2.8 ÉQUATIONS TRIGONOMÉTRIQUES

cours 20

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Sont des équations trigonométriques

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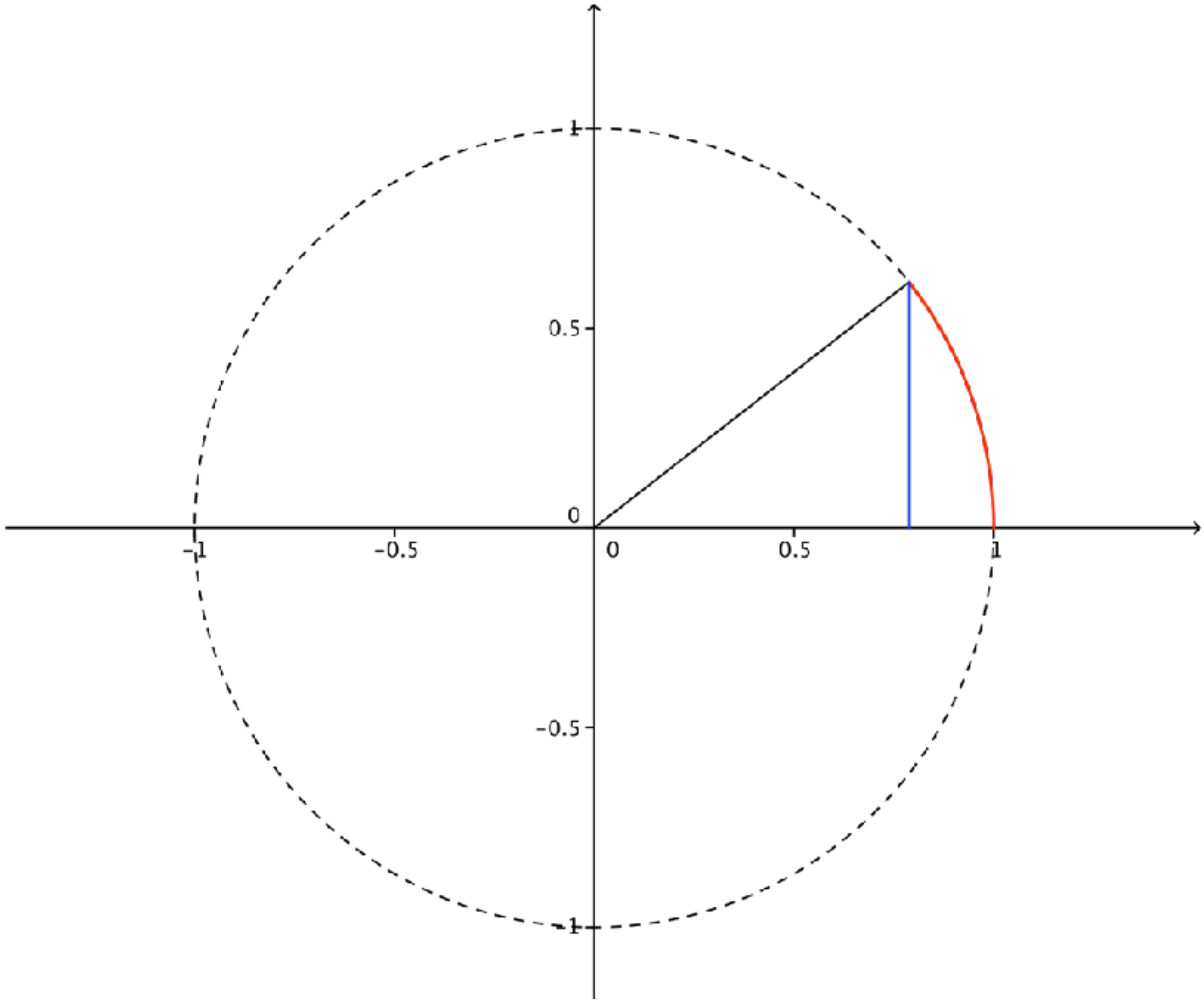
On doit donc essayer de comprendre comment inverser le processus nous permettant de trouver les rapports trigonométriques.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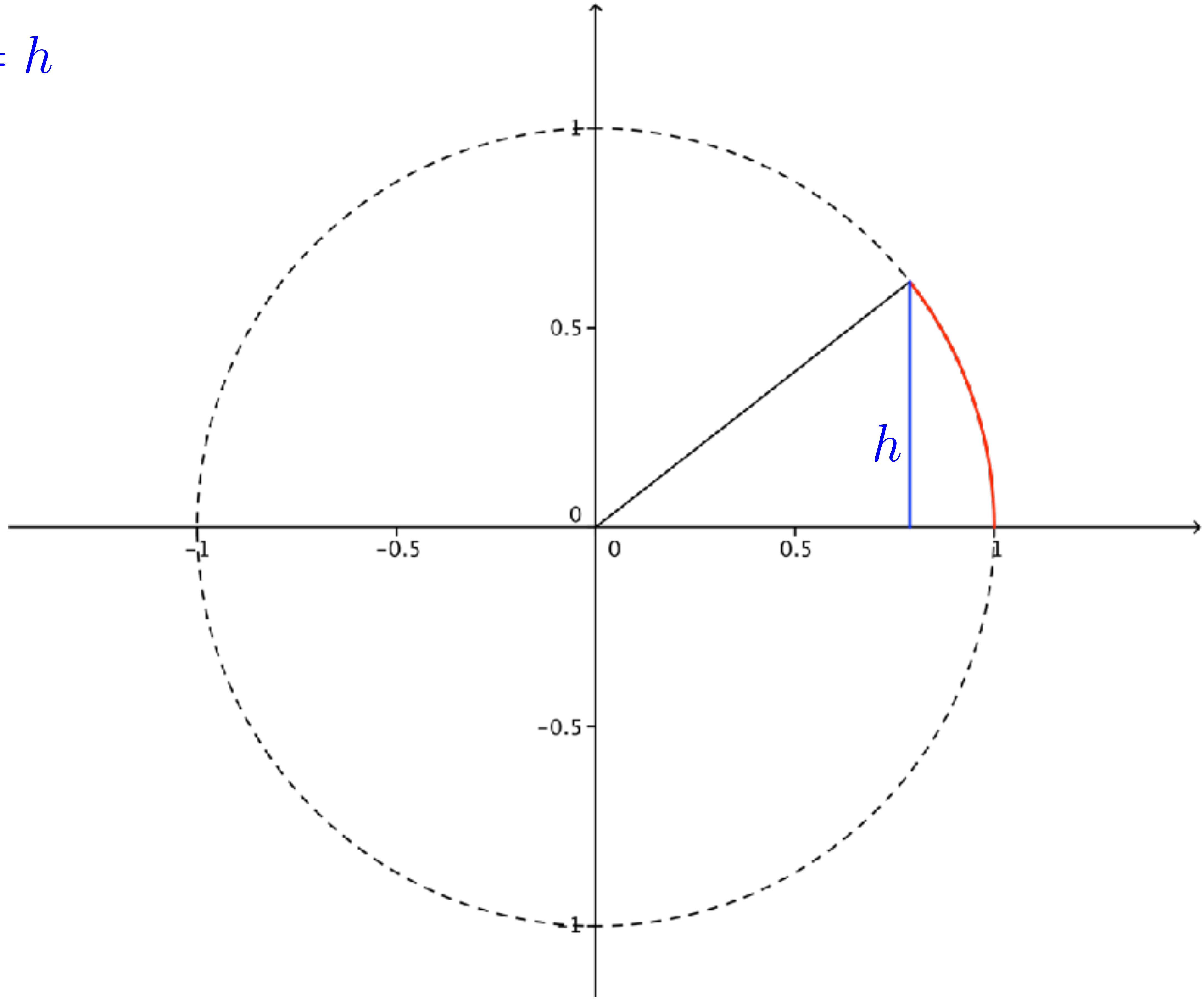
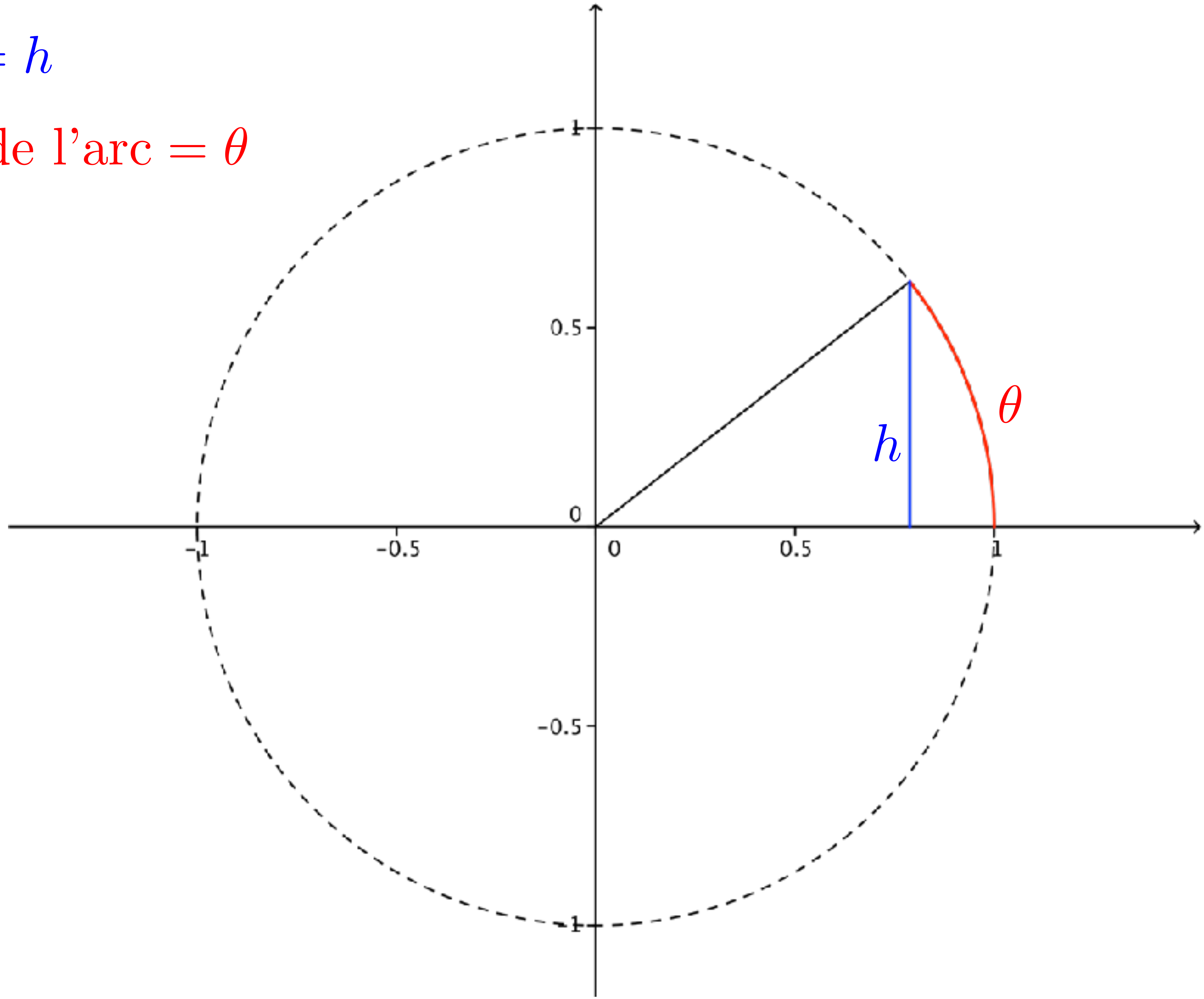
hauteur $= h$



hauteur = h

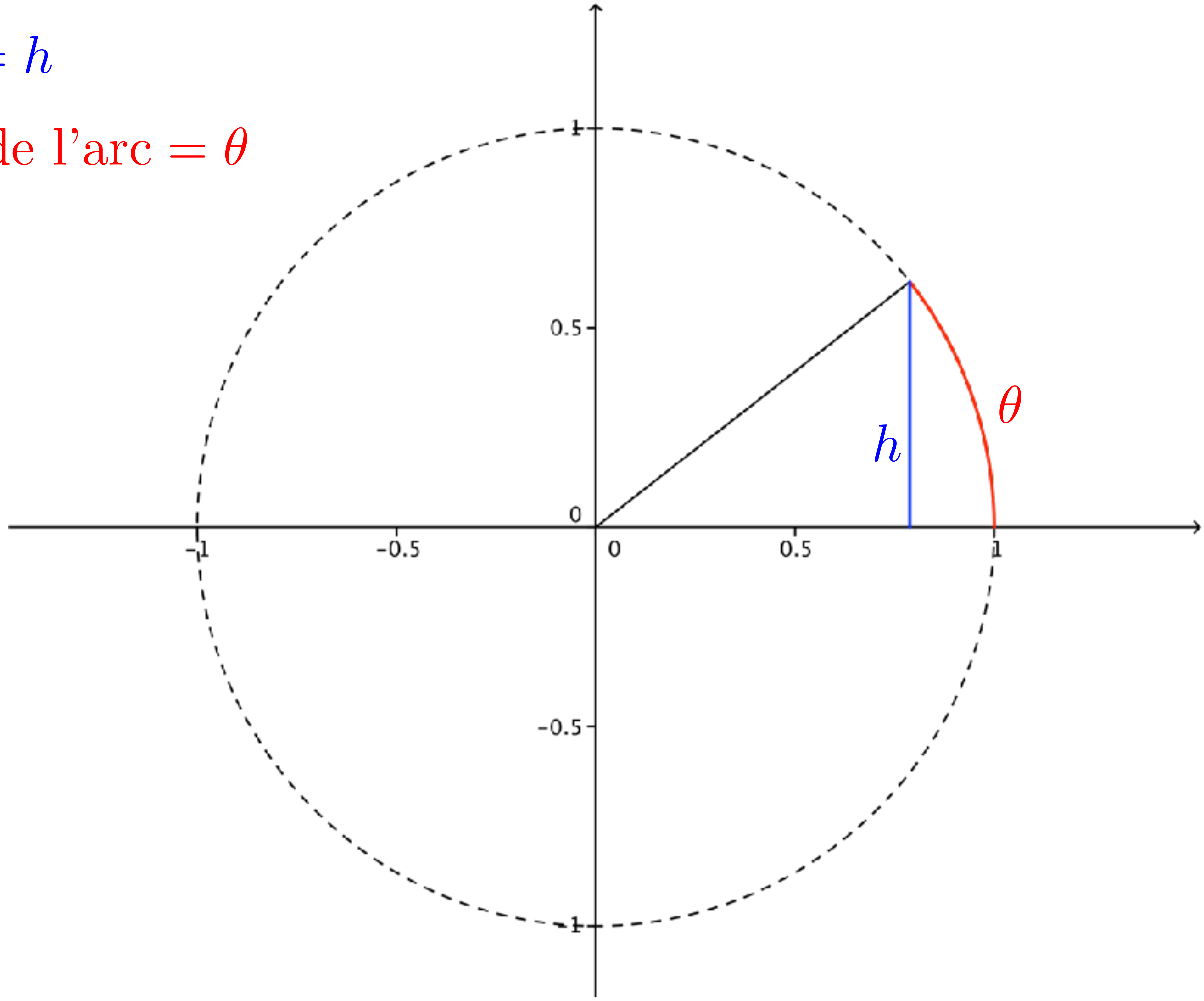
longueur de l'arc = θ



hauteur $= h$

longueur de l'arc $= \theta$

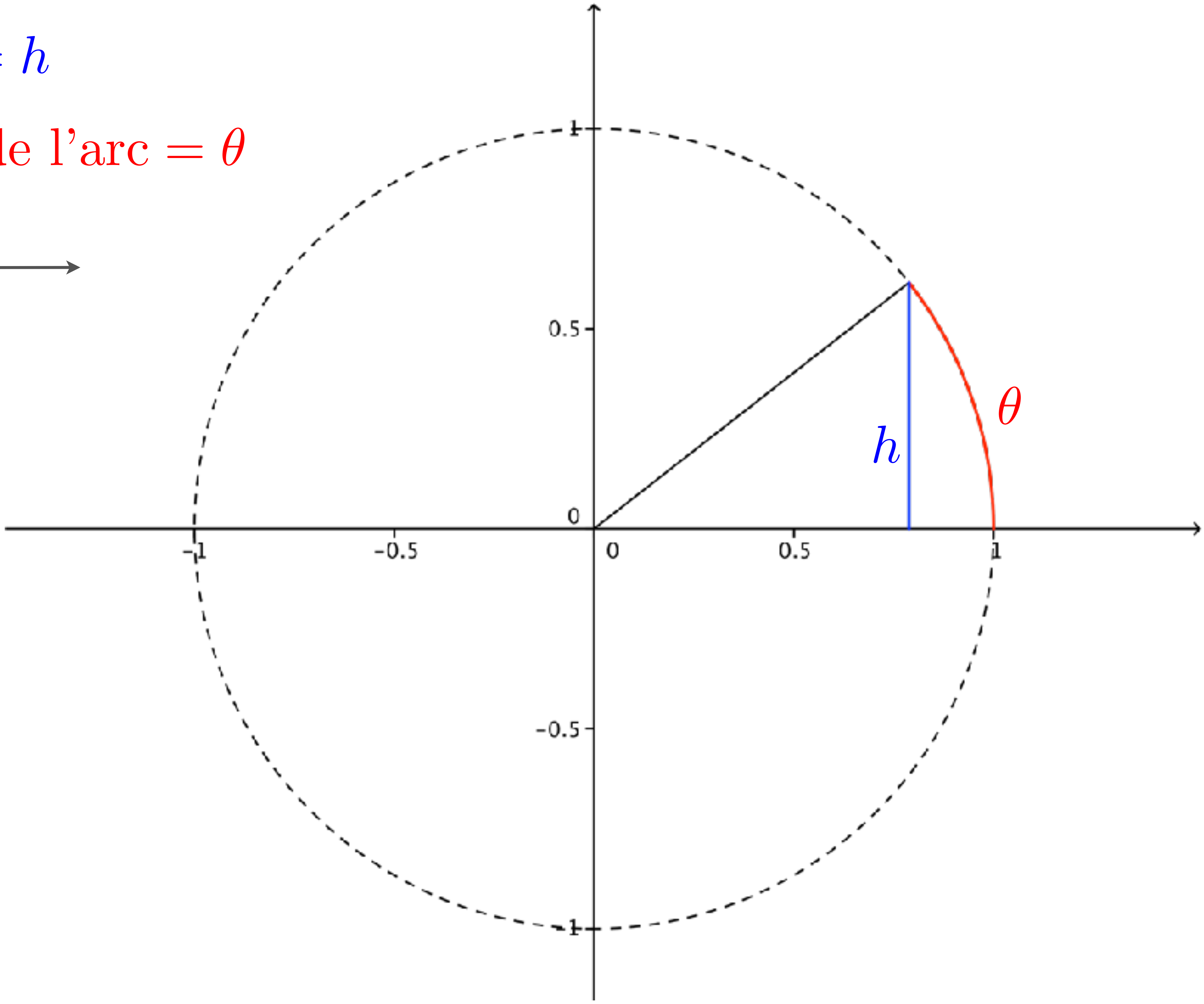
θ



$\color{blue}{\text{hauteur} = h}$

$\color{red}{\text{longueur de l'arc} = \theta}$

$$\theta \xrightarrow{\ \sin\ } h$$



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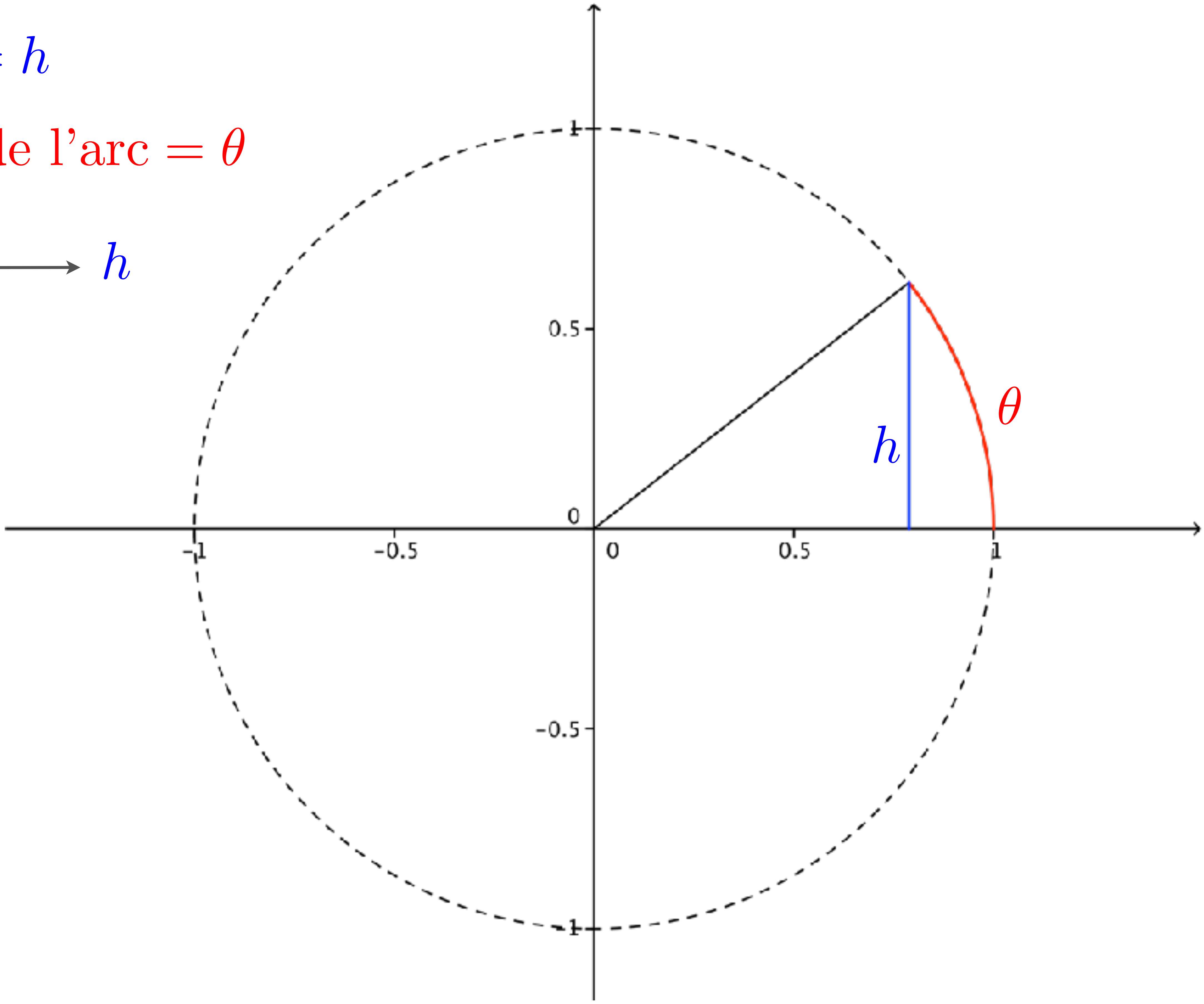
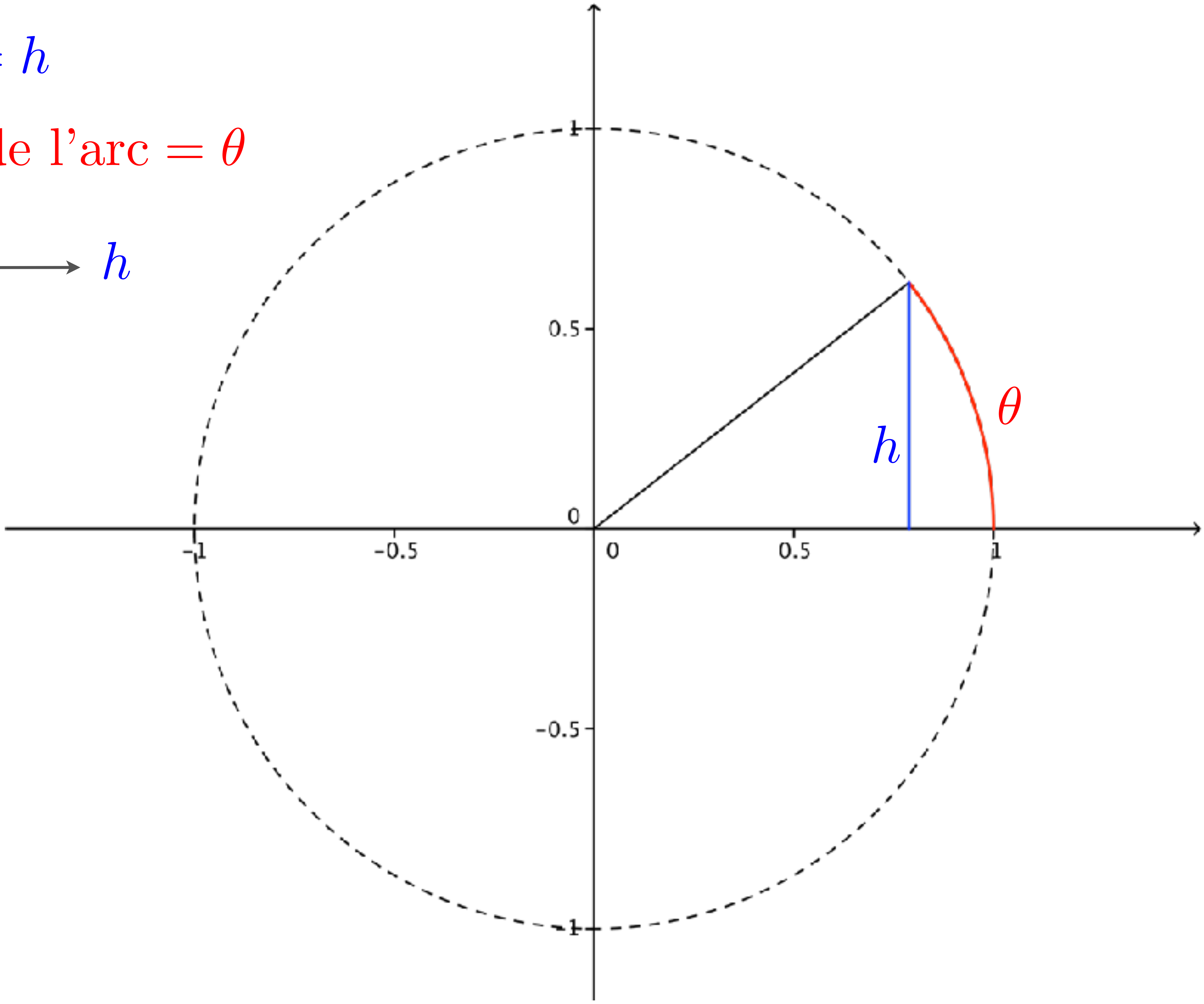


