2-3 \leqslant 1$$
$$x^2-3-1 \leqslant 0$$
$$x^2-4 \leqslant 0$$
$$x^2-4=0$$
$$x_1=-2,\ x_2=2$$



$$\boxed{x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle}$$

c) **Domena**

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

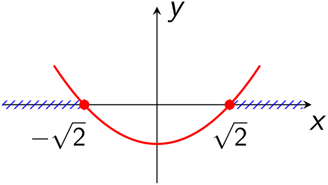
✏ $x - 2 \neq 0$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

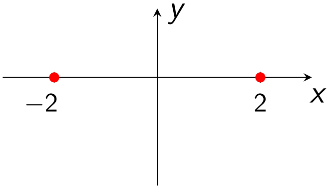
$$\boxed{x \neq 2}$$

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$
$$x^2 - 2 = 0$$
$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



$$x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle$$

$$x^2 - 3 \leqslant 1$$
$$x^2 - 3 - 1 \leqslant 0$$
$$x^2 - 4 \leqslant 0$$
$$x^2 - 4 = 0$$
$$x_1 = -2,\ x_2 = 2$$



c) Domena

$$g(x) = \frac{\arccos\left(x^2-3\right)}{x-2}$$

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

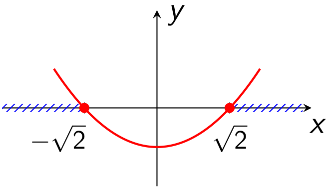
✏ $x - 2 \neq 0$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

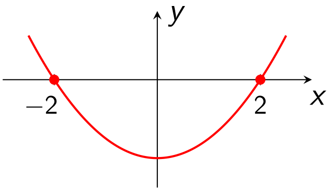
$$\boxed{x \neq 2}$$

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$
$$x^2 - 2 = 0$$
$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



$$\boxed{x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle}$$

$$x^2 - 3 \leqslant 1$$
$$x^2 - 3 - 1 \leqslant 0$$
$$x^2 - 4 \leqslant 0$$
$$x^2 - 4 = 0$$
$$x_1 = -2,\ x_2 = 2$$



c) Domena

✏ $x^2 - 3 \geqslant -1$

✏ $x^2 - 3 \leqslant 1$

✏ $x - 2 \neq 0$

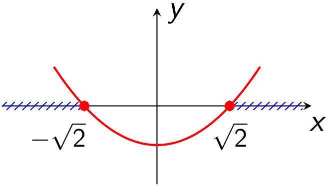
$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

domena funkcije arccos je segment $[-1, 1]$

zbog nazivnika

$$\boxed{x \neq 2}$$

$$x^2 - 3 \geqslant -1$$
$$x^2 - 3 + 1 \geqslant 0$$
$$x^2 - 2 \geqslant 0$$
$$x^2 - 2 = 0$$
$$x_1 = -\sqrt{2},\ x_2 = \sqrt{2}$$



$$x^2 - 3 \leqslant 1$$
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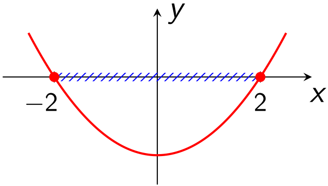

$$\boxed{x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle}$$

c) Domena

$$g(x) = \frac{\arccos\left(x^2 - 3\right)}{x - 2}$$

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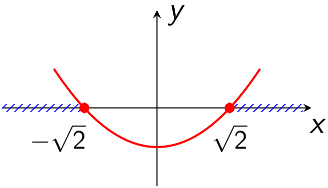

$$\boxed{x \in \left\langle -\infty, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, +\infty\right\rangle}$$

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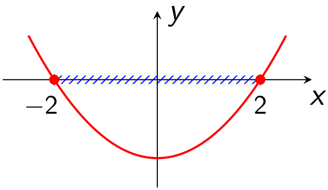

$$x \in [-2, 2]$$

c) **Domena**

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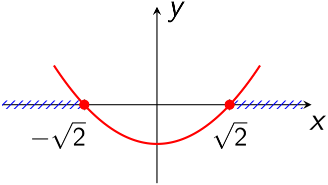