hauteur $= h$

longueur de l'arc $= \theta$

$$\theta \xrightarrow{\sin} h$$

h

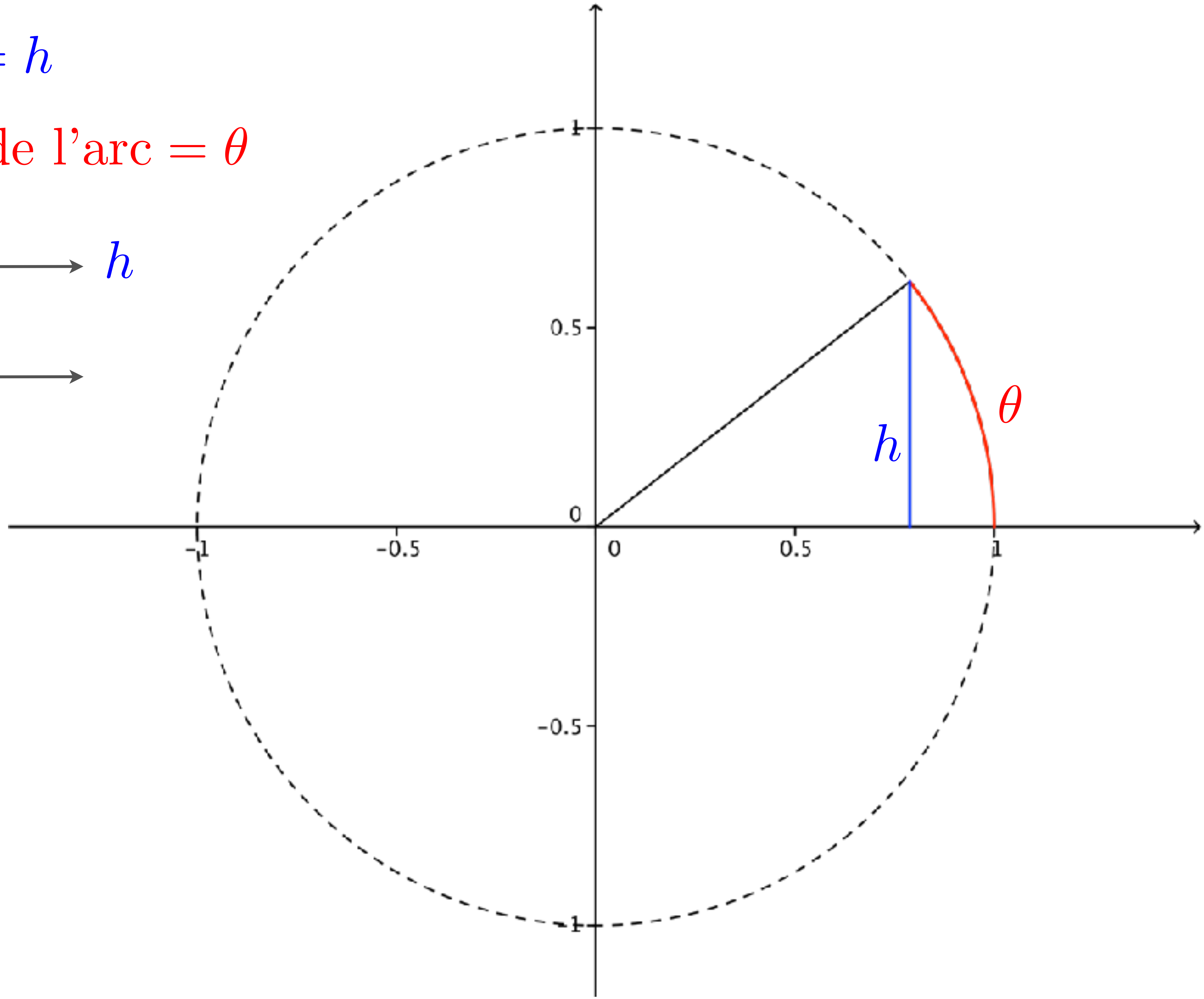


hauteur $= h$

longueur de l'arc $= \theta$

$$\theta \xrightarrow{\ \sin\ } h$$

$$h \xrightarrow{\ \arcsin\ }$$

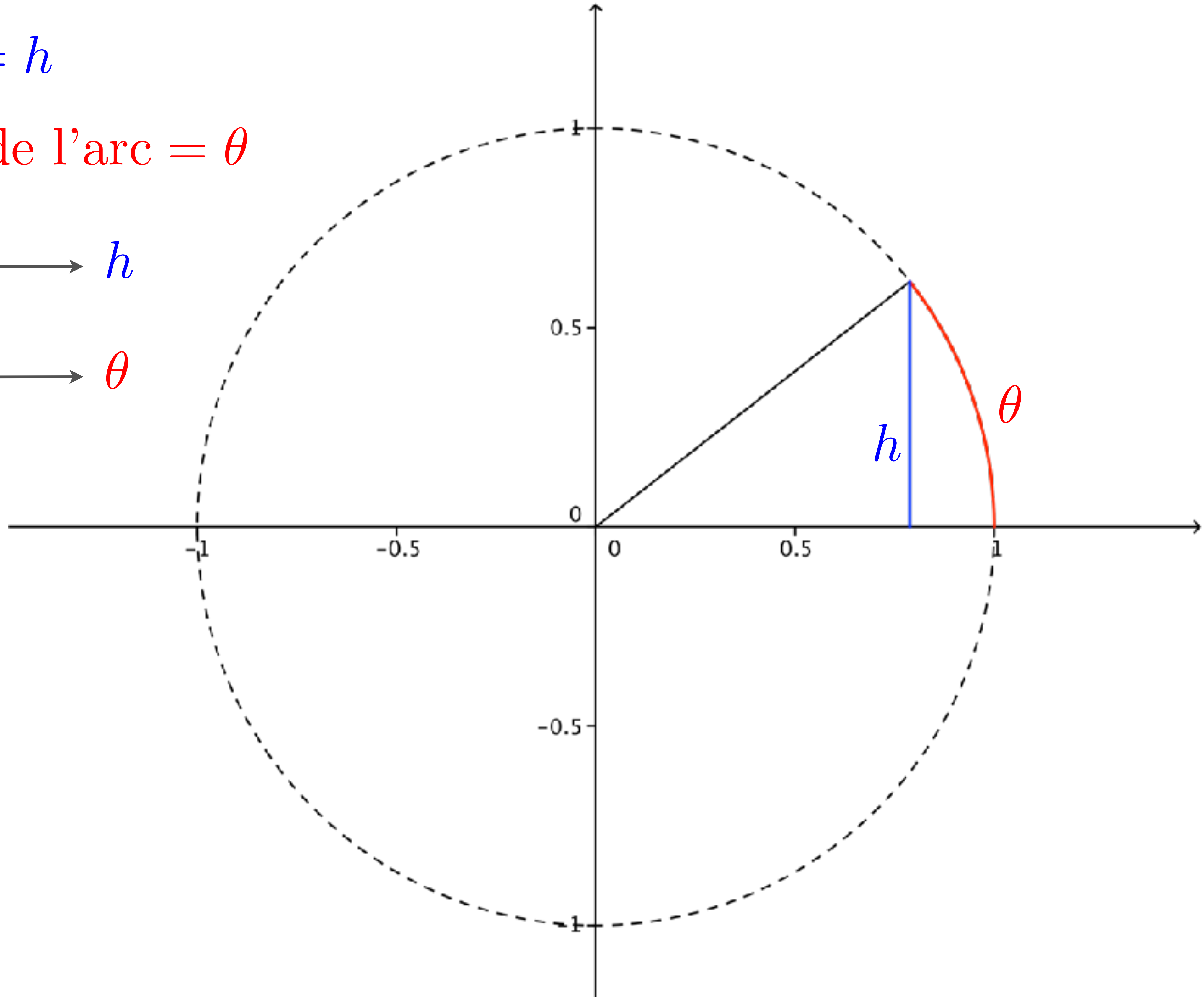


hauteur $= h$

longueur de l'arc $= \theta$

$$\theta \xrightarrow{\sin} h$$

$$h \xrightarrow{\arcsin} \theta$$



On note

On note

$$\arcsin x = \theta$$

On note

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On note

$$\arcsin x = \theta \iff \sin \theta = x$$

$$\arccos x = \theta$$

On note

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$$\arccos x = \theta \iff \cos\theta = x$$

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$$\arcsin x = \theta \iff \sin\theta = x$$

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$$\arctan x = \theta \iff \tan\theta = x$$

$$\mathrm{arcsec} x = \theta \iff \sec\theta = x$$

$$\mathrm{arccsc} x = \theta \iff \csc\theta = x$$

$$\mathrm{arccot} x = \theta \iff \cot\theta = x$$

On note

Mais on utilise surtout ceux-là

$$\arcsin x = \theta \iff \sin \theta = x$$

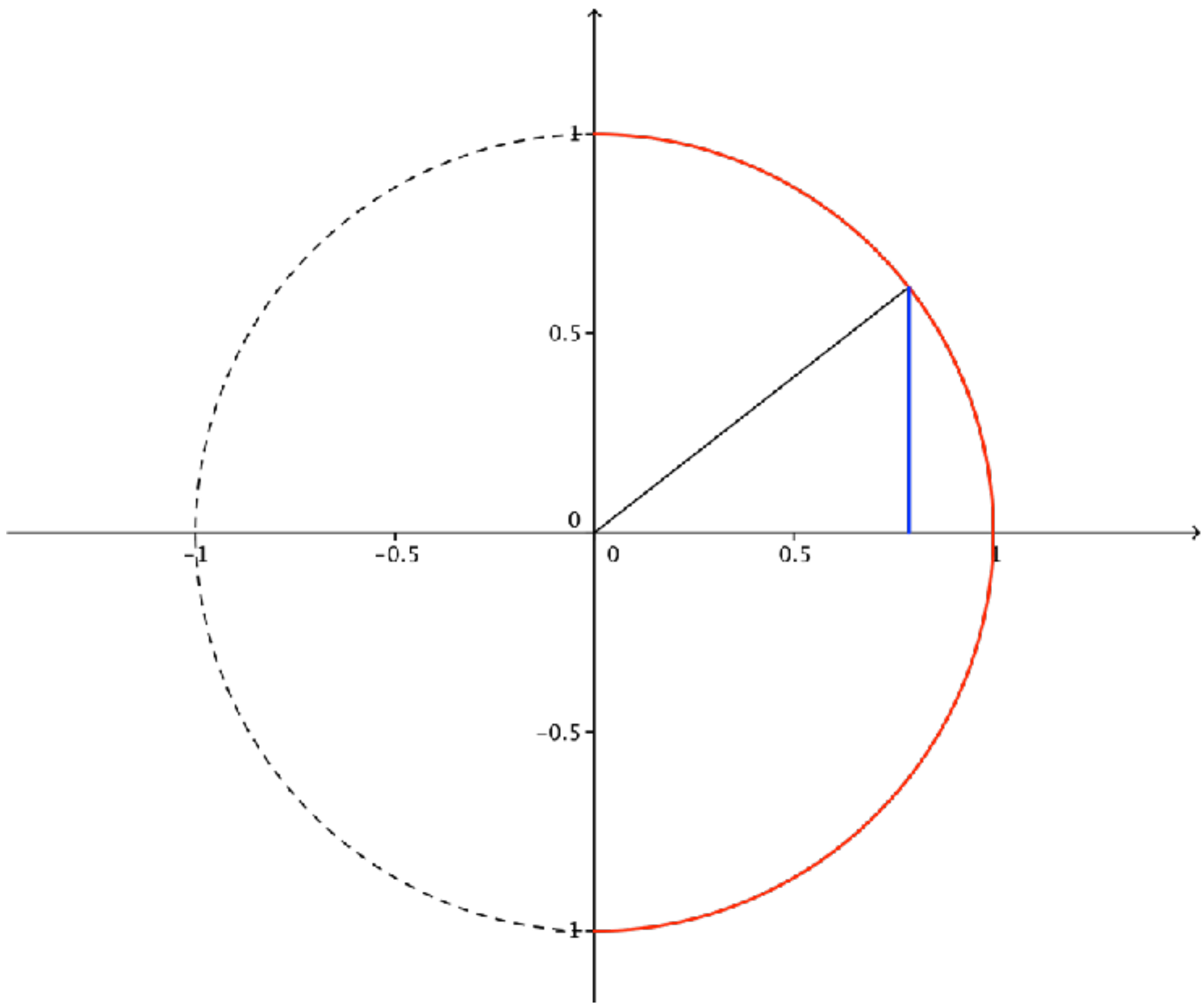
$$\arccos x = \theta \iff \cos \theta = x$$

$$\arctan x = \theta \iff \tan \theta = x$$

$$\text{arcsec} x = \theta \iff \sec \theta = x$$

$$\text{arccsc} x = \theta \iff \csc \theta = x$$

$$\text{arccot} x = \theta \iff \cot \theta = x$$



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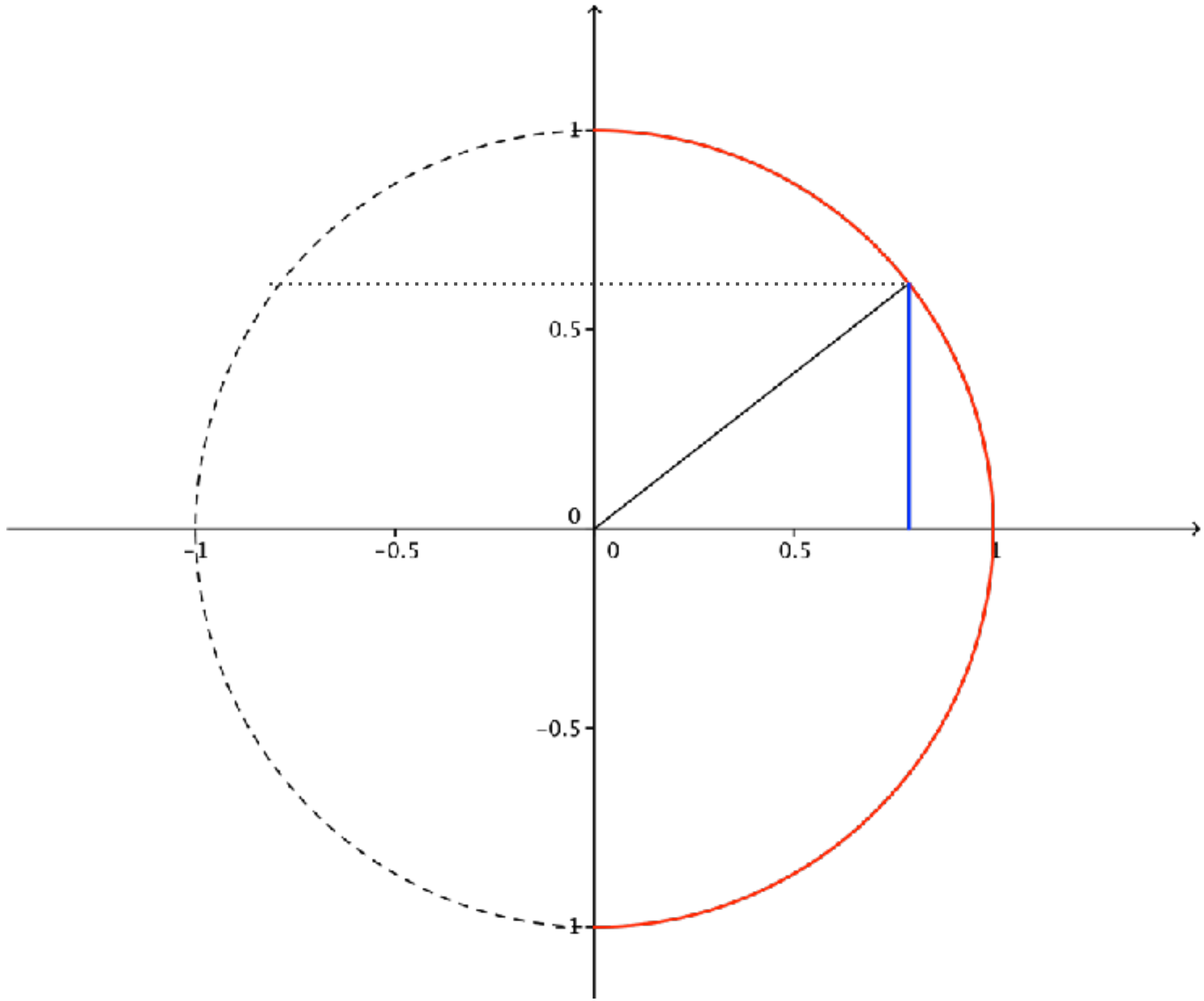
0.5
0
−0.5
−1
−1
−0.5
0
0.5
1



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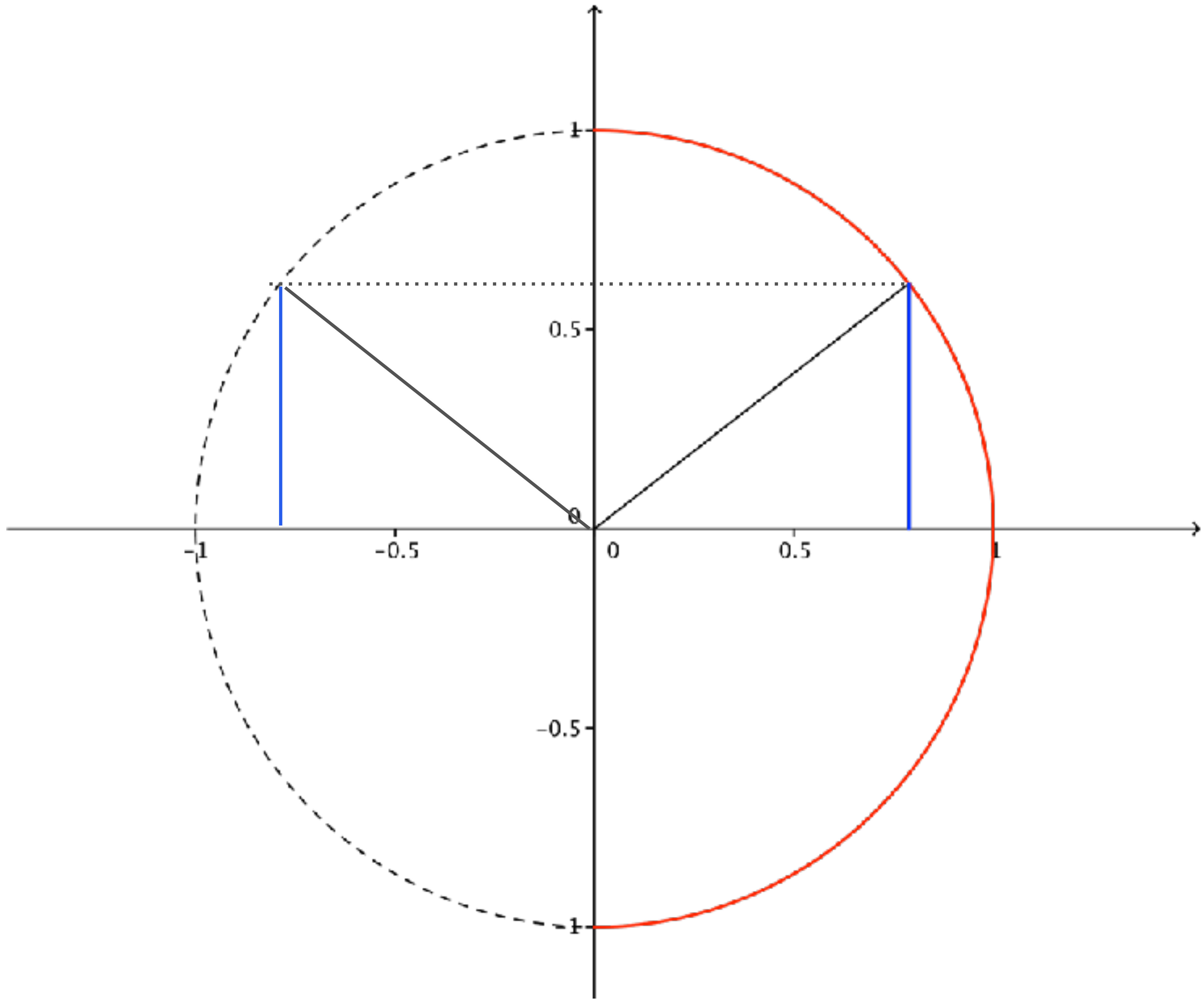

1
0.5
0
−0.5
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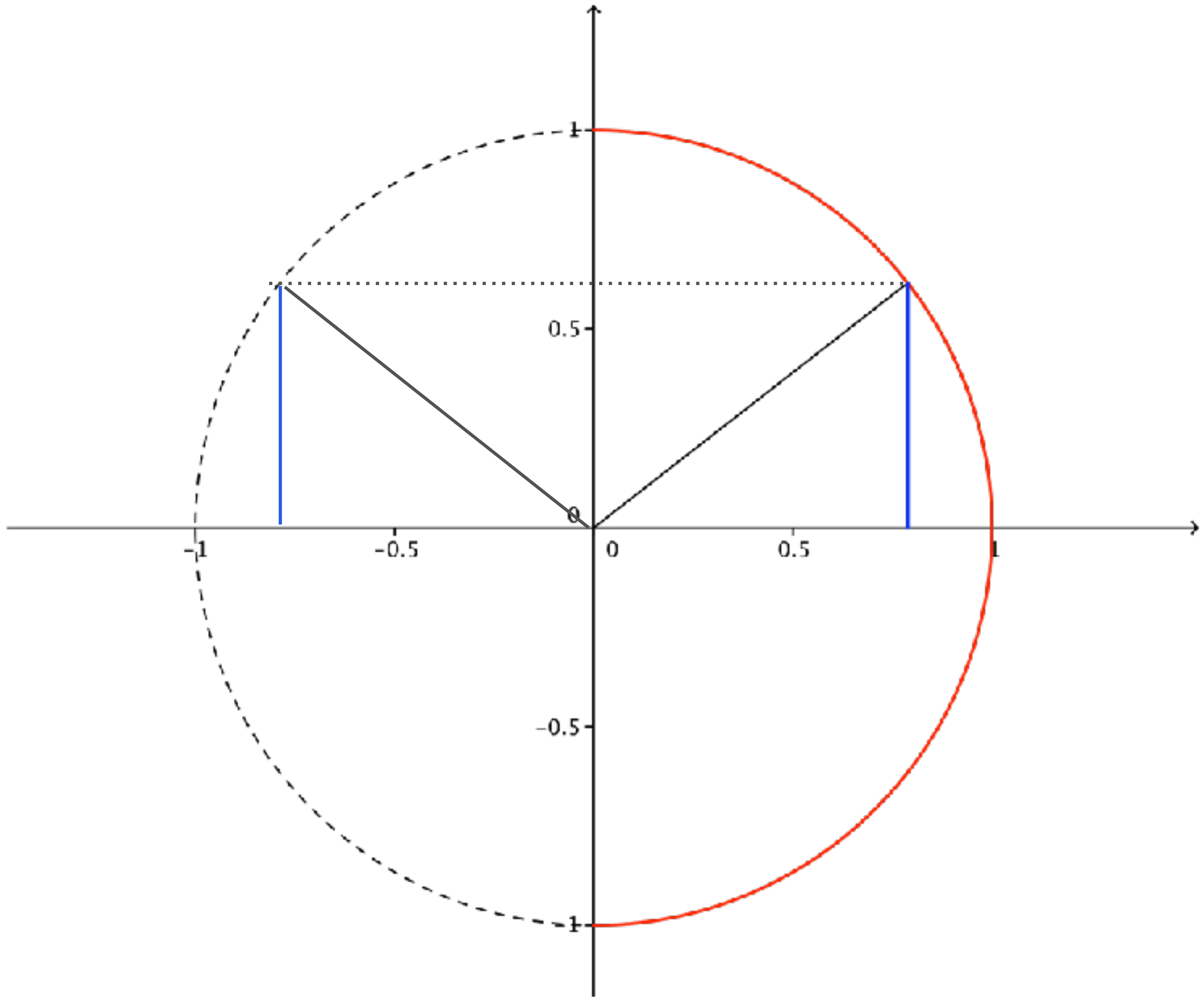
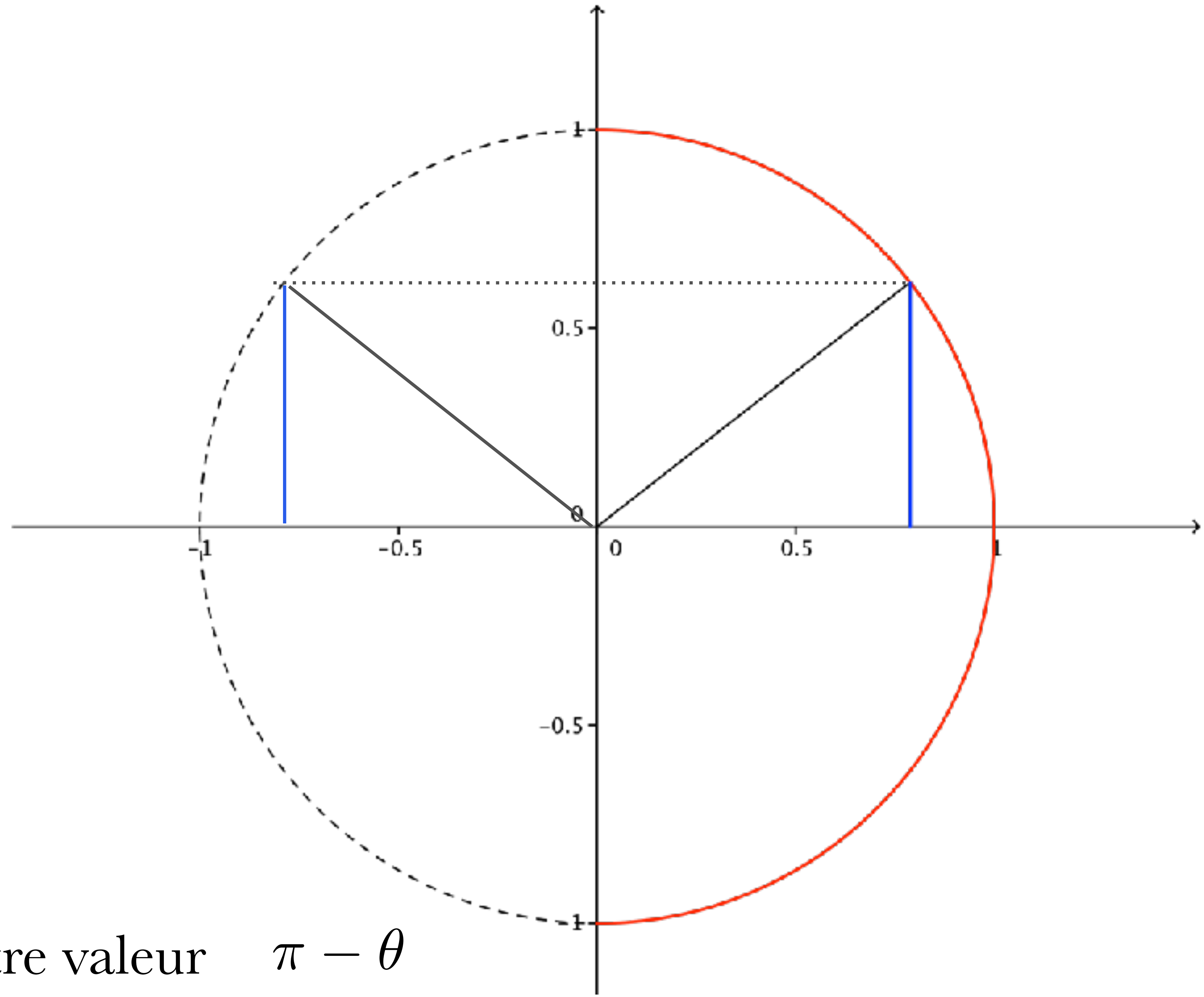
-1
-0.5
0
0.5
1

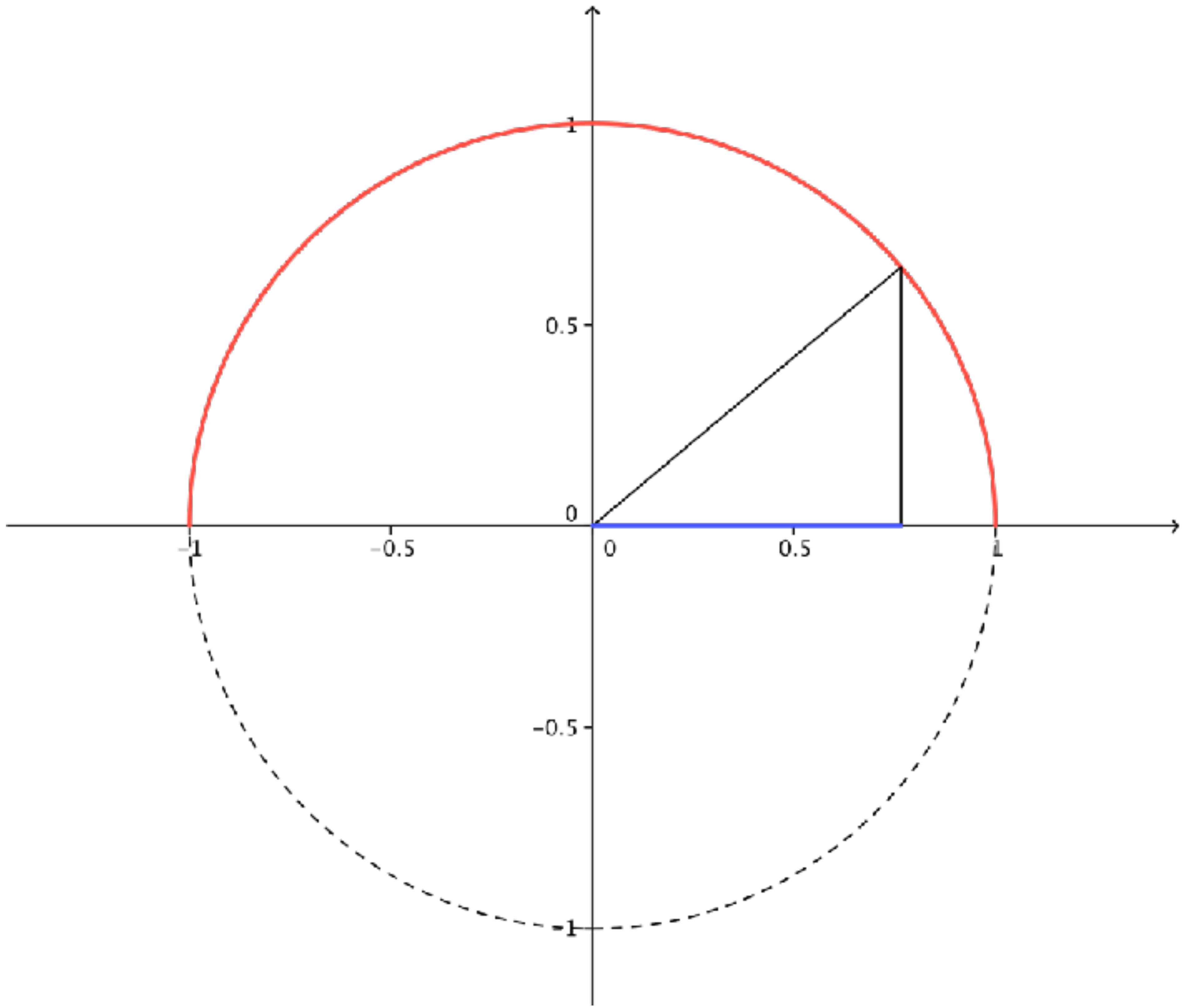
Les valeurs de $\arcsin x$ sont comprises entre $-\dfrac{\pi}{2}$ et $\dfrac{\pi}{2}$



Les valeurs de $\arcsin x$ sont comprises entre $-\dfrac{\pi}{2}$ et $\dfrac{\pi}{2}$



L'autre valeur $\pi - \theta$



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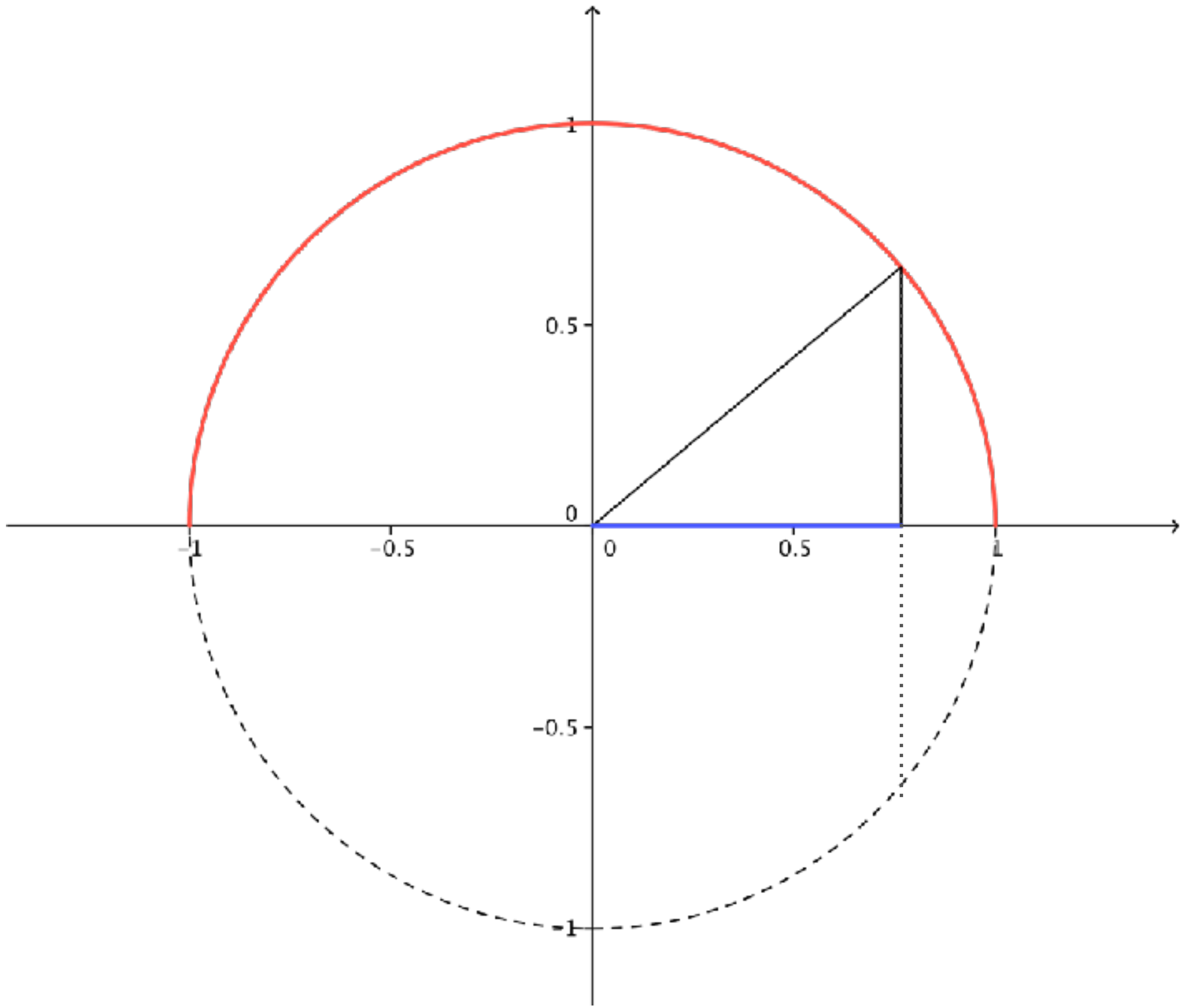
0.5
0
-1
-0.5
0
0.5
1
-0.5
-1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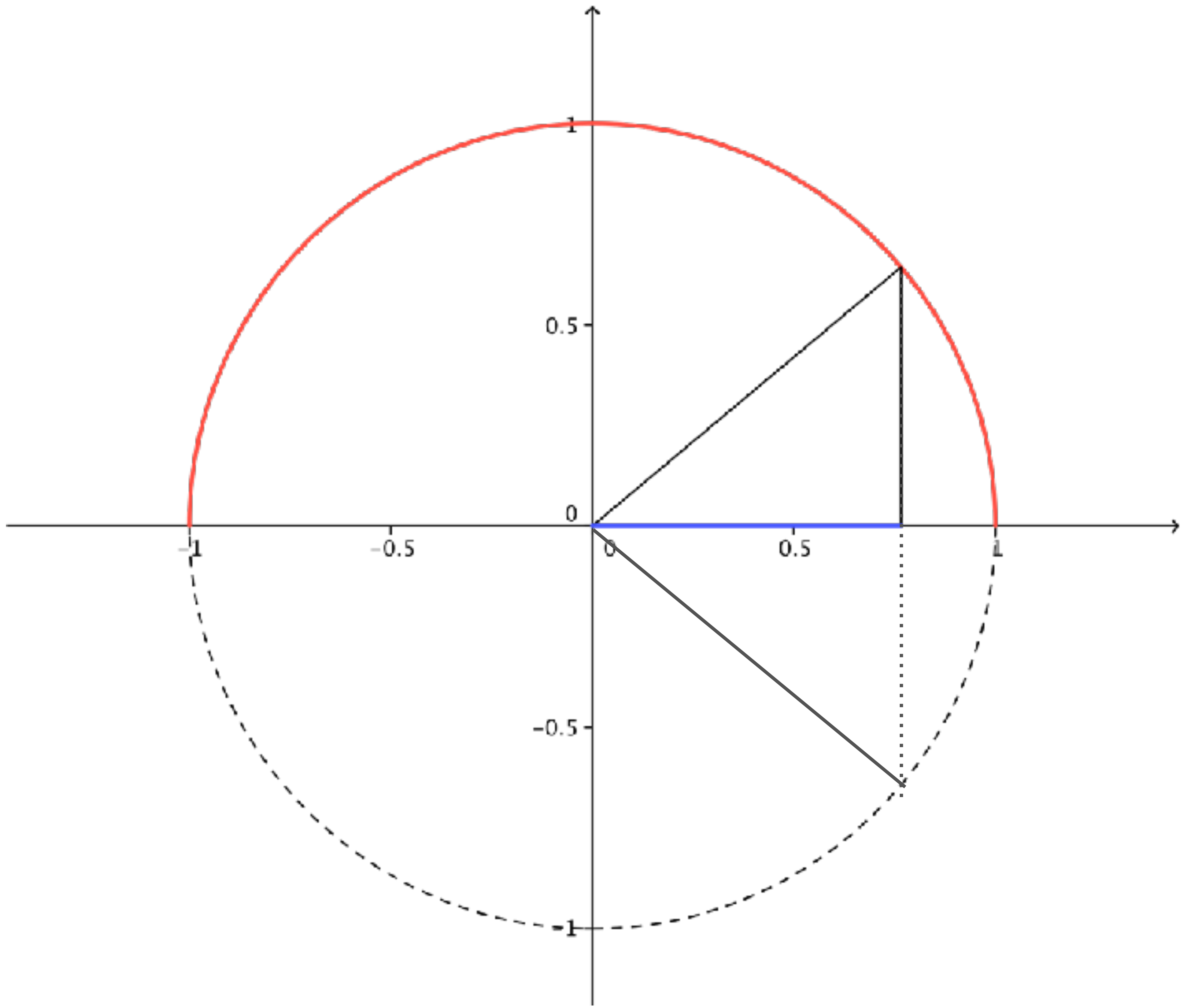
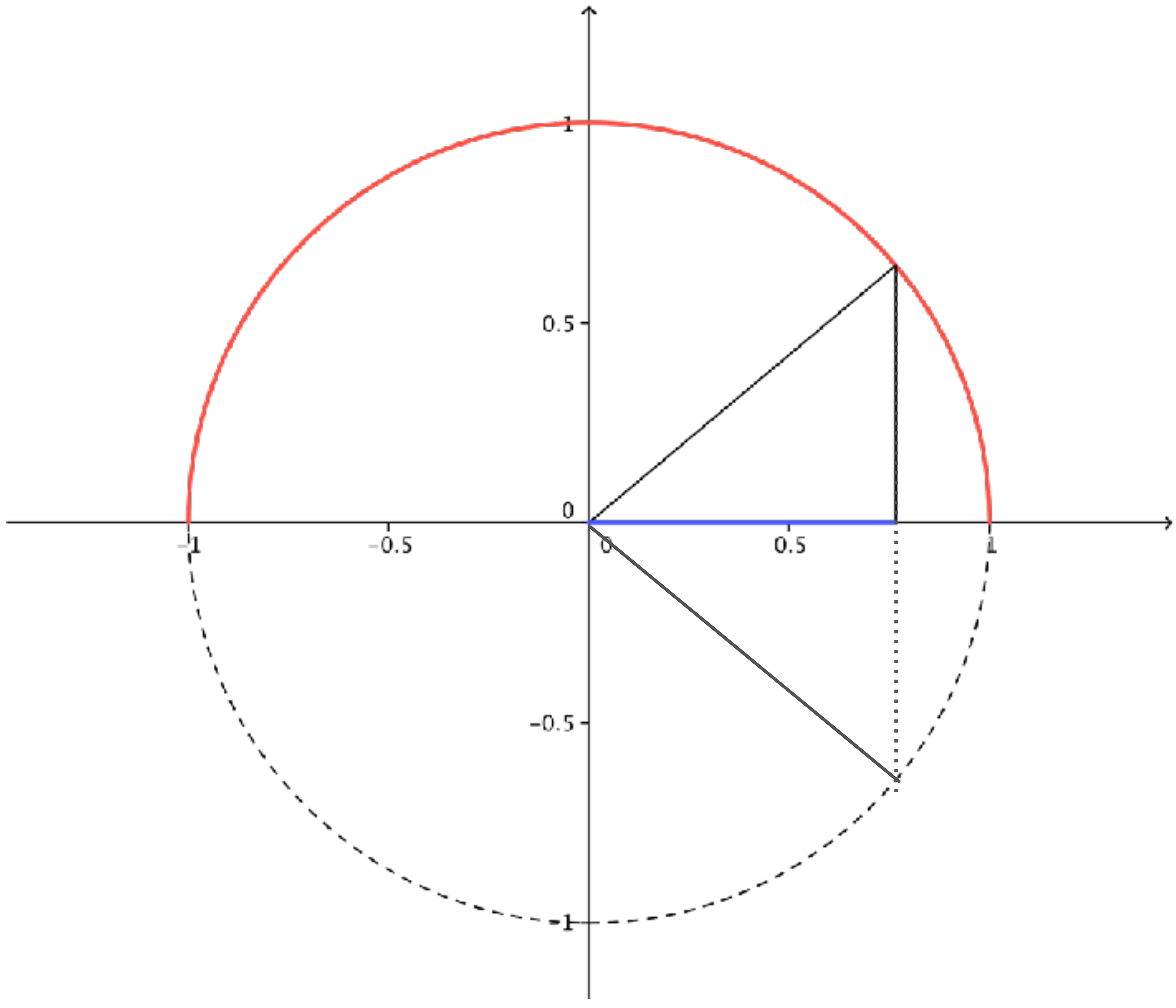
0
-1
-0.5
0
0.5
1
-0.5
-1