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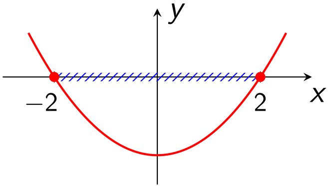

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c) Domena

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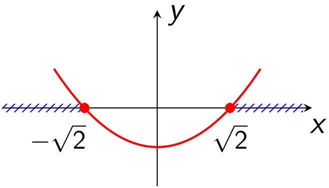

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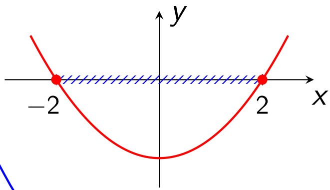

presjek
rješenja

$$\boxed{x \in \langle -\infty, -\sqrt{2}\,] \cup [\,\sqrt{2}, +\infty\rangle}$$

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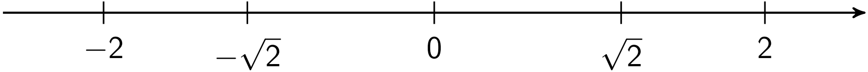

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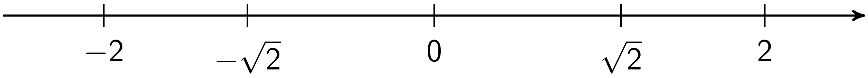

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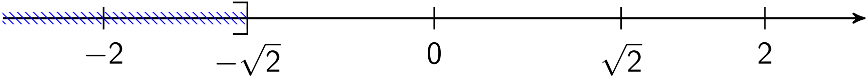

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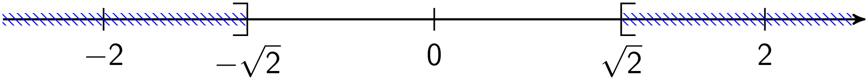

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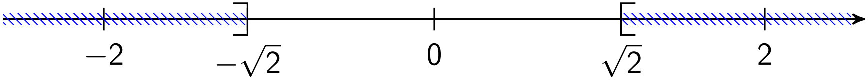

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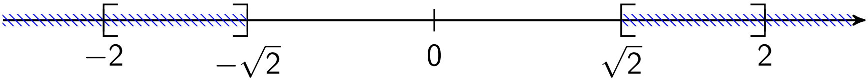

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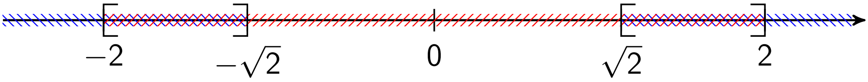

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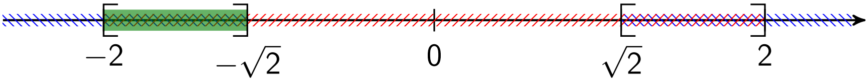

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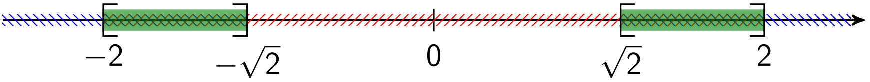

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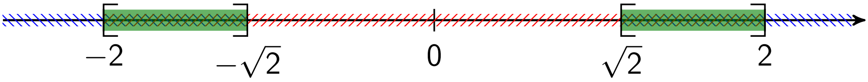

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$] \xrightarrow{\text{zamjena}} \rangle$

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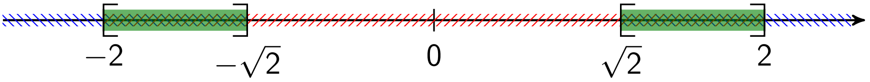

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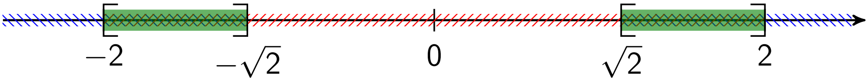

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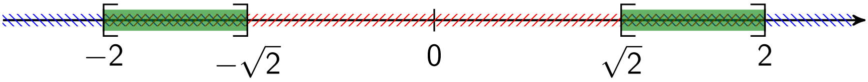