1
0.5
0
−1
−0.5
0
0.5
1
−0.5
−1

Les valeurs de arccos x sont comprises entre 0 et π



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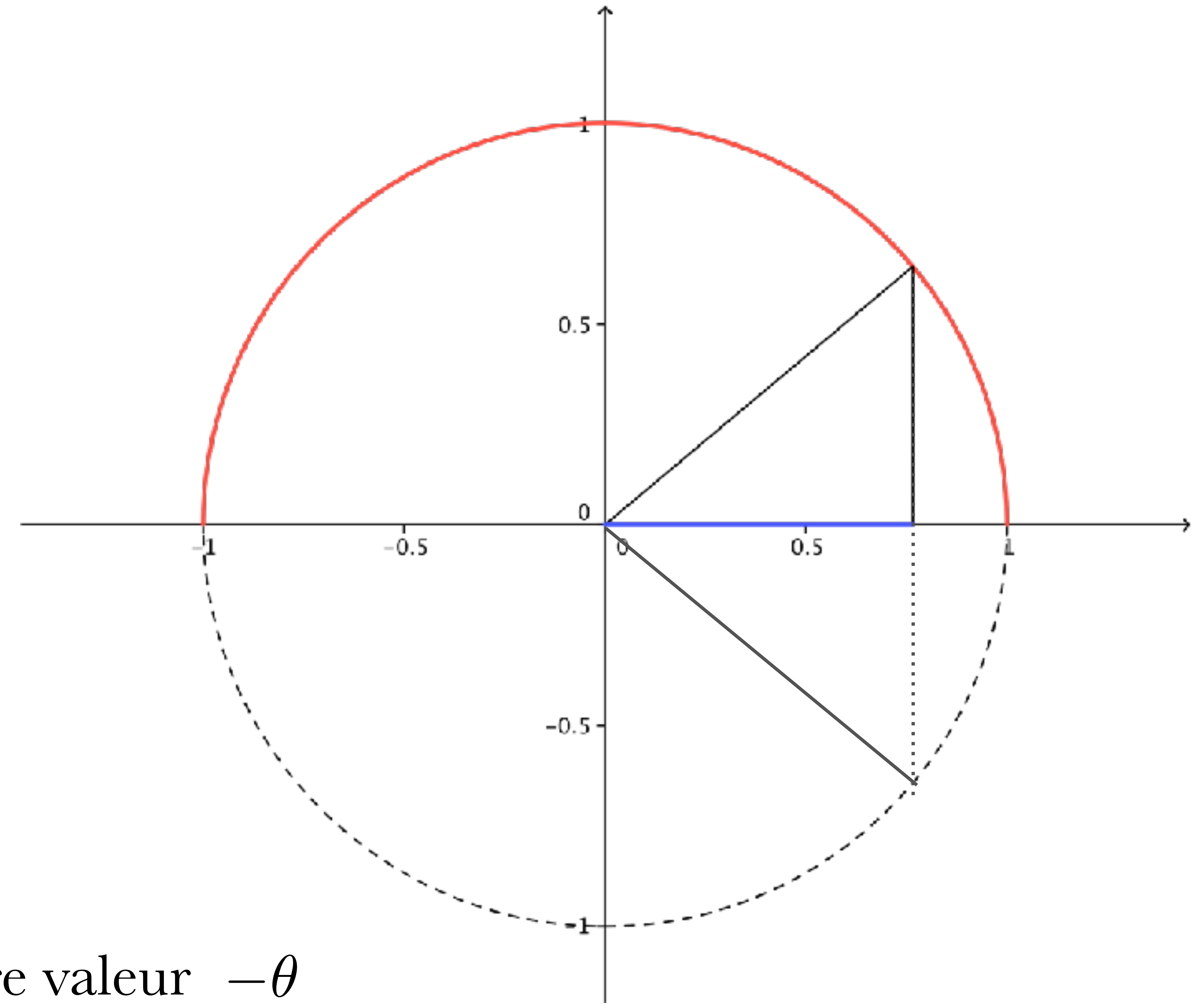
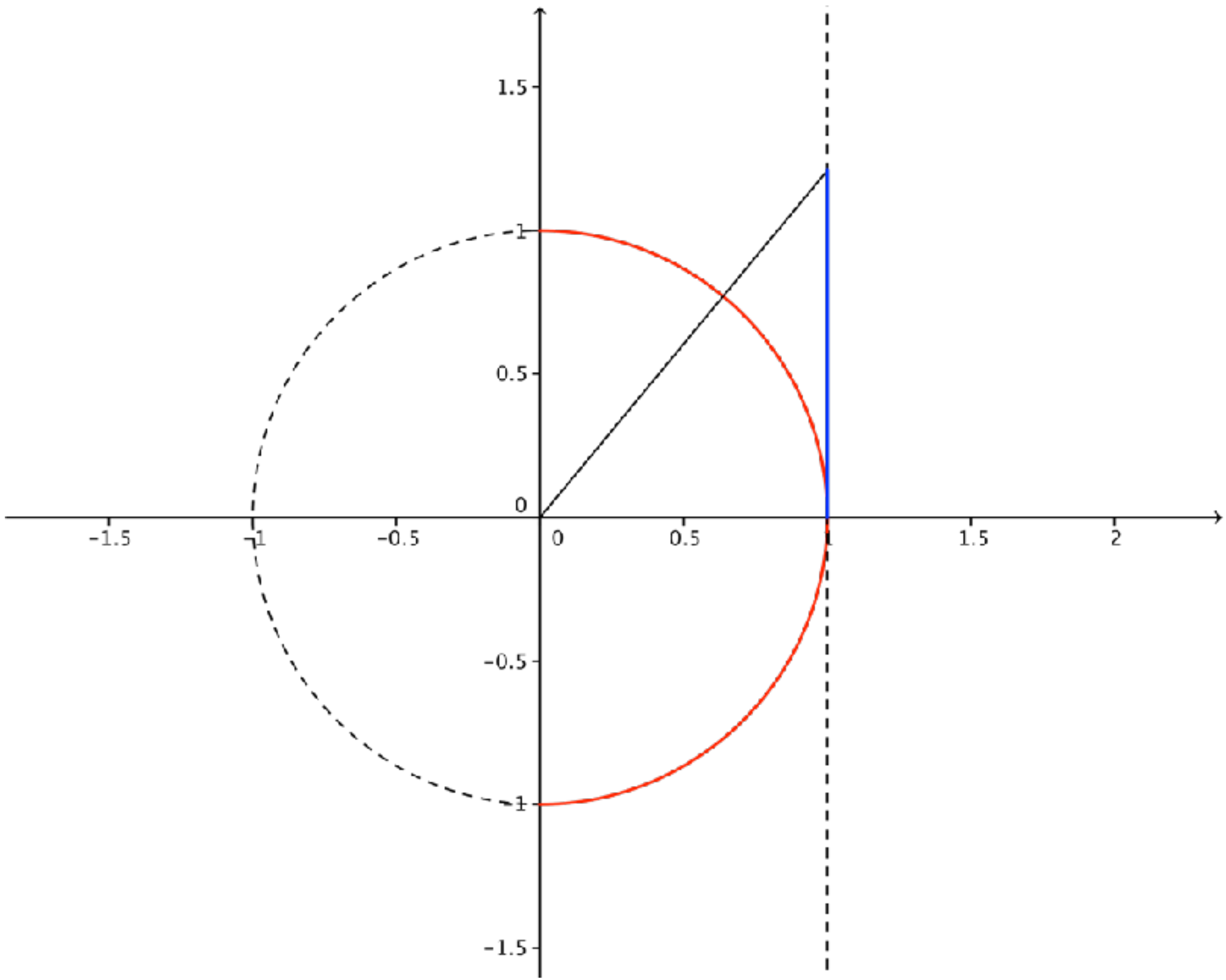


L'autre valeur $-\theta$



1.5
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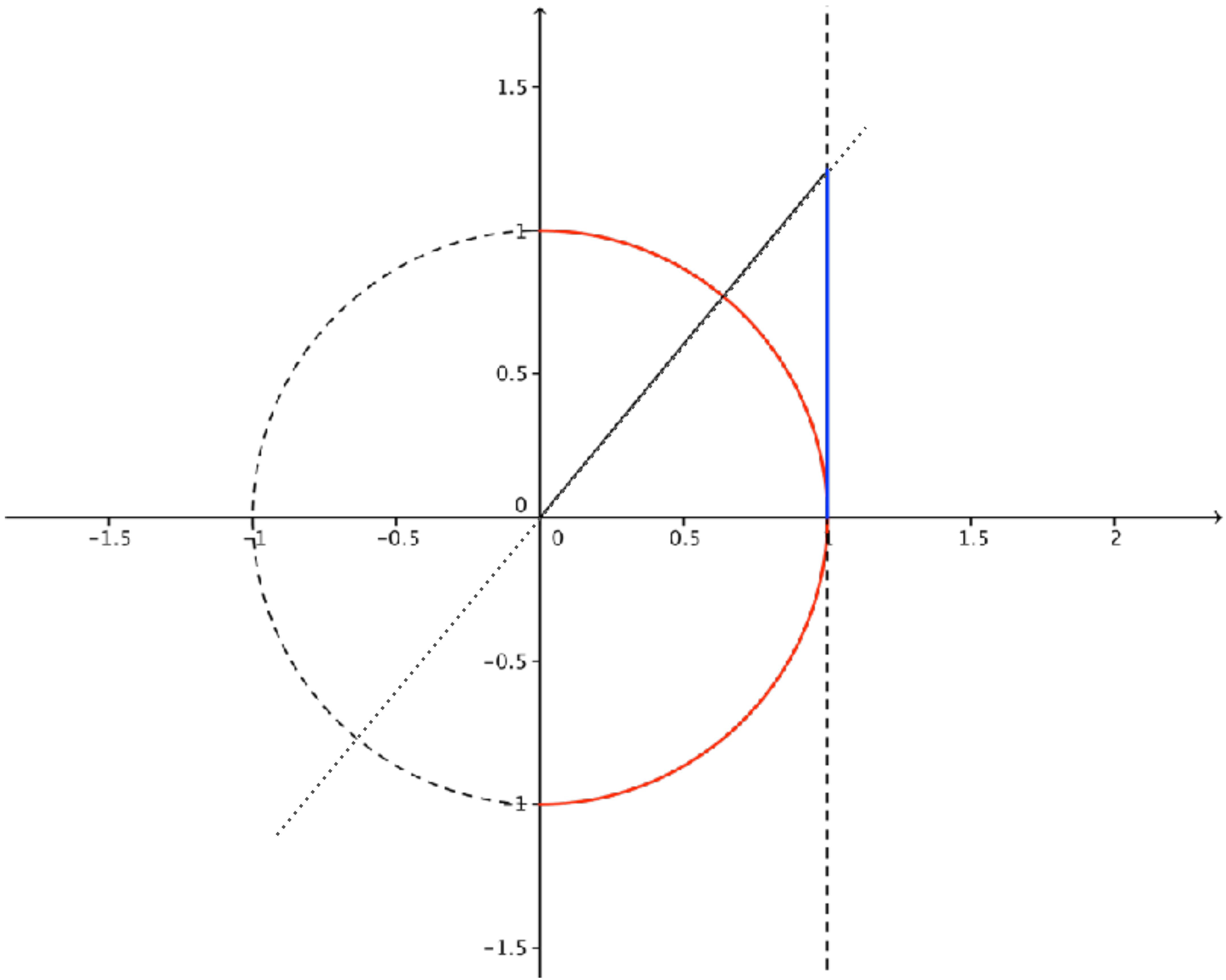
0.5
0
-0.5
-1
-1.5
-1.5
-1
-0.5
0
0.5
1
1.5
2



1.5
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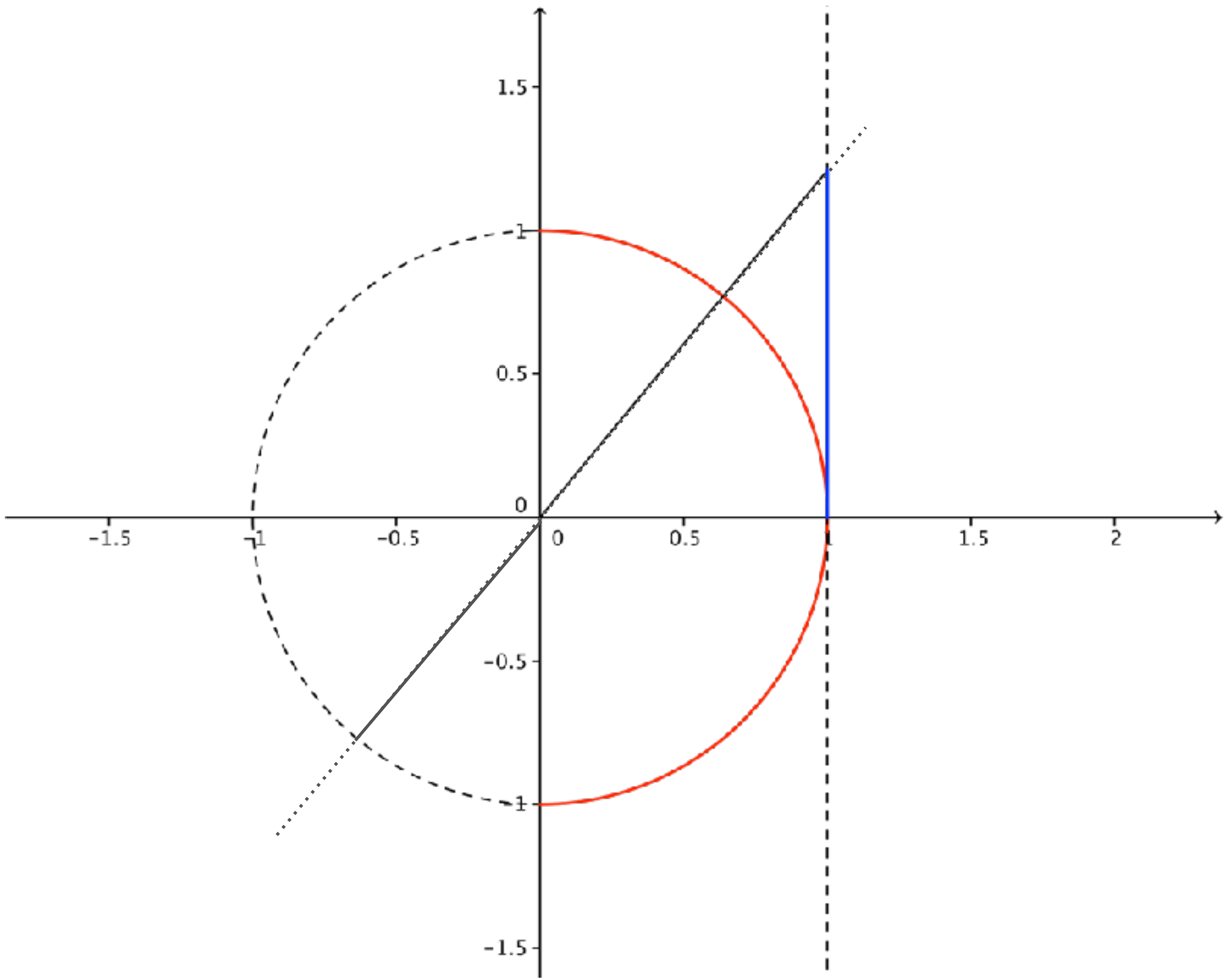
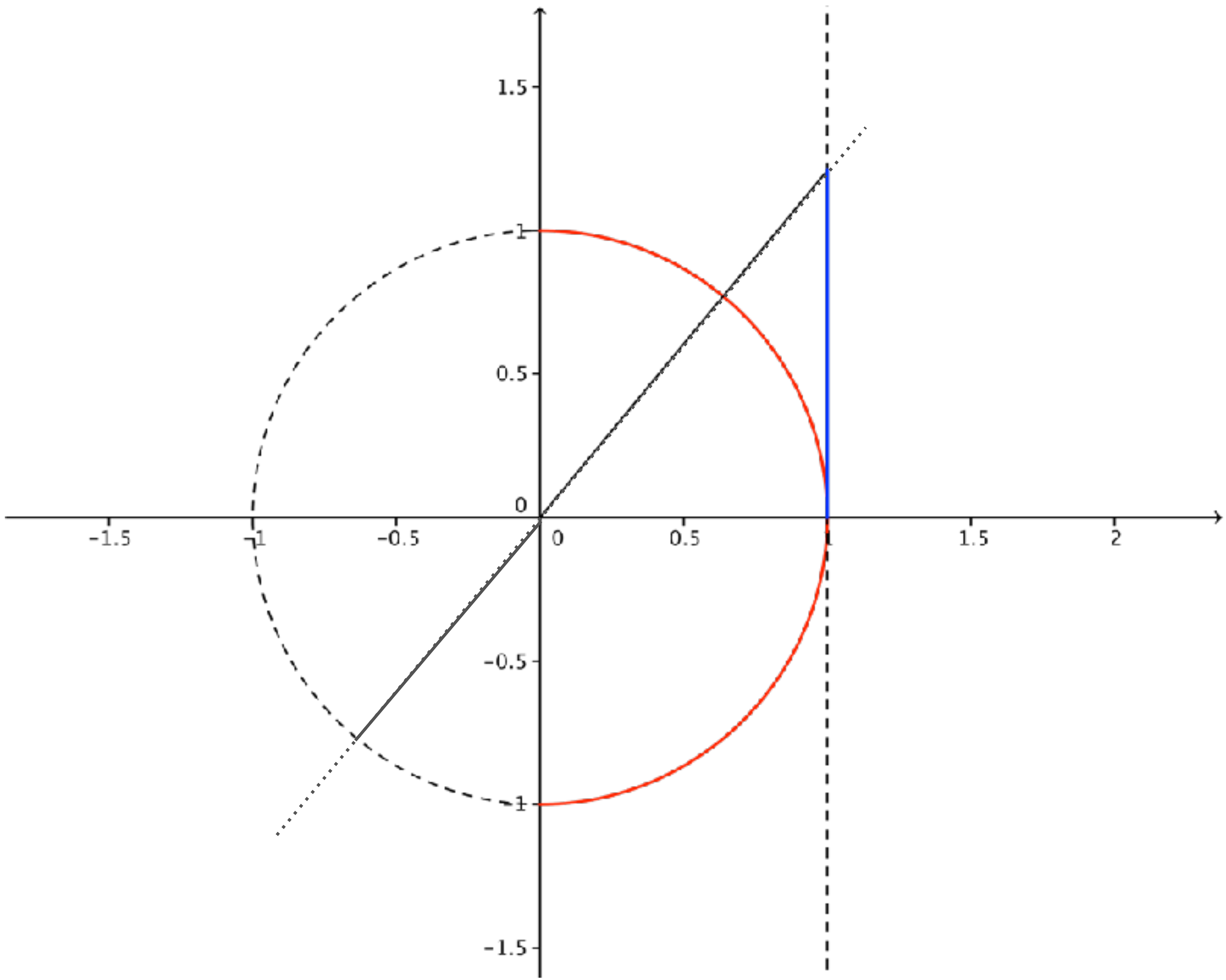
0.5
0
-0.5
-1
-1.5
-1.5
-1
-0.5
0
0.5
1
1.5
2



1.5
1
0.5
0
-0.5
-1
-1.5
-1.5
-1
-0.5
0
0.5
1
1.5
2

Les valeurs de $\arctan x$ sont comprises entre $-\dfrac{\pi}{2}$ et $\dfrac{\pi}{2}$



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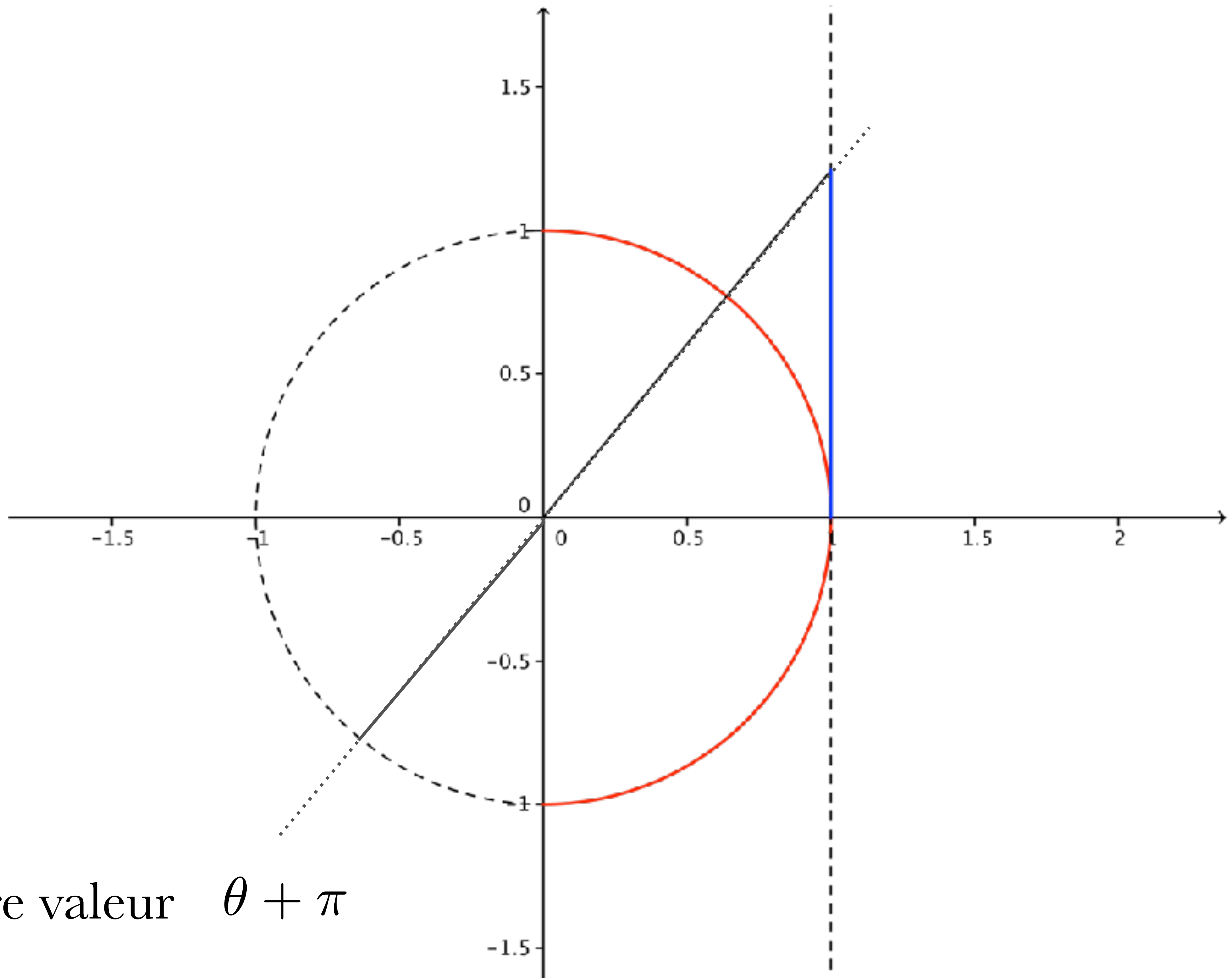
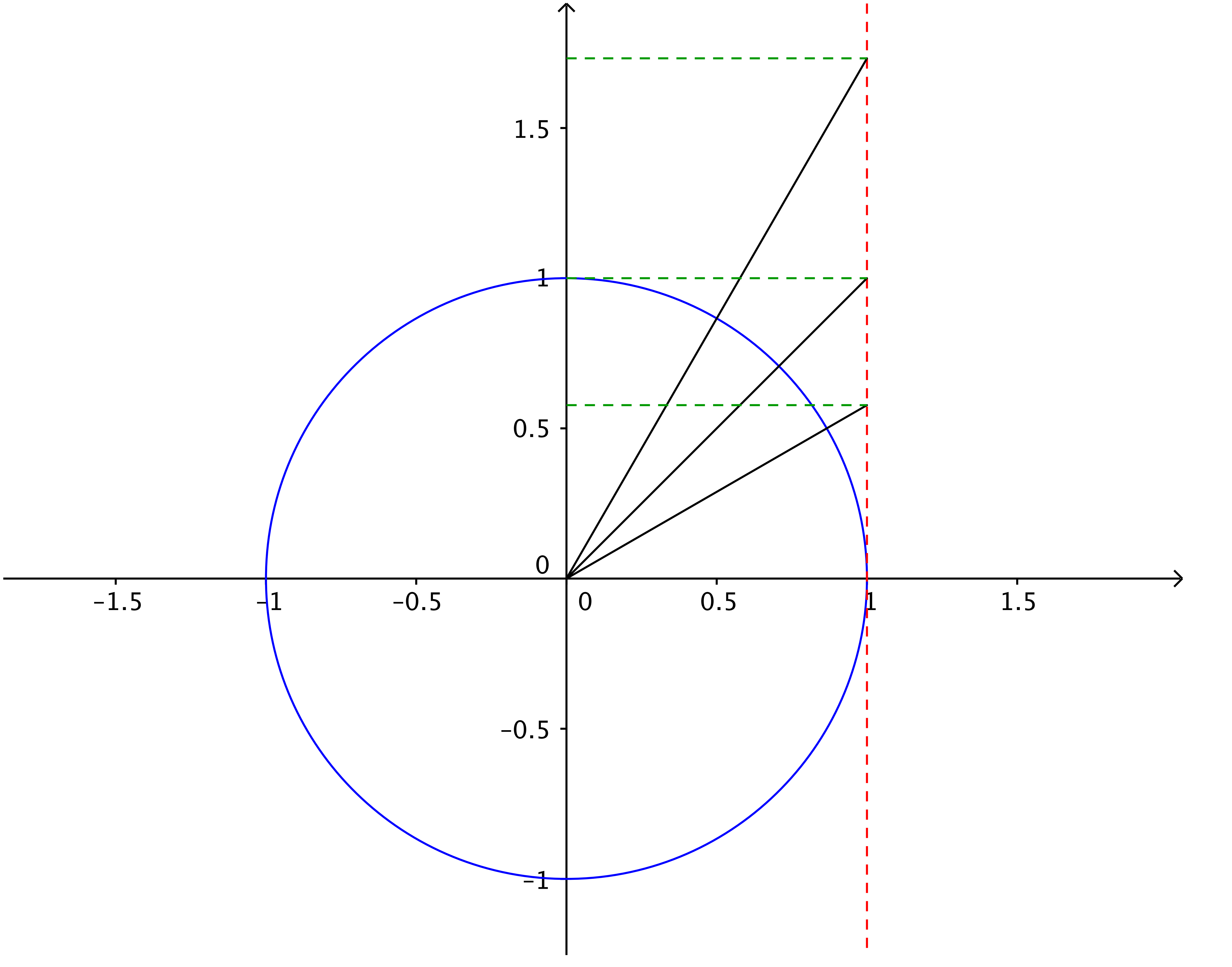
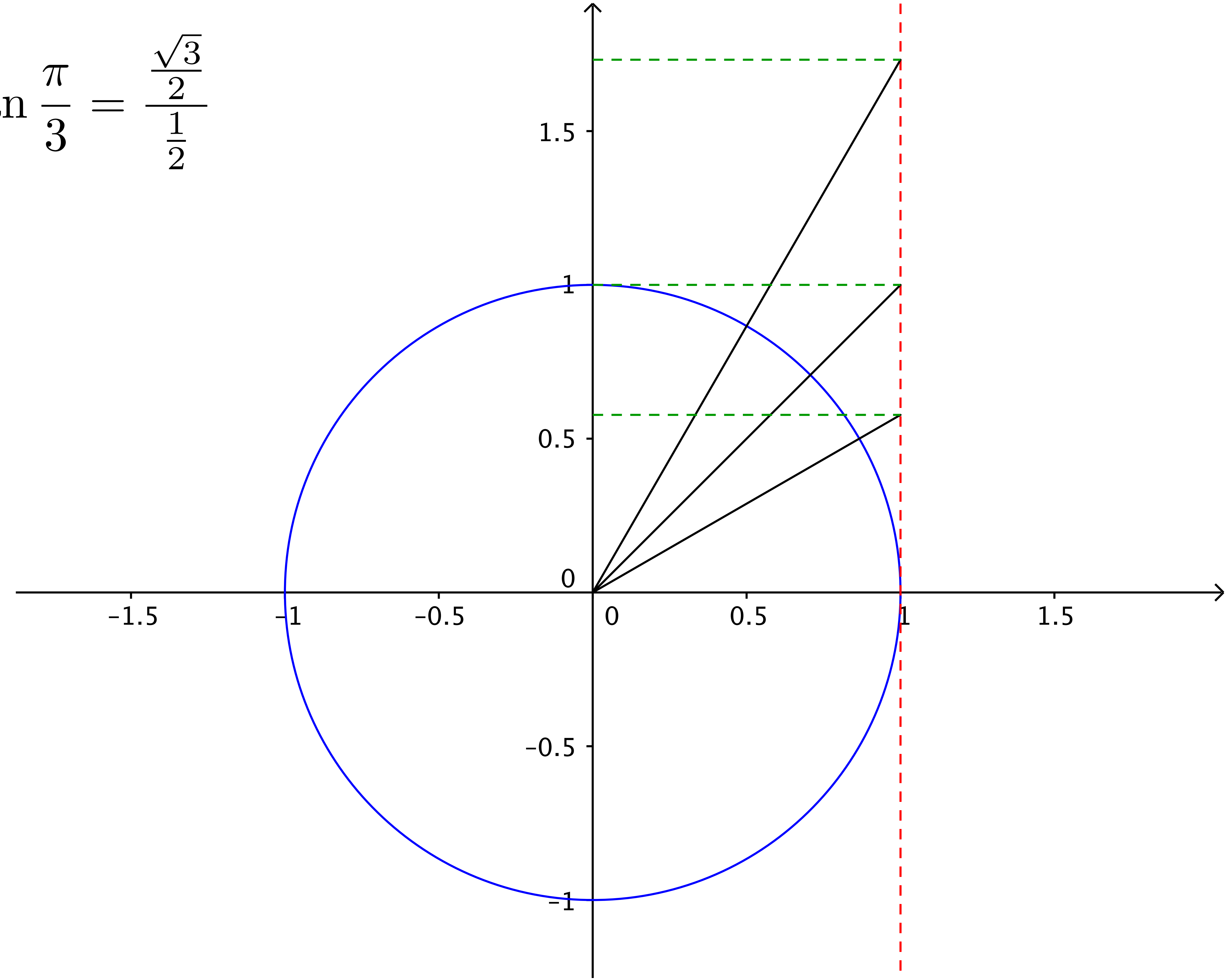


L'autre valeur $\theta + \pi$

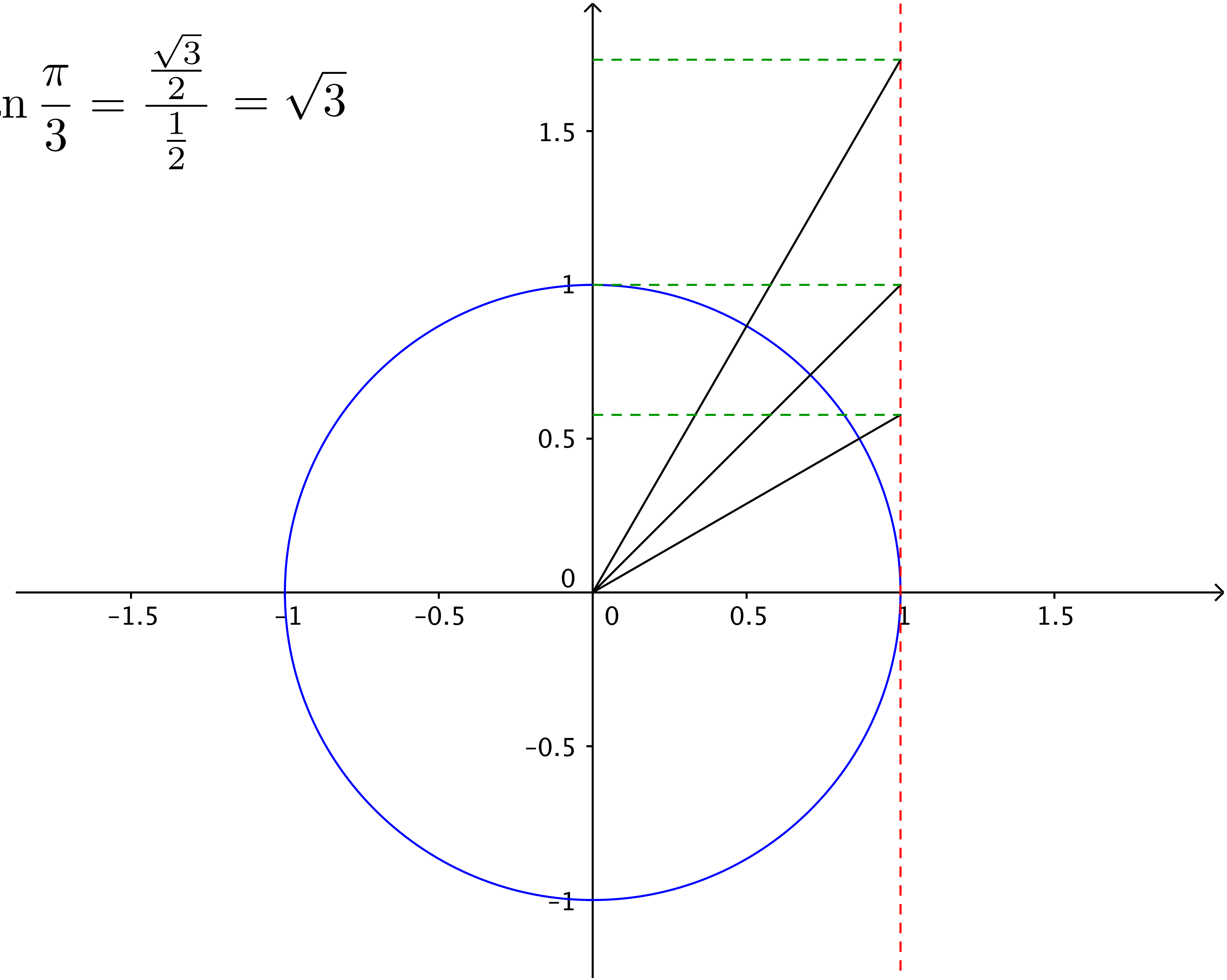


1.5
1
0.5
0
−0.5
−1
−1.5
−1
−0.5
0
0.5
1
1.5

$$\tan\frac{\pi}{3} = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}}$$



$$\tan\frac{\pi}{3} = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \sqrt{3}$$



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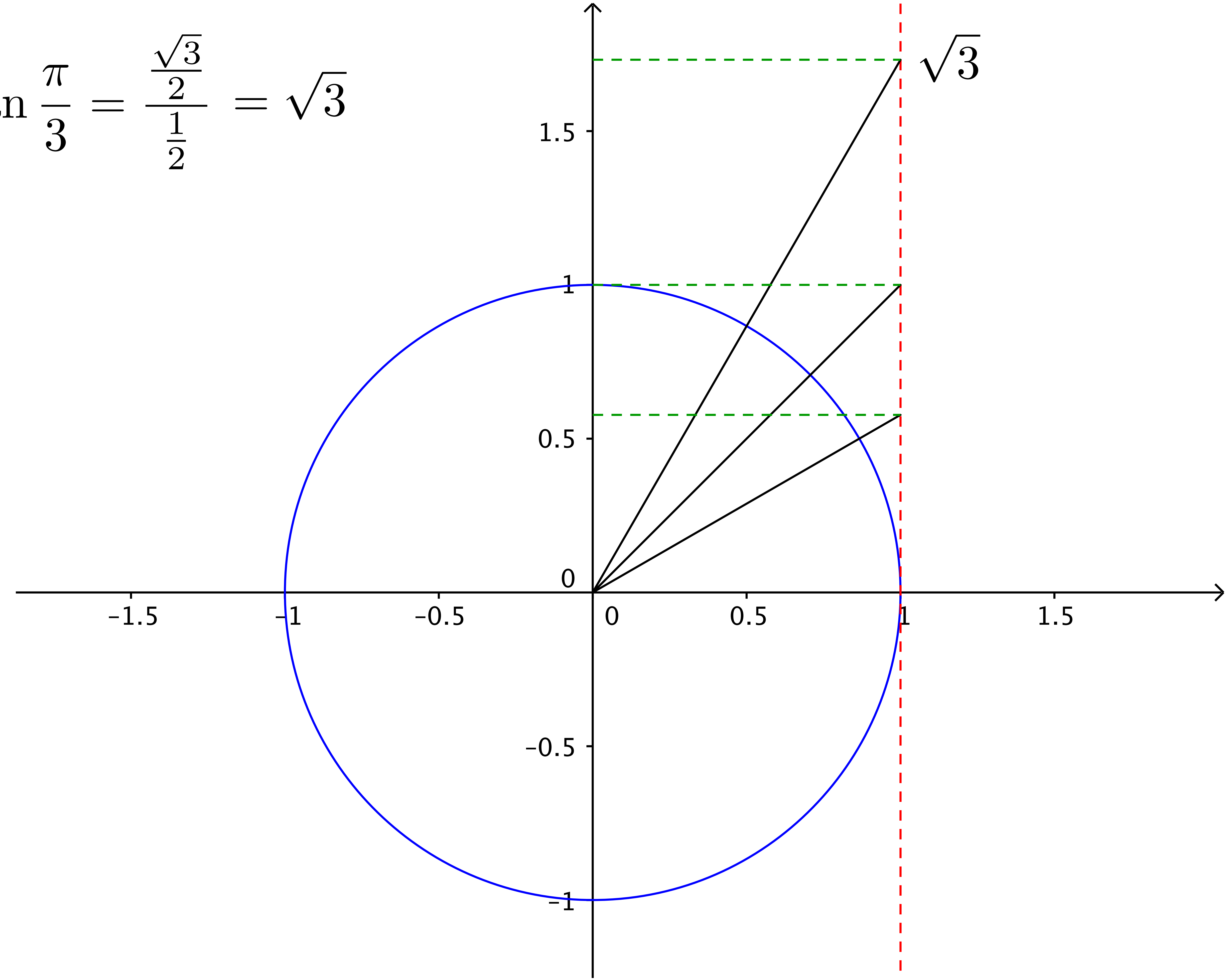
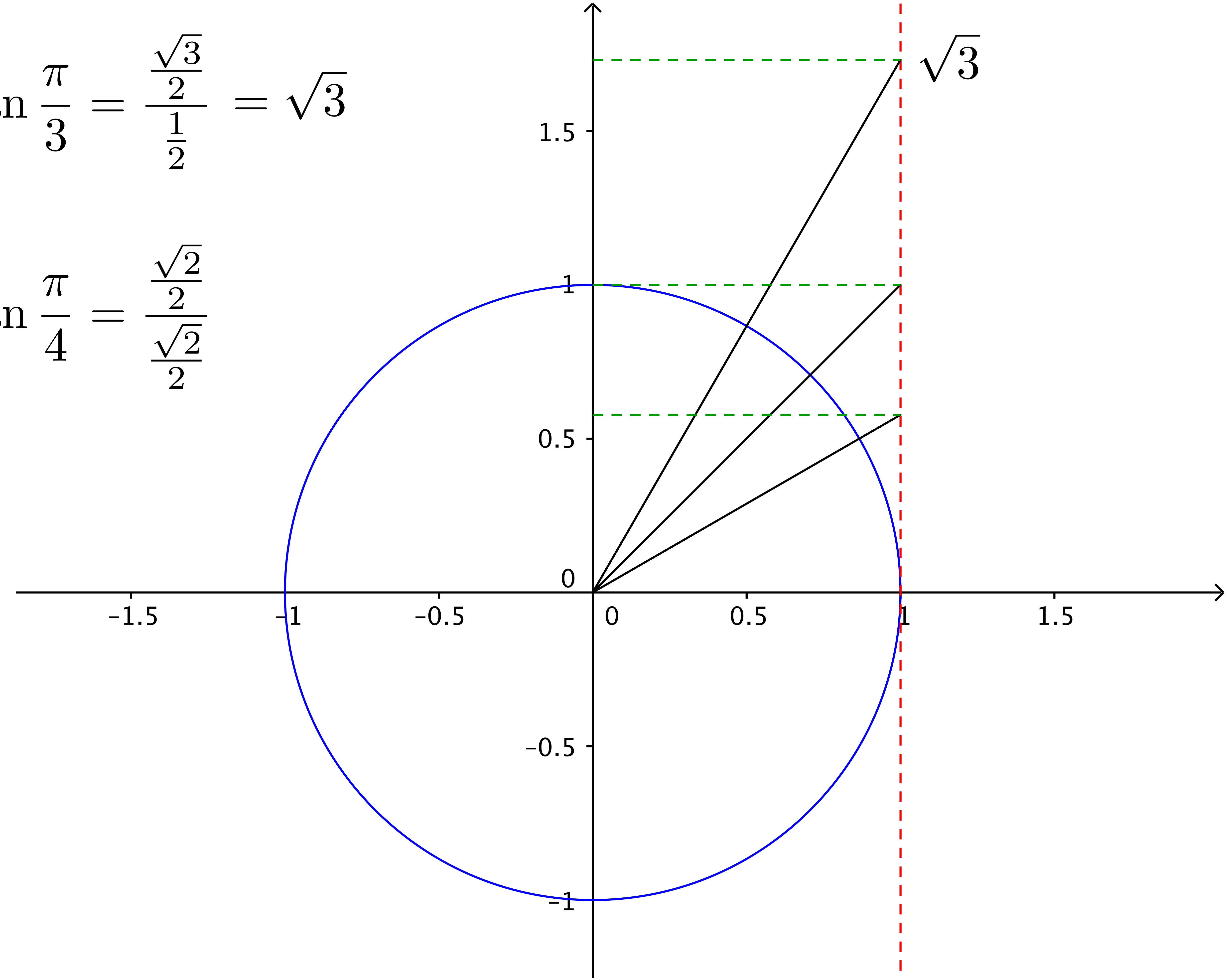


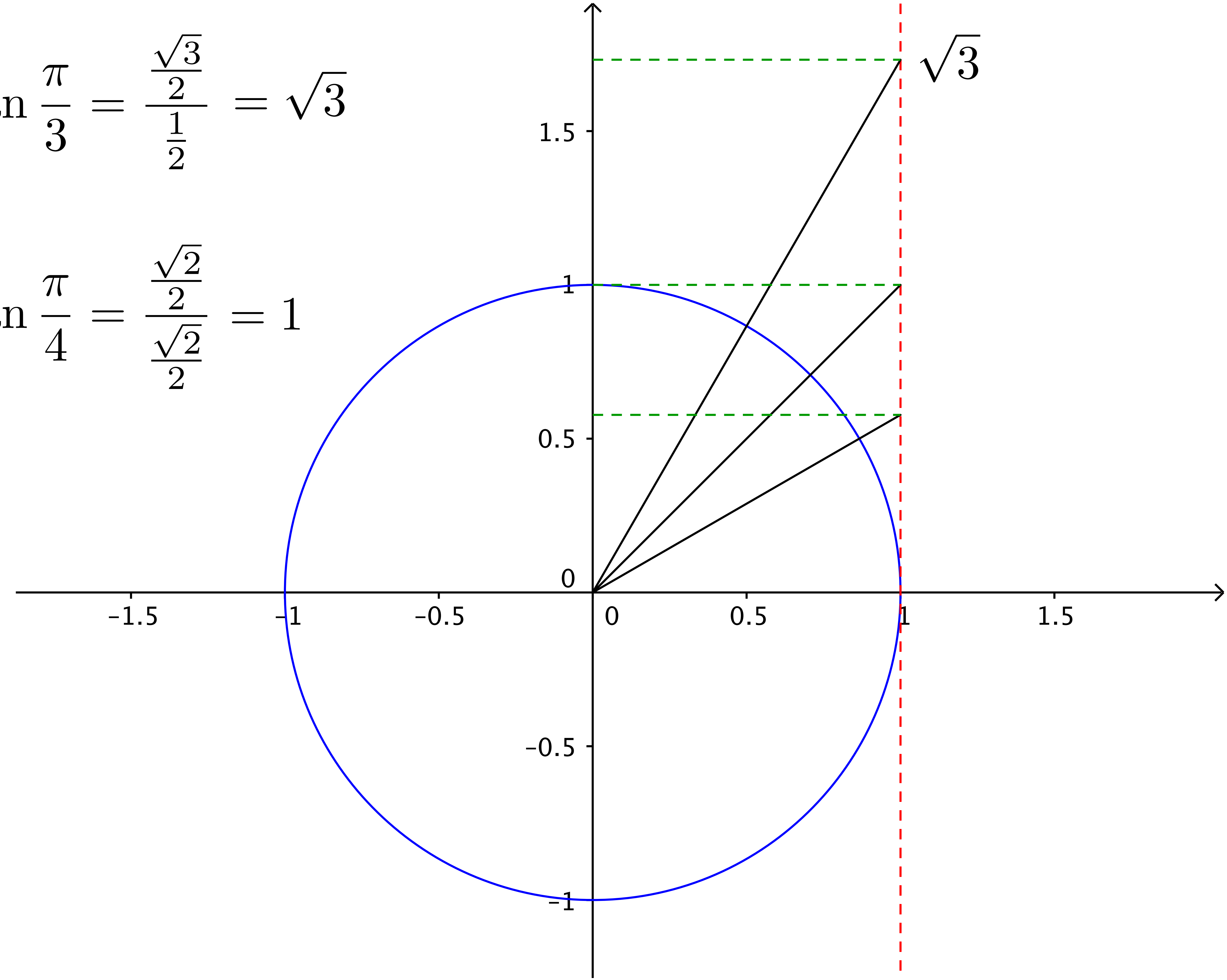
$$\tan\frac{\pi}{3} = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \sqrt{3}$$

$$\tan\frac{\pi}{4} = \frac{\frac{\sqrt{2}}{2}}{\frac{\sqrt{2}}{2}}$$



$$\tan\frac{\pi}{3} = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \sqrt{3}$$

$$\tan\frac{\pi}{4} = \frac{\frac{\sqrt{2}}{2}}{\frac{\sqrt{2}}{2}} = 1$$



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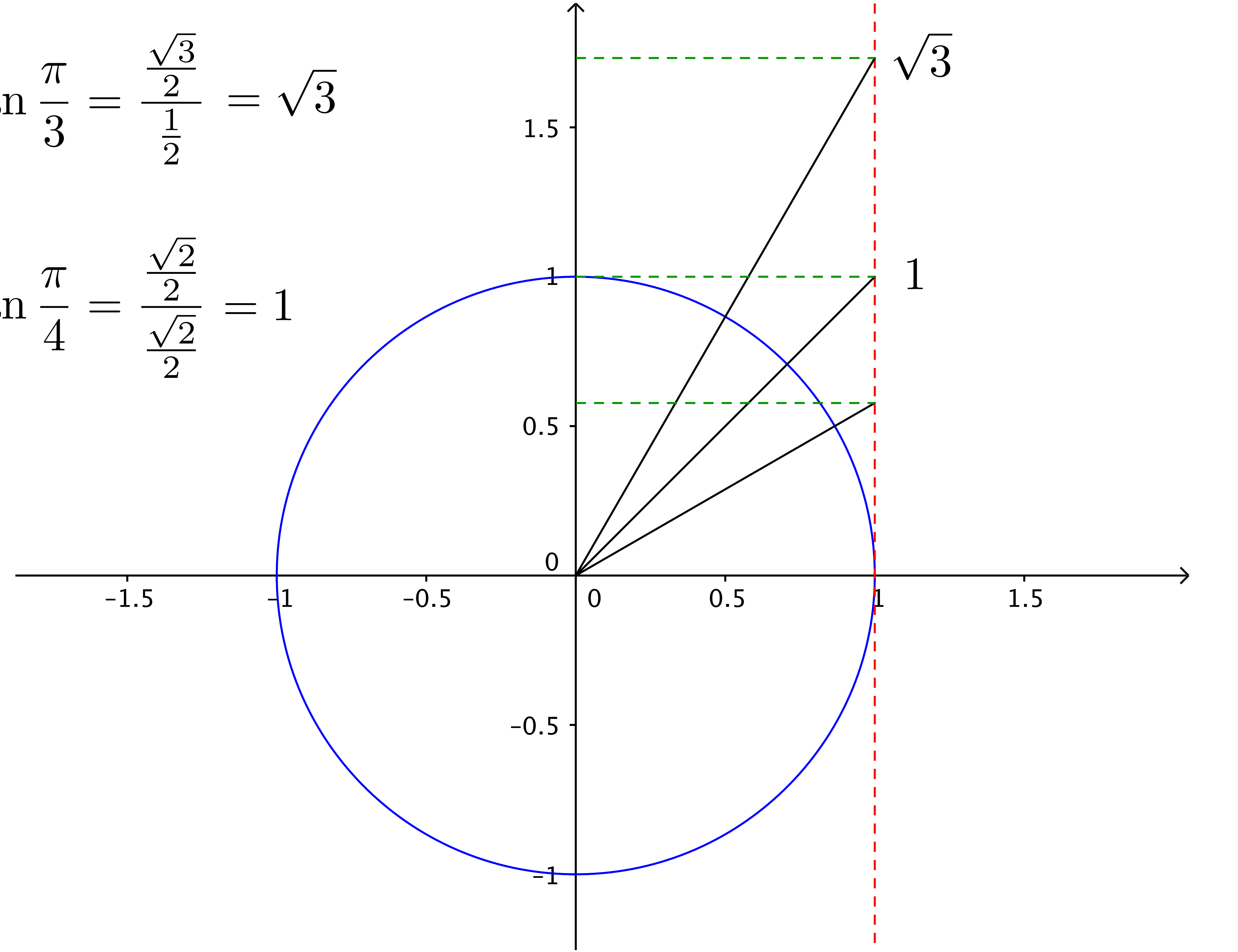