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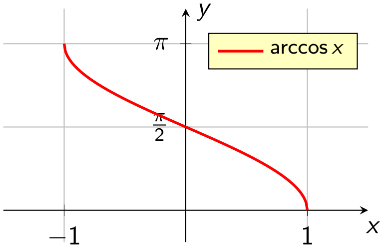

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$$\arccos x = 0 \quad \Leftrightarrow \quad x = 1$$

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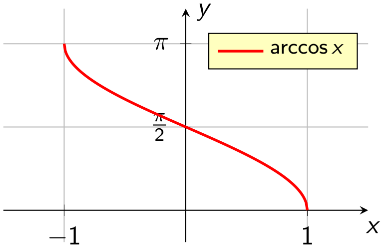

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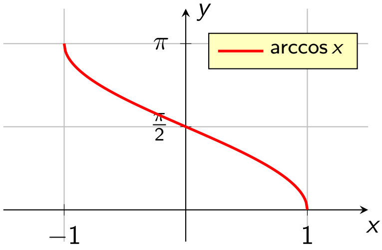

c) $\boxed{\text{Nultočke}}$

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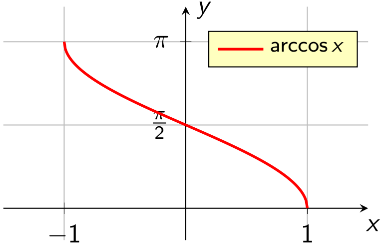

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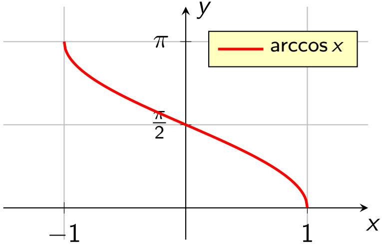

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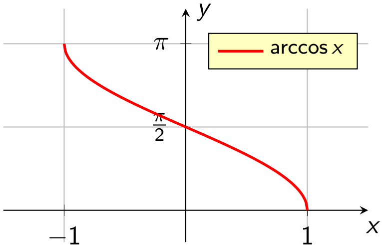

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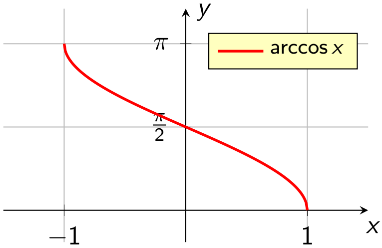

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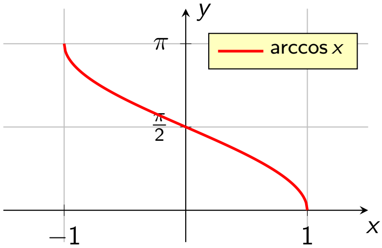

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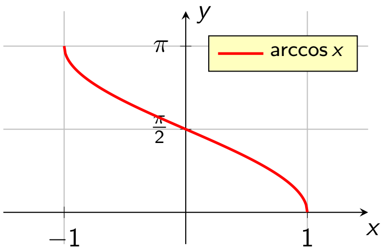

jest nultočka jer pripada domeni

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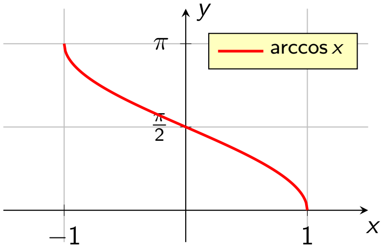

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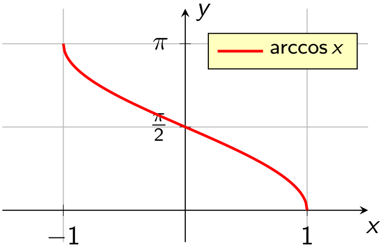

$$\boxed{x_1 = -2} \qquad \cancel{x_2 = 2}$$

jest nultočka jer pripada domeni

nije nultočka jer ne pripada domeni

$$D_g = x \in \left[-2, -\sqrt{2}\,\right] \cup \left[\sqrt{2}, 2\right\rangle$$