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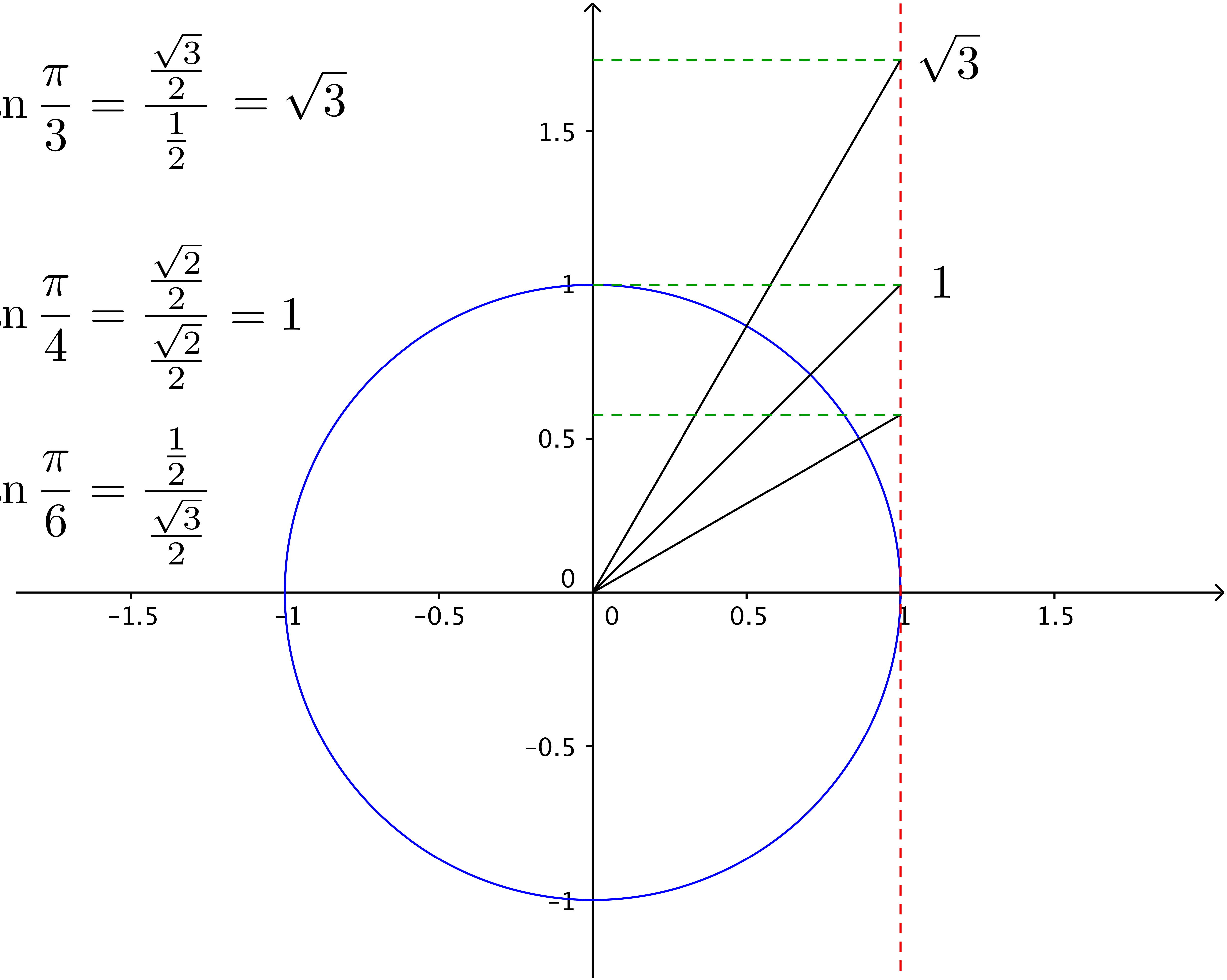
$$\tan\frac{\pi}{6} = \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}}$$



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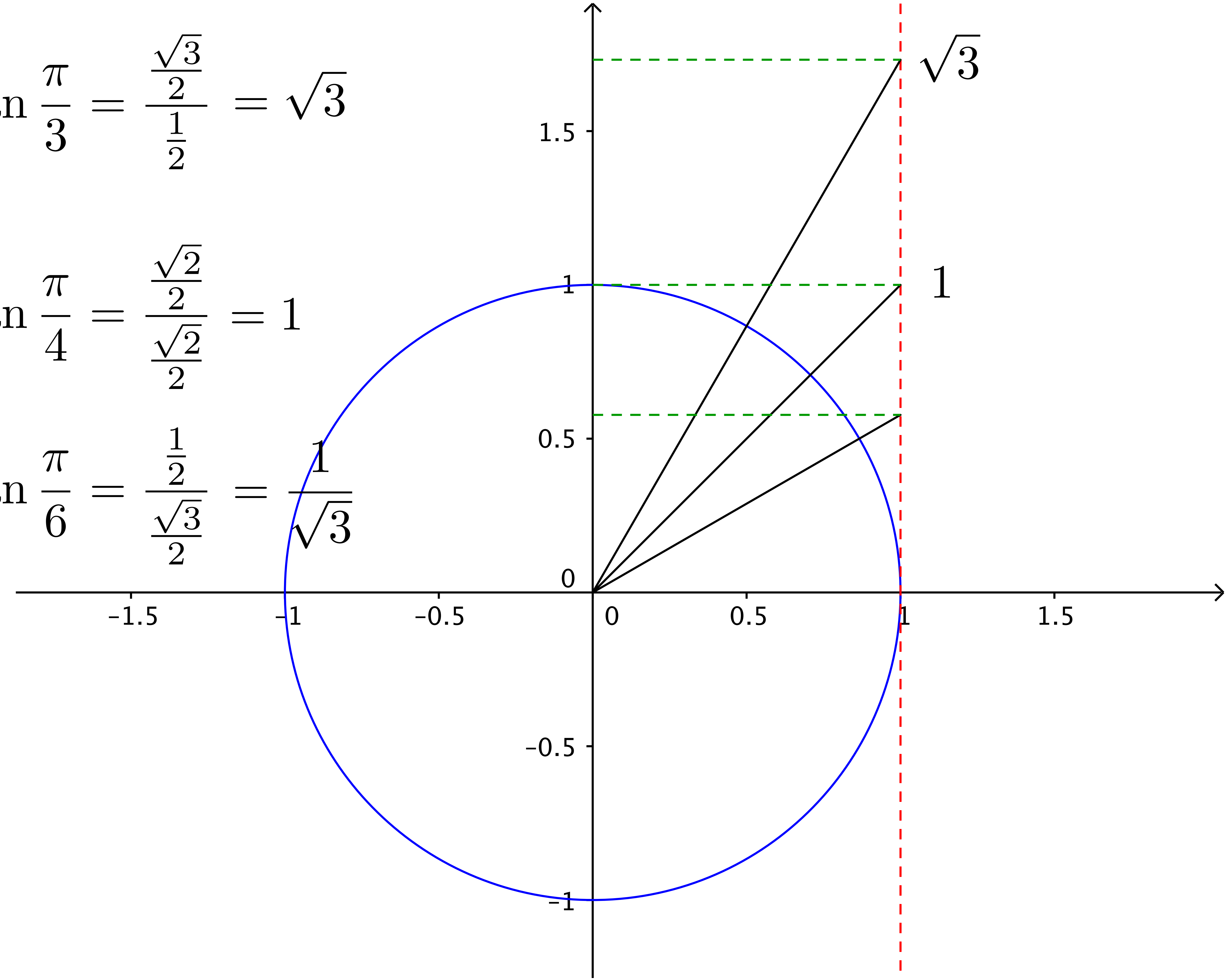

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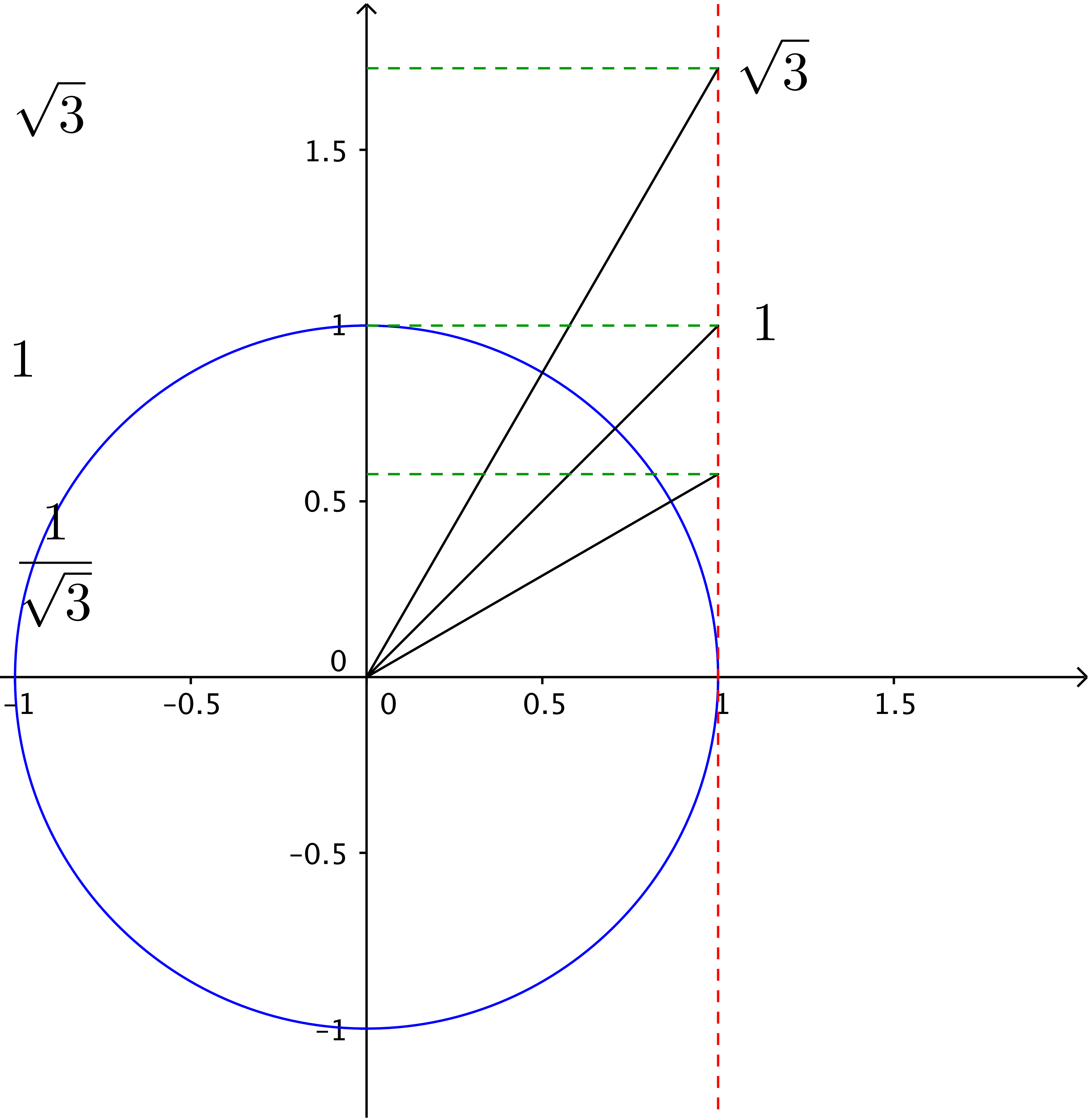
$$= \frac{\sqrt{3}}{\sqrt{3}\sqrt{3}}$$



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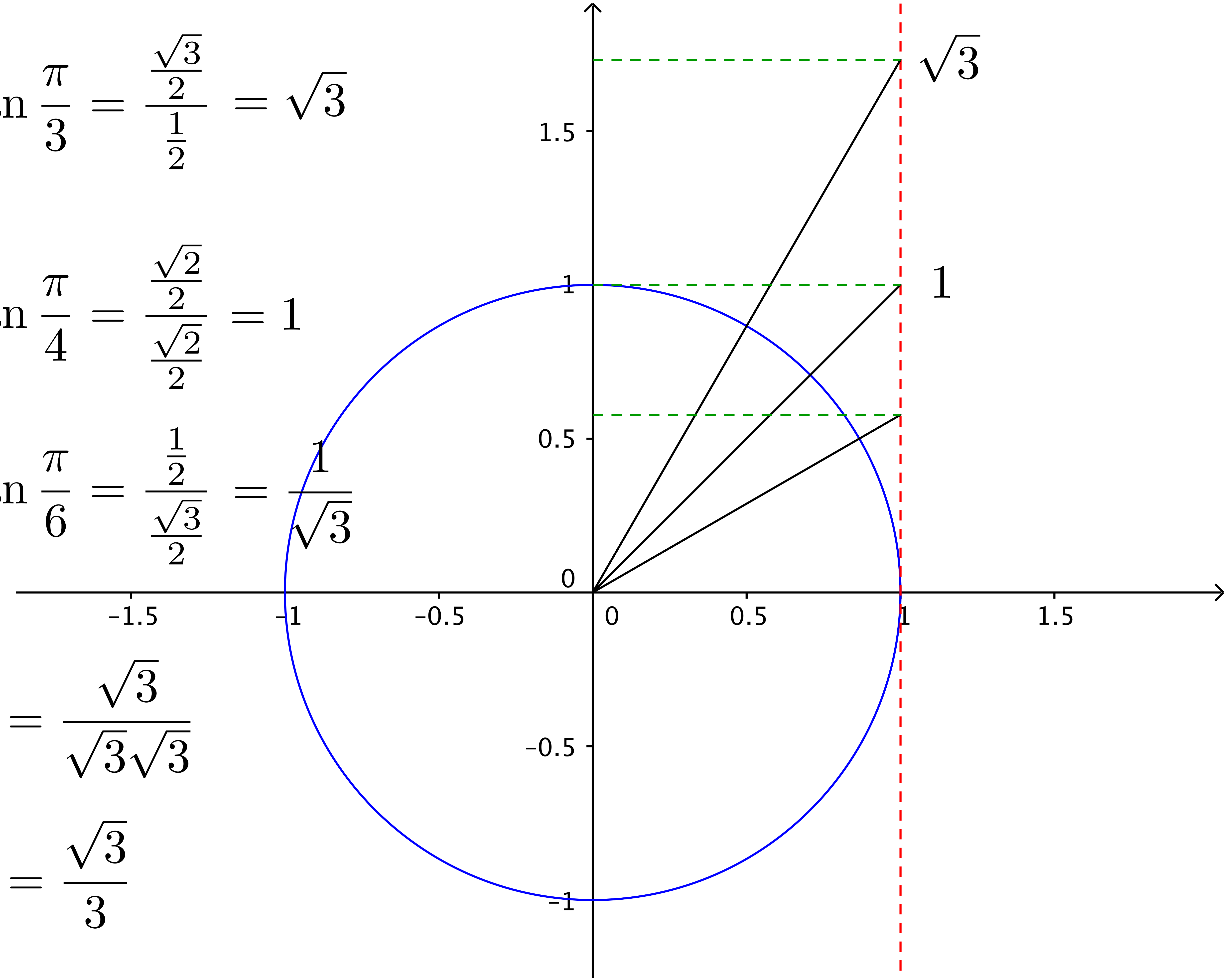
$$= \frac{\sqrt{3}}{3}$$



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$$= \frac{\sqrt{3}}{\sqrt{3}\sqrt{3}}$$

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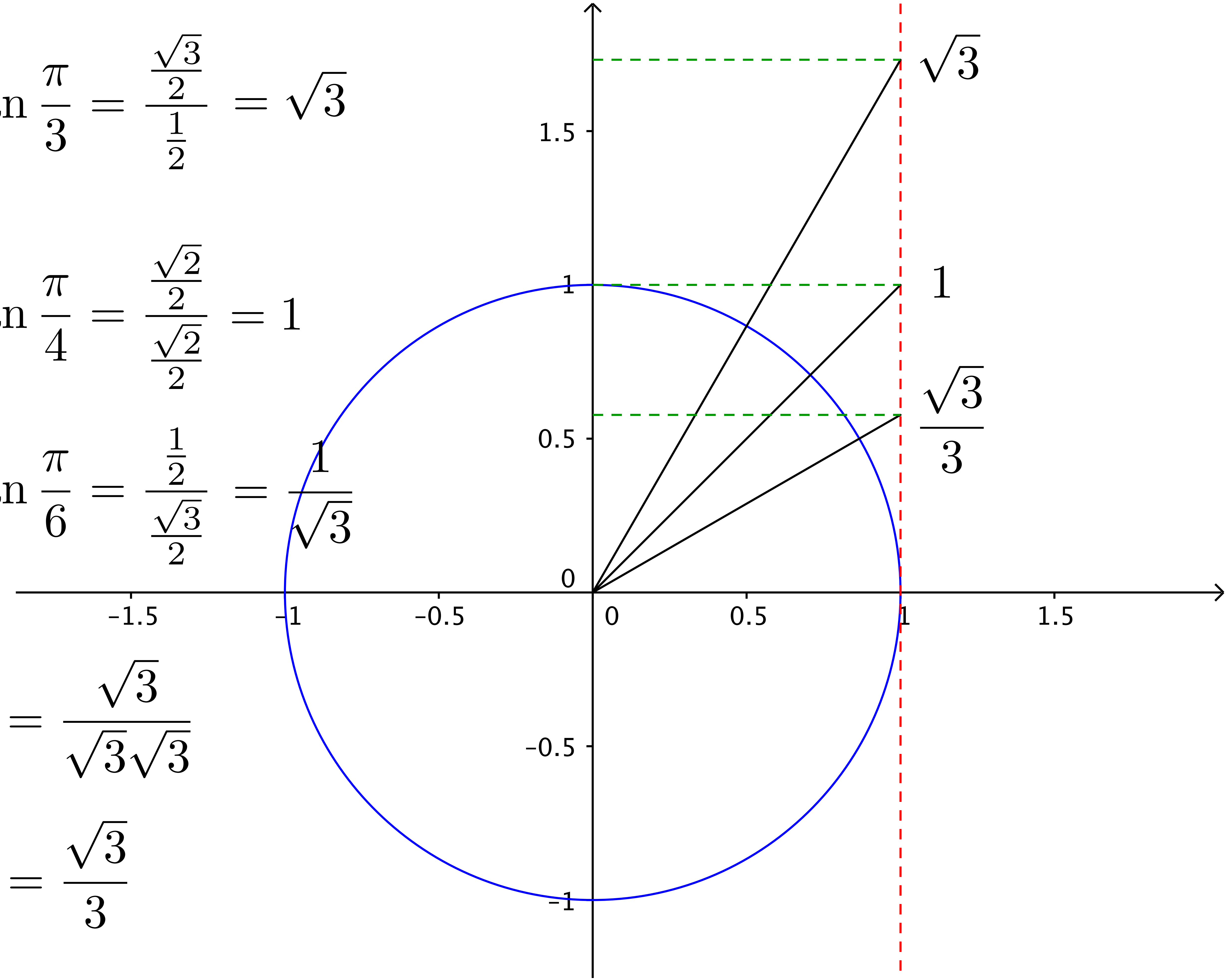

Faites les exercices suivants

Évaluer

a) $\arccos -1$

b) $\arcsin 0$

c) $\arcsin \dfrac{\sqrt{2}}{2}$

d) $\arcsin \left(-\dfrac{\sqrt{3}}{2}\right)$

e) $\arccos \left(-\dfrac{1}{2}\right)$

f) $\arctan 1$

g) $\operatorname{arcsec}\sqrt{2}$

h) $\arccos \dfrac{\sqrt{3}}{2}$

Un peu comme $\sqrt{x^2} \neq x$ mais plutôt $\sqrt{x^2} = |x|$

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on a

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on a

$$\arcsin(\sin\theta) = \begin{cases} \theta & \text{si} \quad -\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}, \\ \pi - \theta & \text{si} \quad \frac{\pi}{2} < \theta < \frac{3\pi}{2}. \end{cases}$$

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$$\arccos(\cos\theta) = \begin{cases} \theta & \text{si} \quad 0 \leq \theta \leq \pi, \\ -\theta & \text{si} \quad \pi < \theta < 2\pi. \end{cases}$$

$$\arctan(\tan\theta) = \begin{cases} \theta & \text{si} \quad -\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}, \\ \theta + \pi & \text{si} \quad \frac{\pi}{2} < \theta < \frac{3\pi}{2}. \end{cases}$$

Par contre lorsqu'on cherche les solutions d'une équation on doit trouver toutes valeurs qui rendent cette équation vraie.

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Ajouter un ou des tours à l'angle nous amène au même point sur le cercle et donc au même rapport trigonométrique.

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Ajouter un ou des tours à l'angle nous amène au même point sur le cercle et donc au même rapport trigonométrique.

Donc dès qu'on a une solution, additionner un multiple de 2π ou en soustraire un nous donne aussi une solution.

Exemple

$$2\sin\theta + 1 = 0$$

Exemple

$$2\sin\theta + 1 = 0 \iff 2\sin\theta = -1$$

Exemple

$$2\sin\theta + 1 = 0 \iff 2\sin\theta = -1$$

$$\iff \sin\theta = -\frac{1}{2}$$

Exemple

$$2\sin\theta + 1 = 0 \iff 2\sin\theta = -1$$

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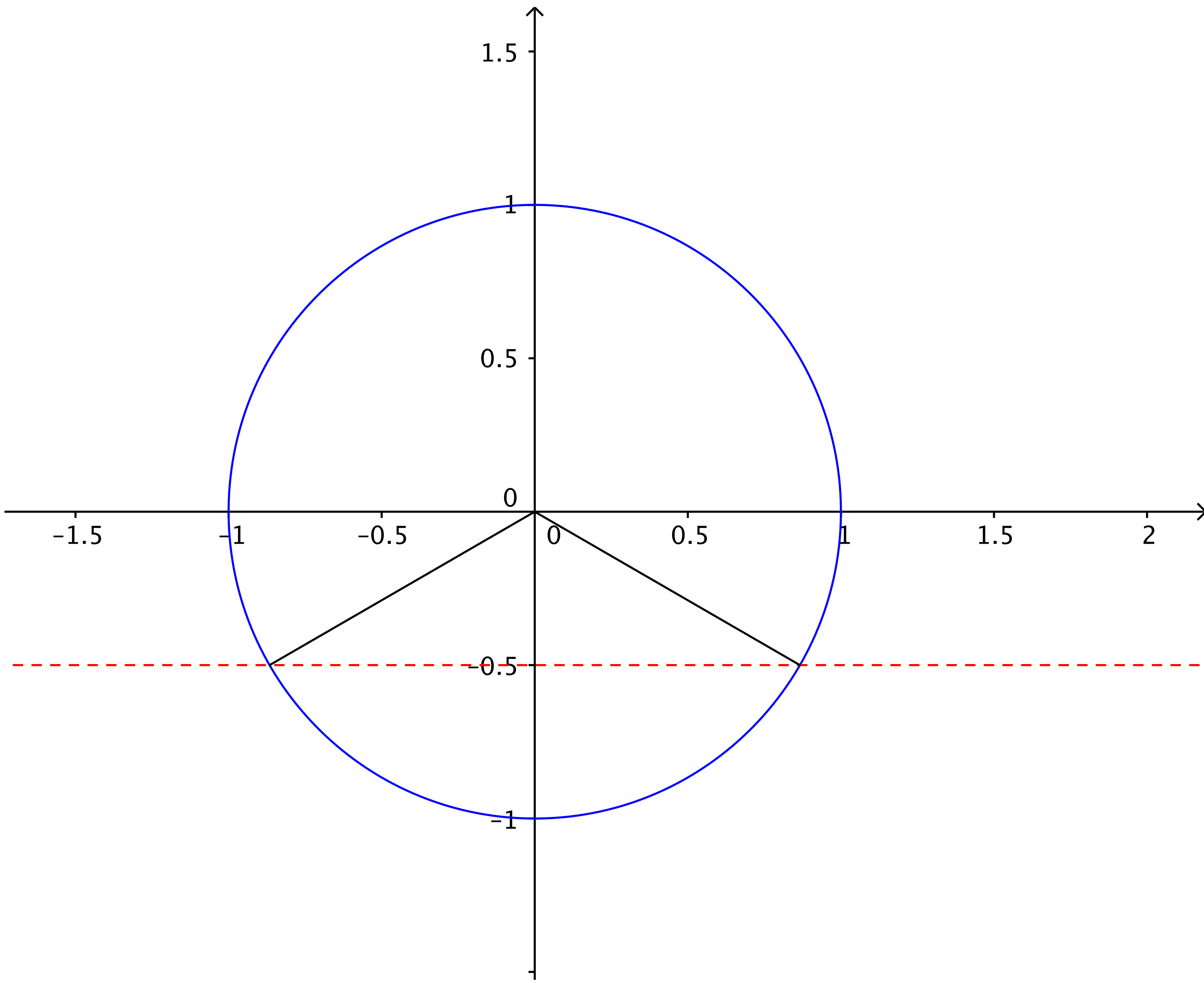

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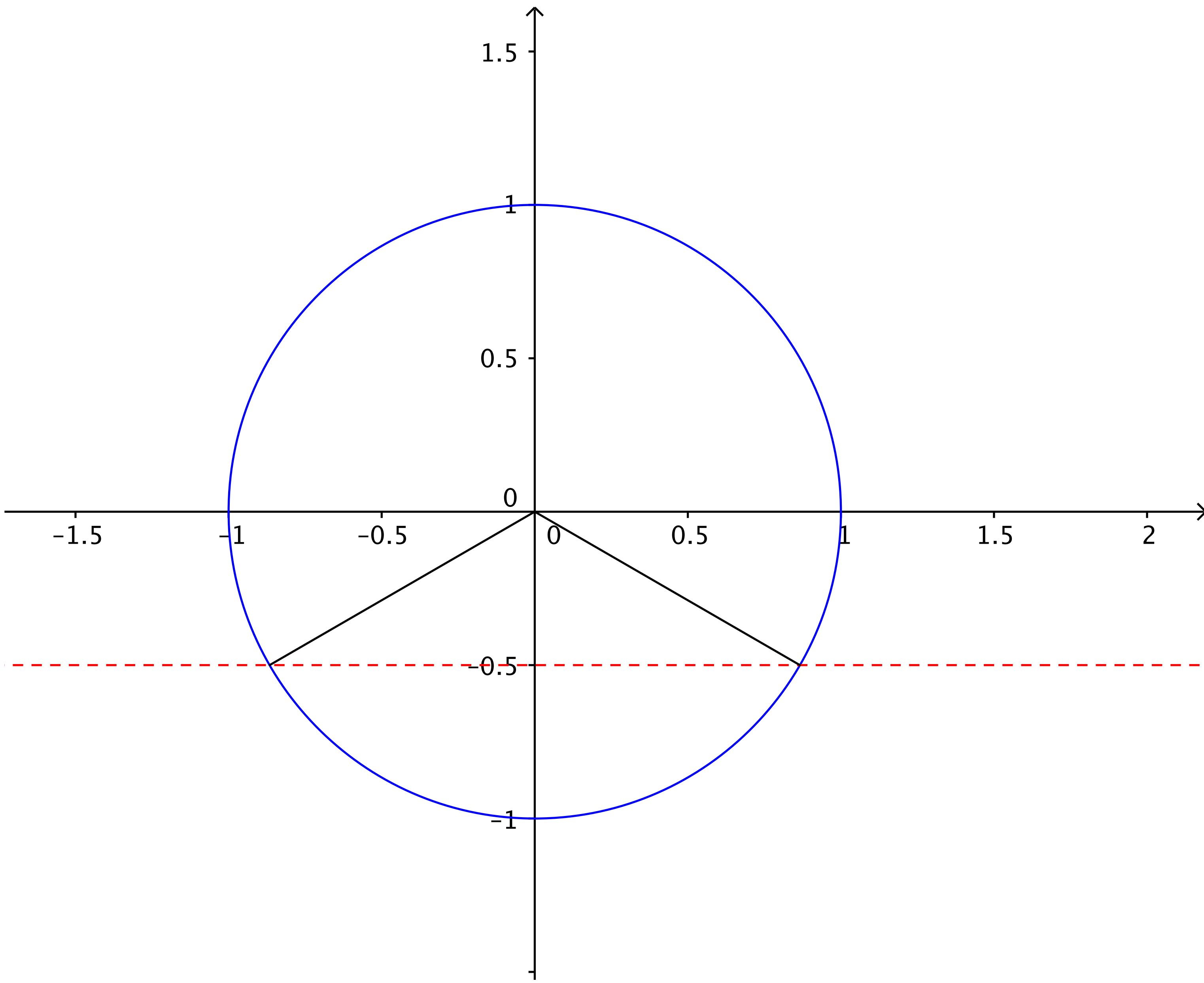

$$\theta = -\frac{\pi}{6}$$

Exemple

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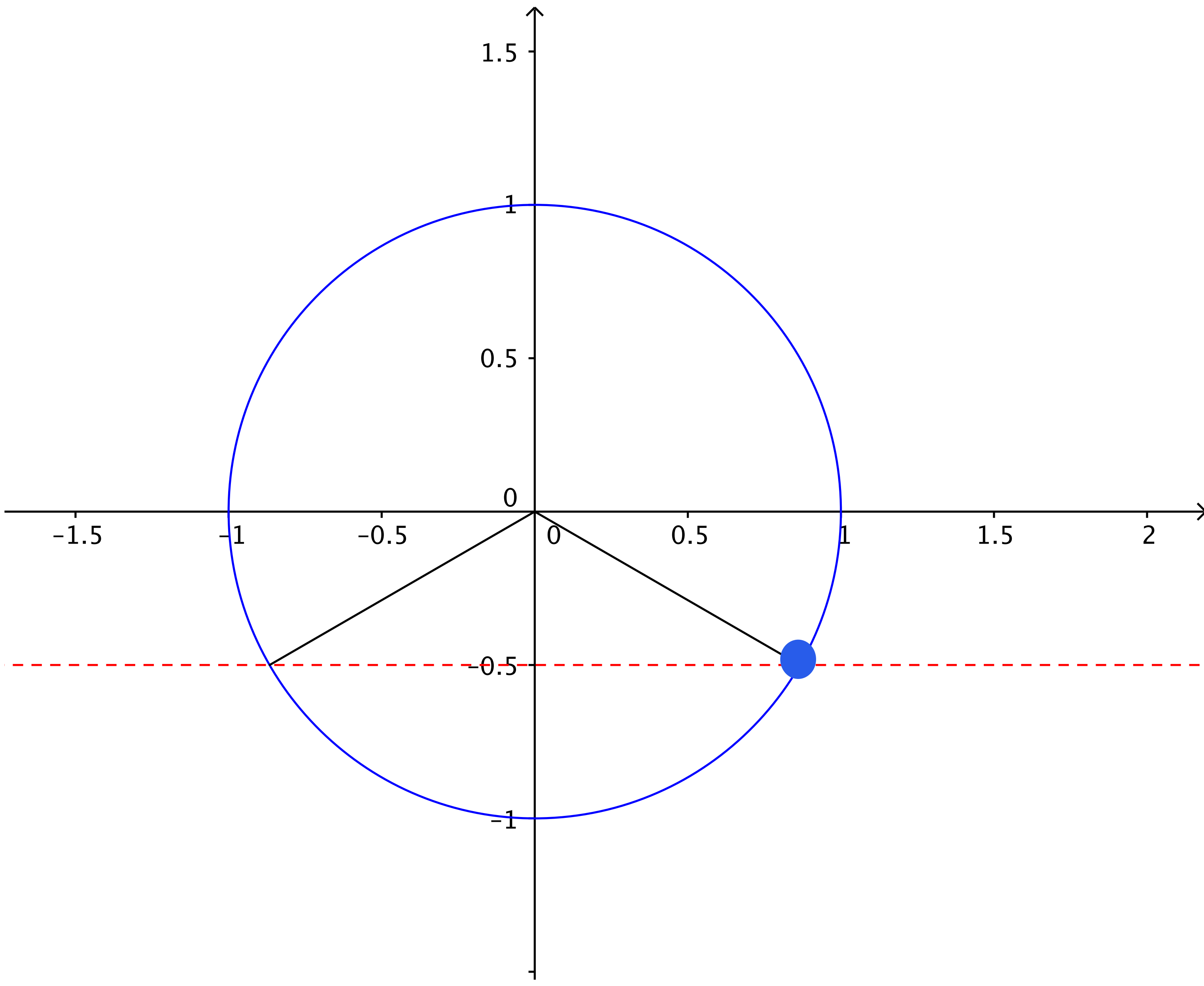

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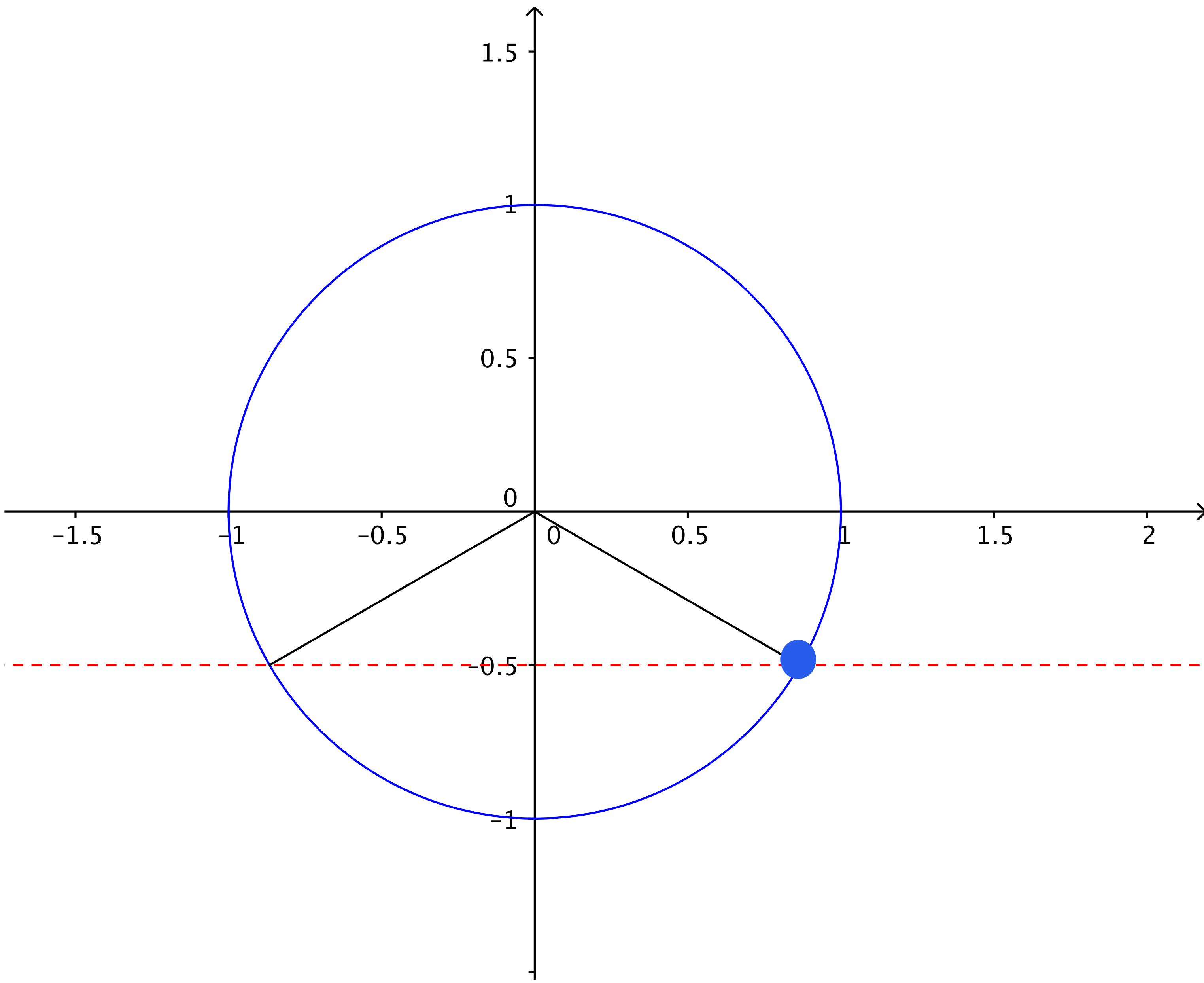

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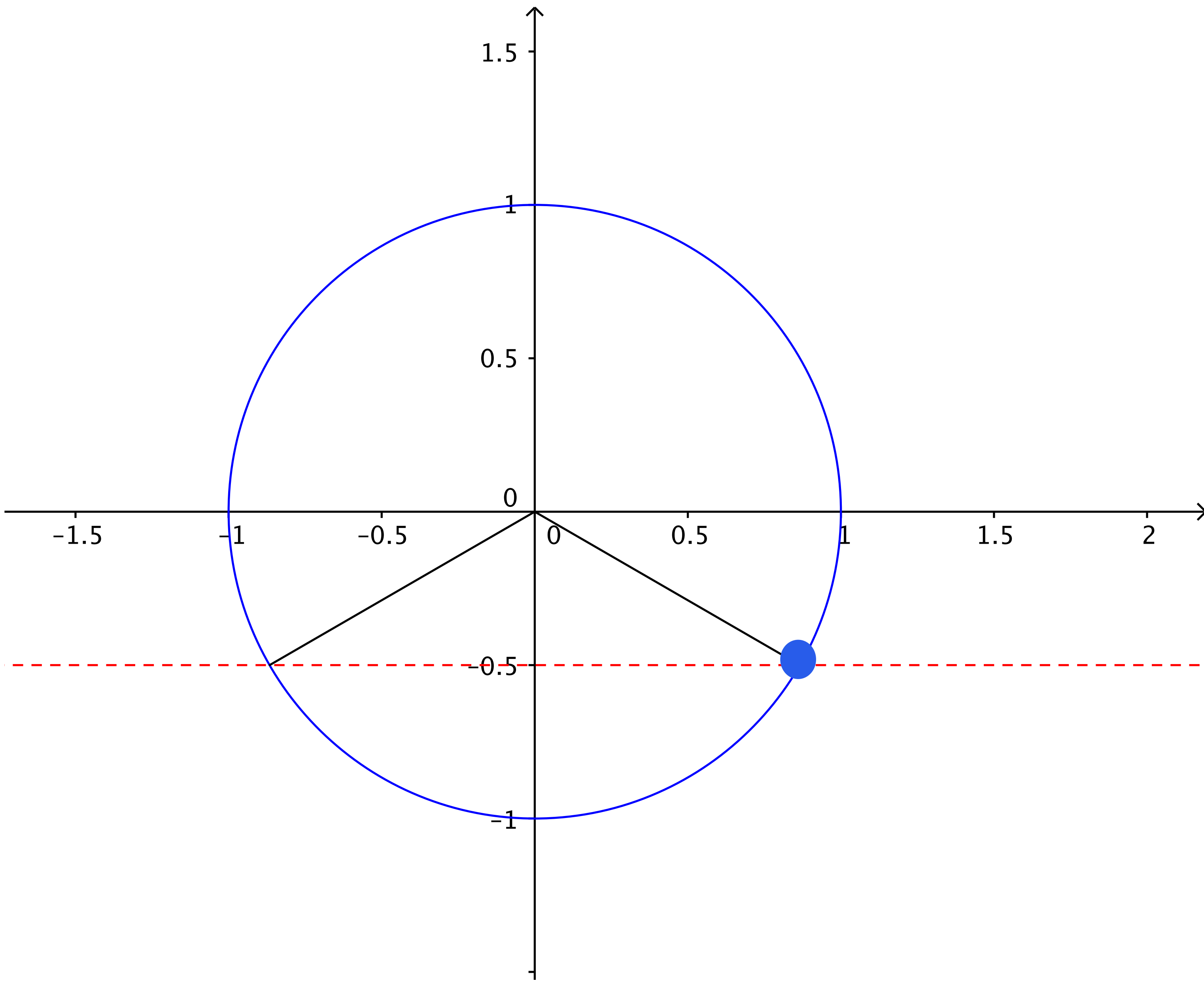

$$\theta = -\frac{\pi}{6}$$

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$$\theta = \frac{7\pi}{6}$$

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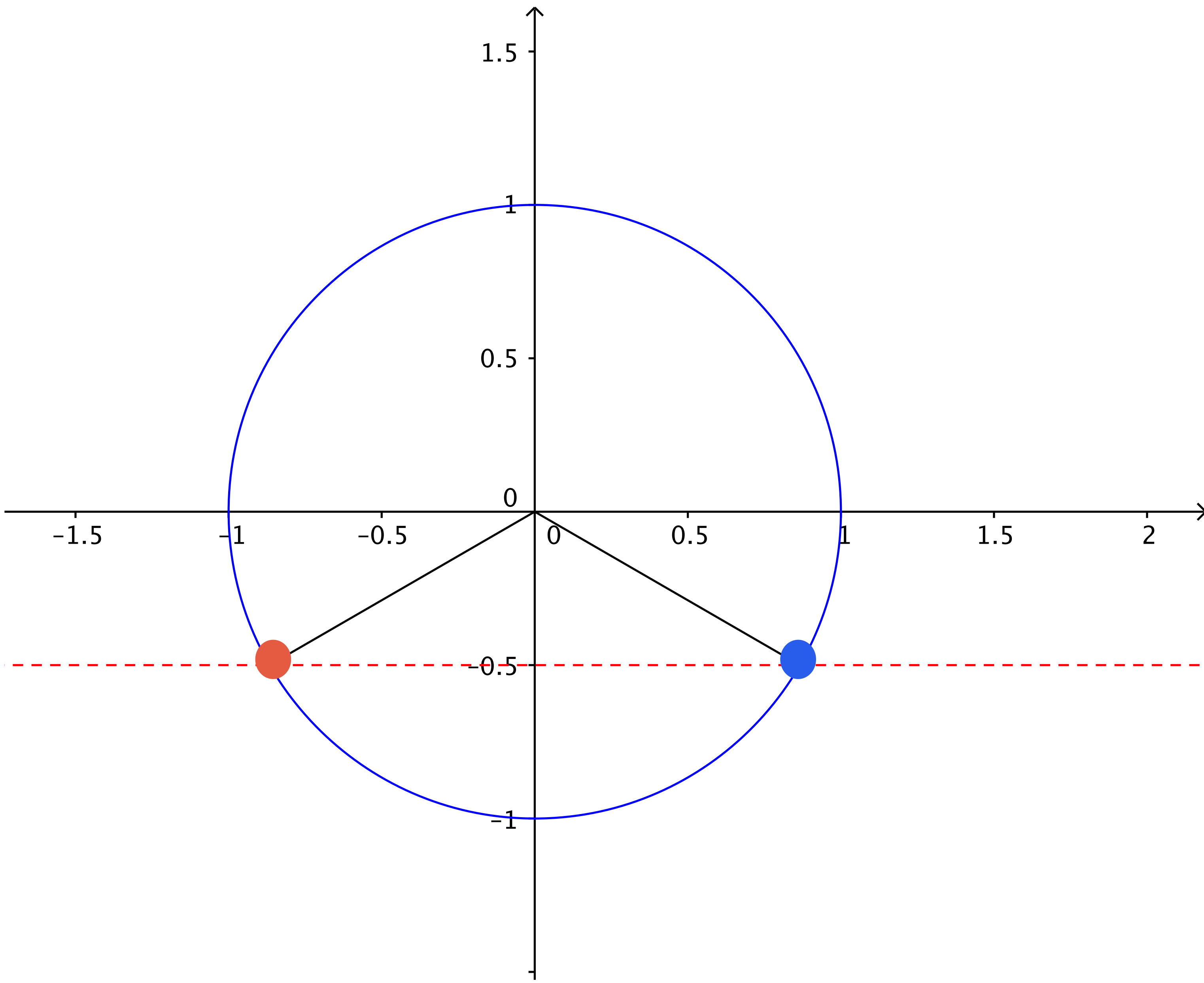

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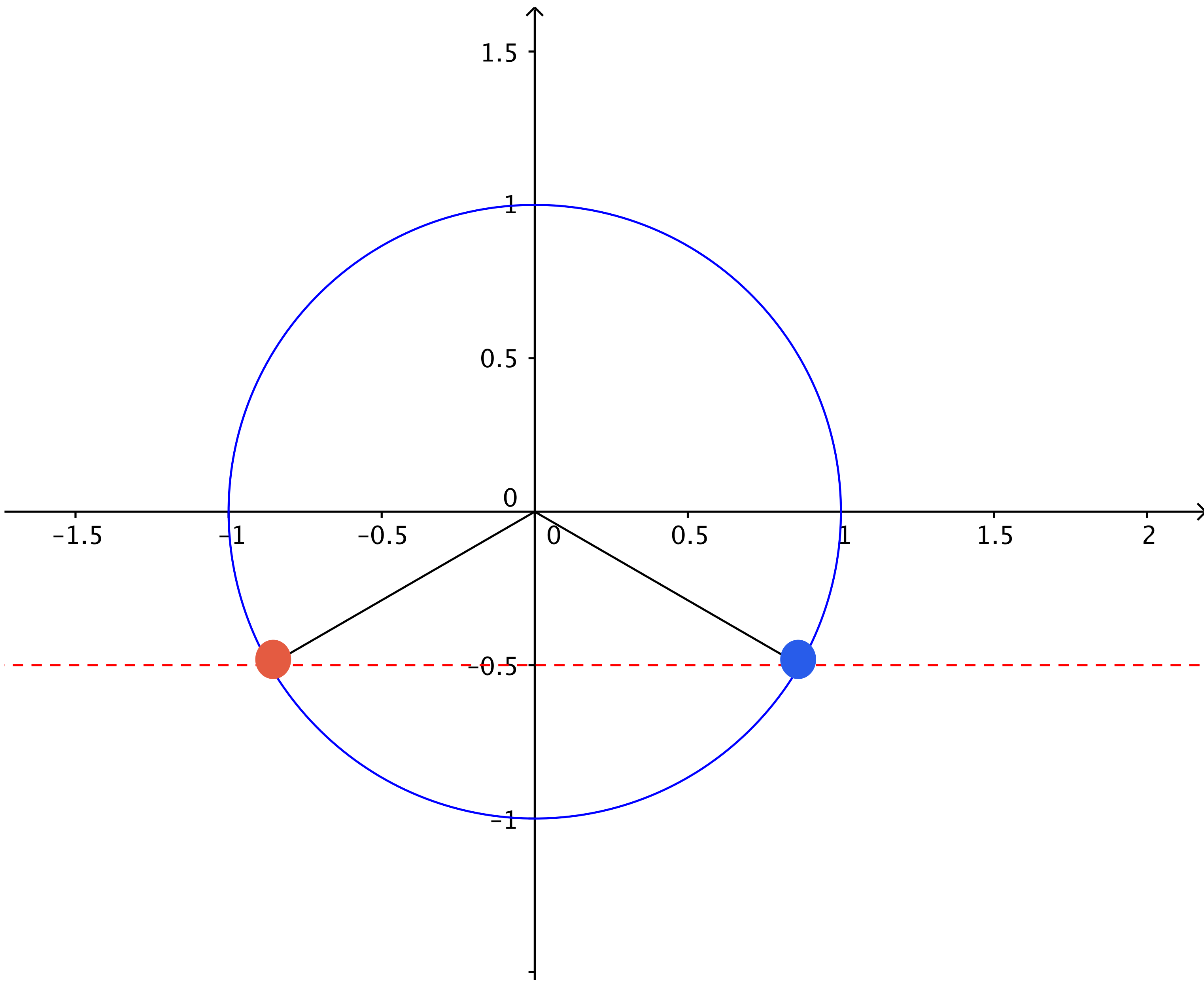

$$\theta = -\frac{\pi}{6} + k2\pi, k \in \mathbb{Z}$$ et $$\theta = \frac{7\pi}{6} + k2\pi, k \in \mathbb{Z}$$

Exemple

$$2\cos^2\theta + \cos\theta - 1 = 0$$

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posons $x = \cos\theta$

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$$2\cos^2\theta + \cos\theta - 1 = 0$$

posons $x = \cos\theta$

$$2x^2 + x - 1 = 0 \qquad x = \frac{-1 \pm \sqrt{1+8}}{4}$$

Exemple $2\cos^2\theta + \cos\theta - 1 = 0$ posons $x = \cos\theta$

$2x^2 + x - 1 = 0$ $$x = \frac{-1 \pm \sqrt{1+8}}{4} = \frac{-1 \pm 3}{4}$$

Exemple

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posons $x = \cos\theta$

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$$x = -1 \qquad x = \frac{2}{4}$$

Exemple

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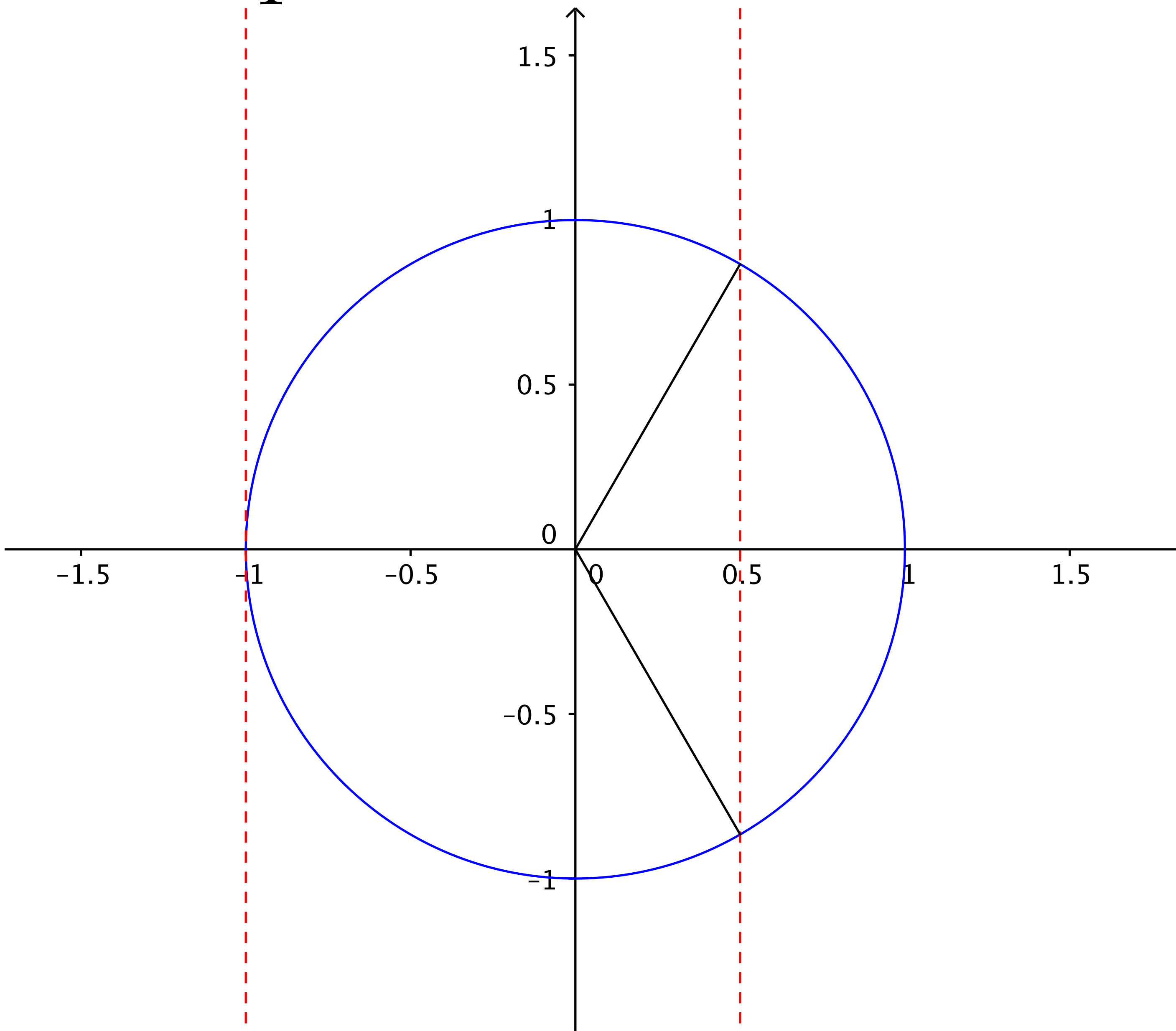

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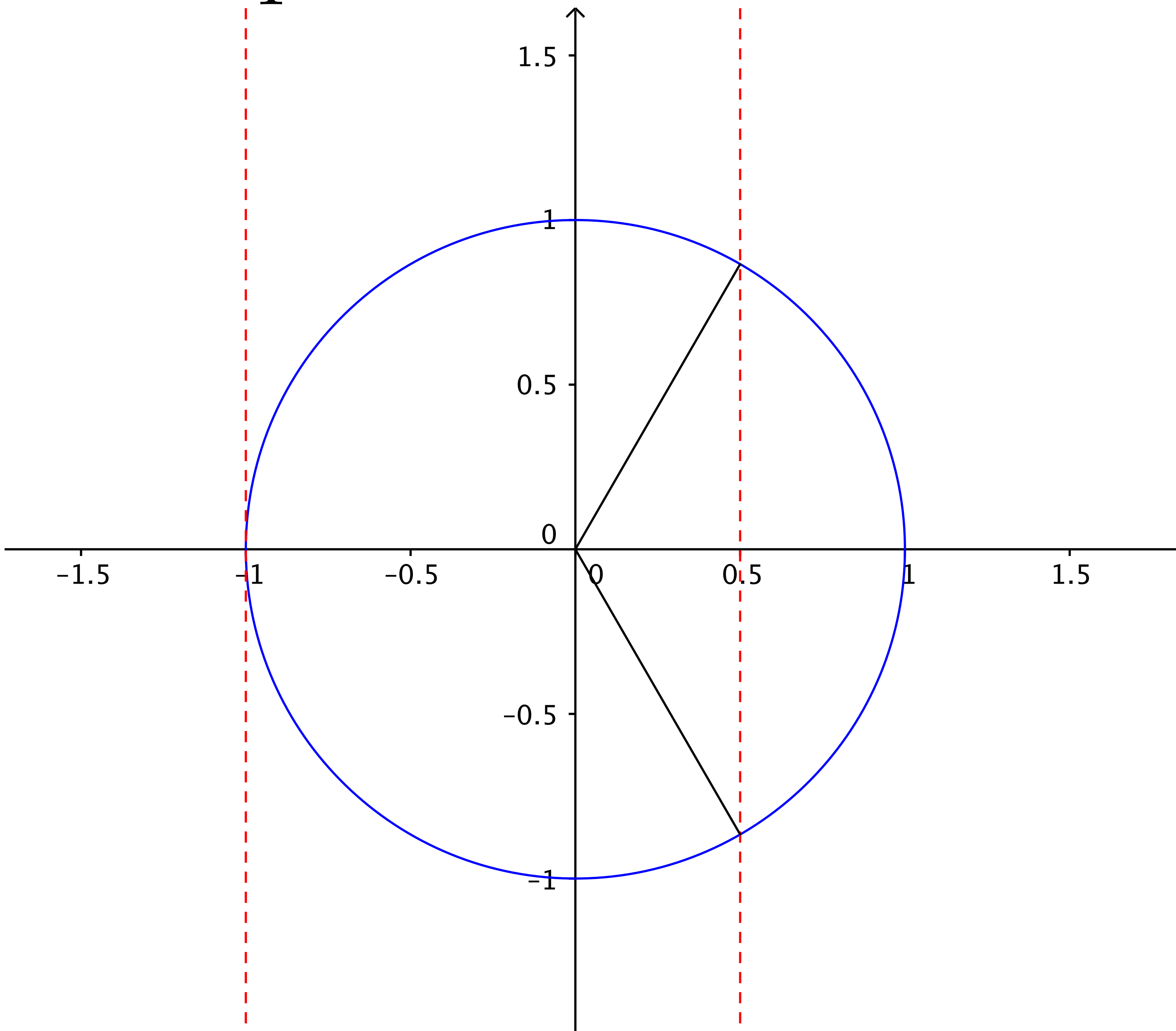

Exemple

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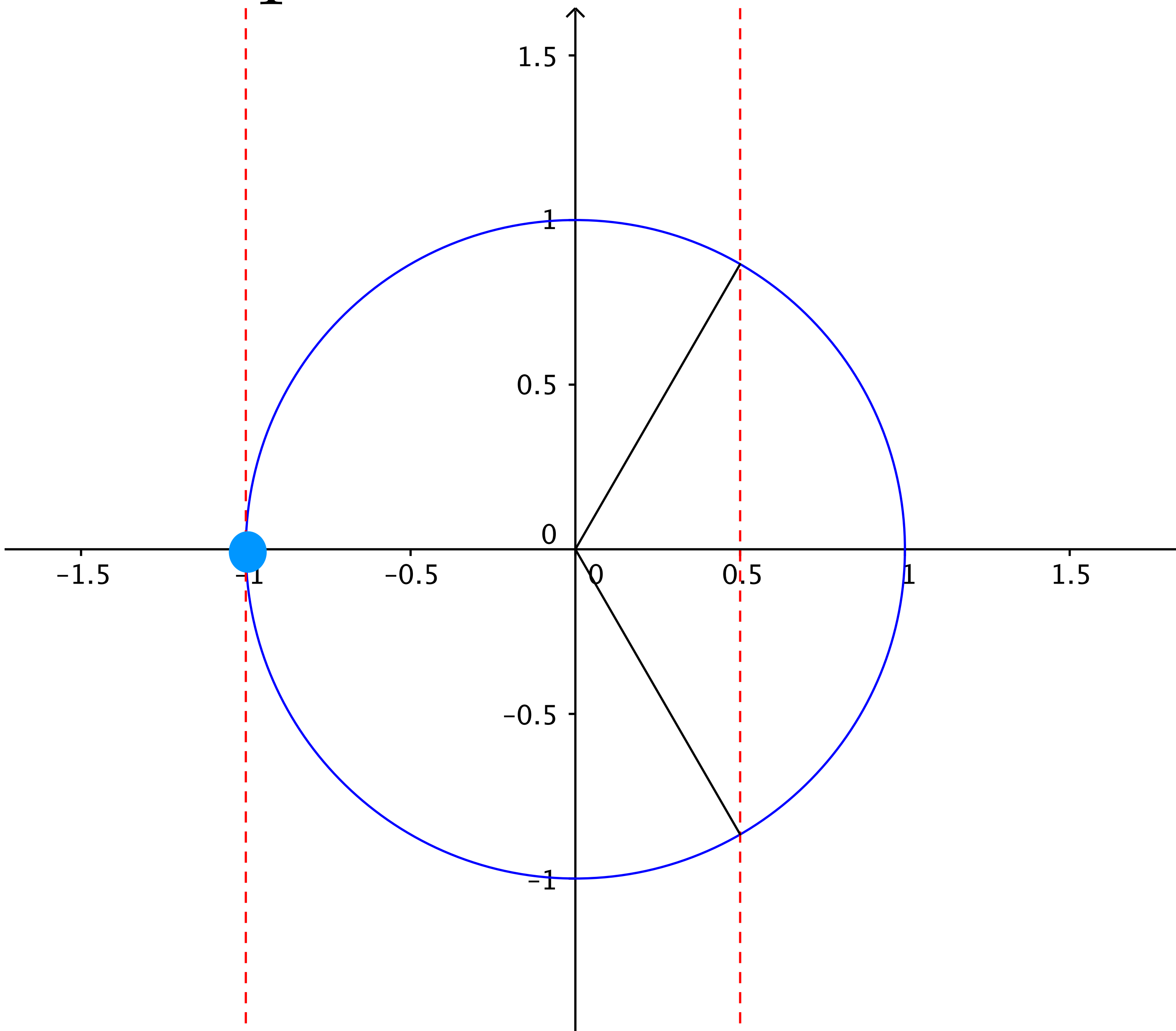

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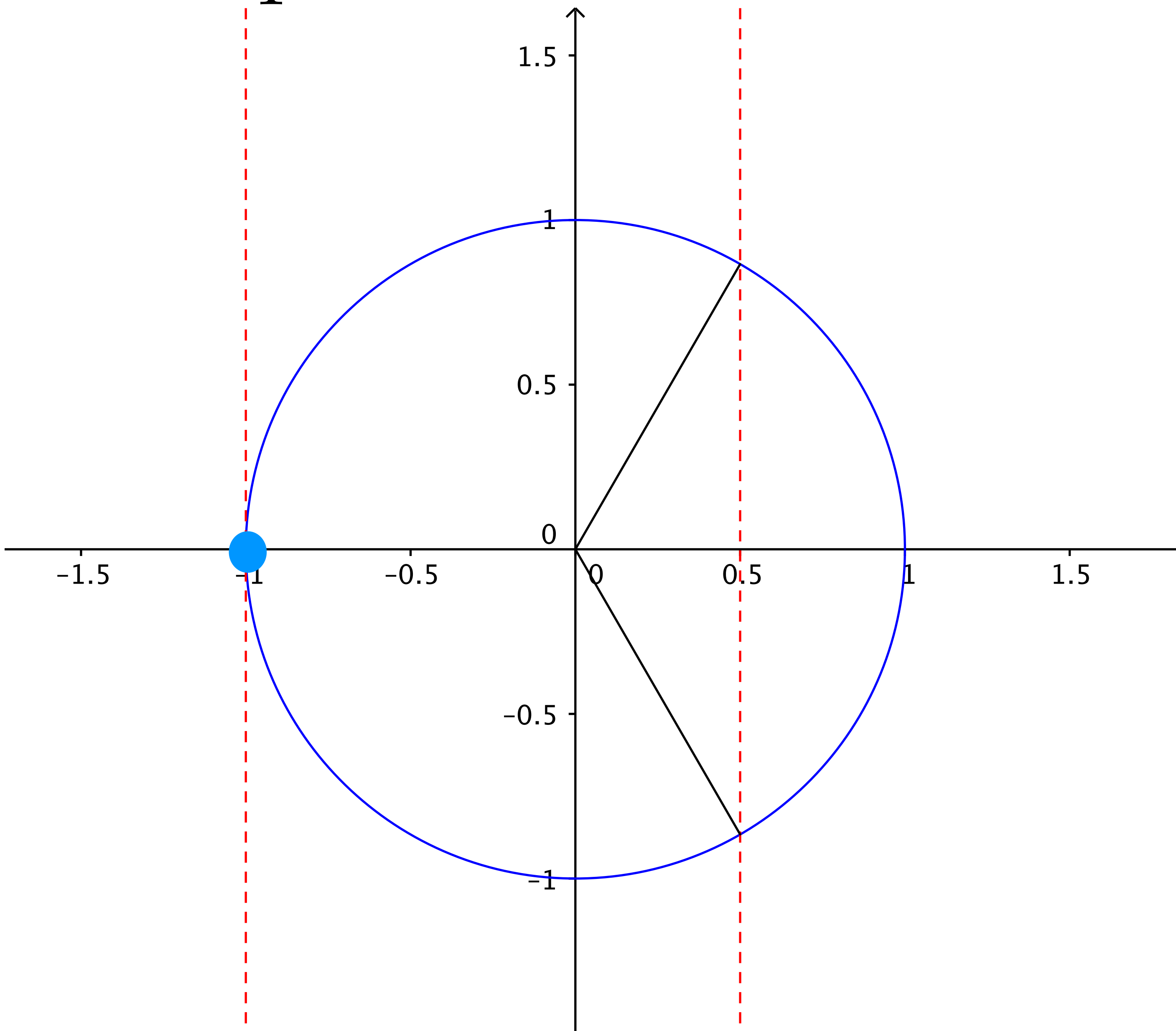

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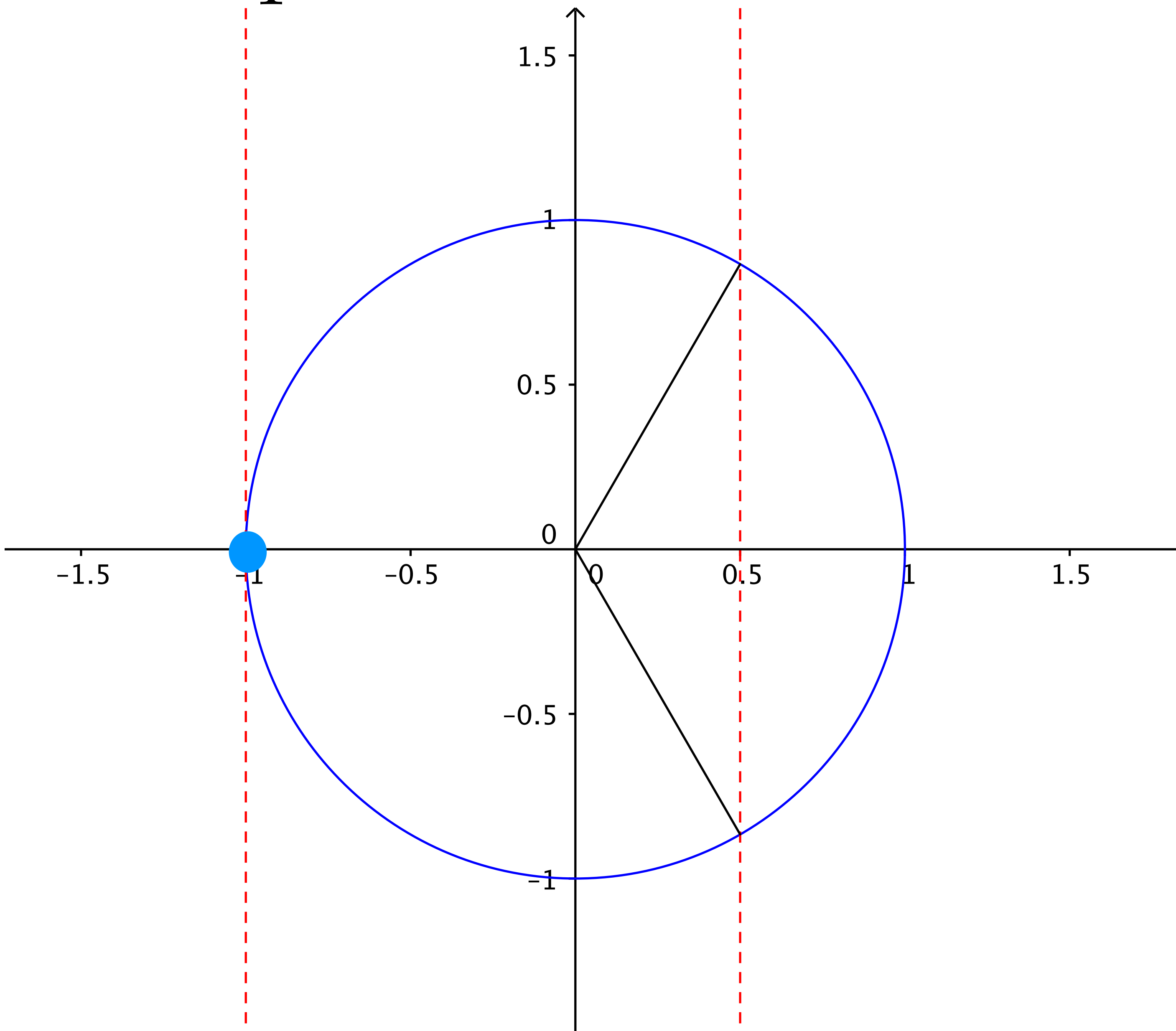

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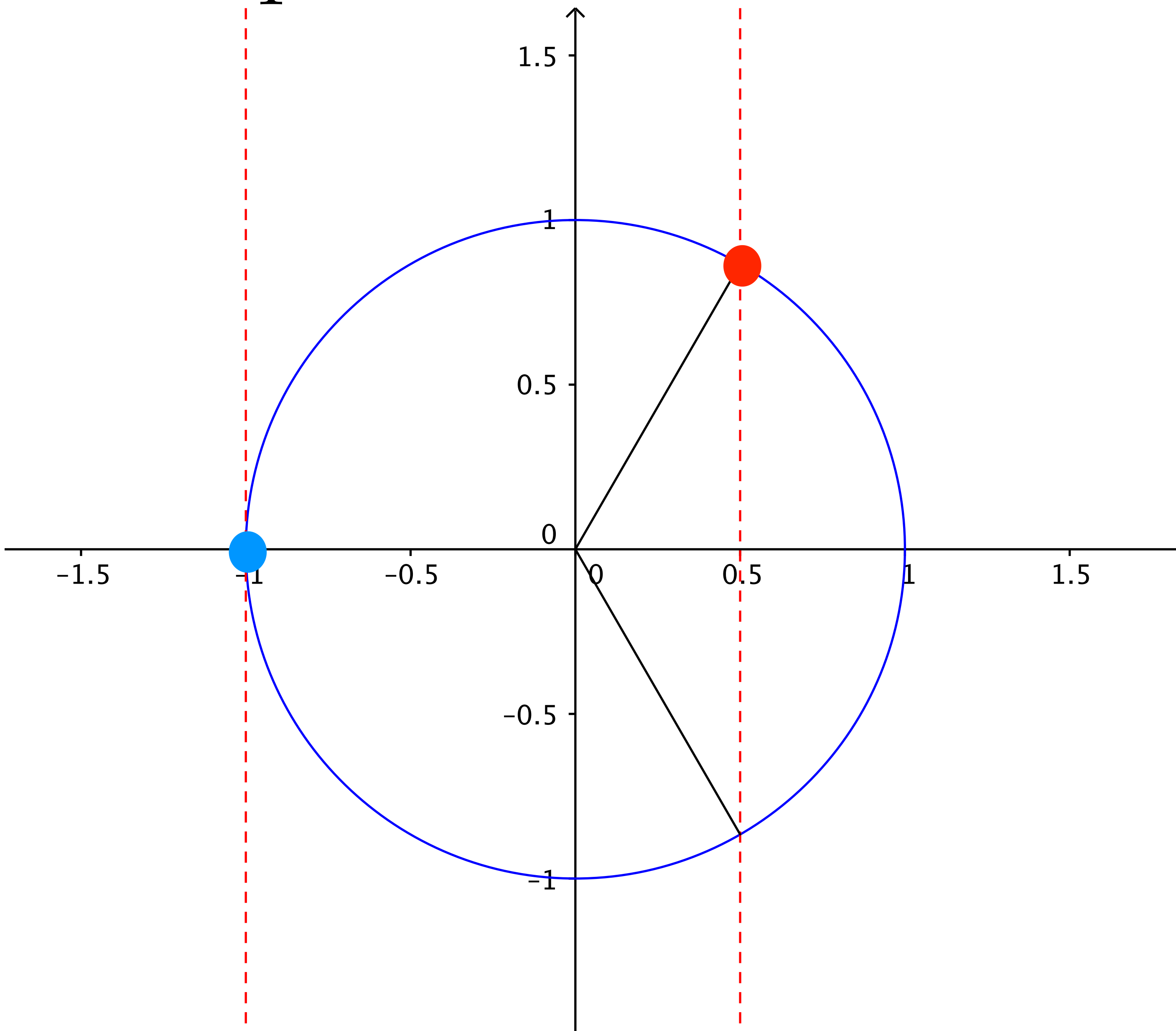

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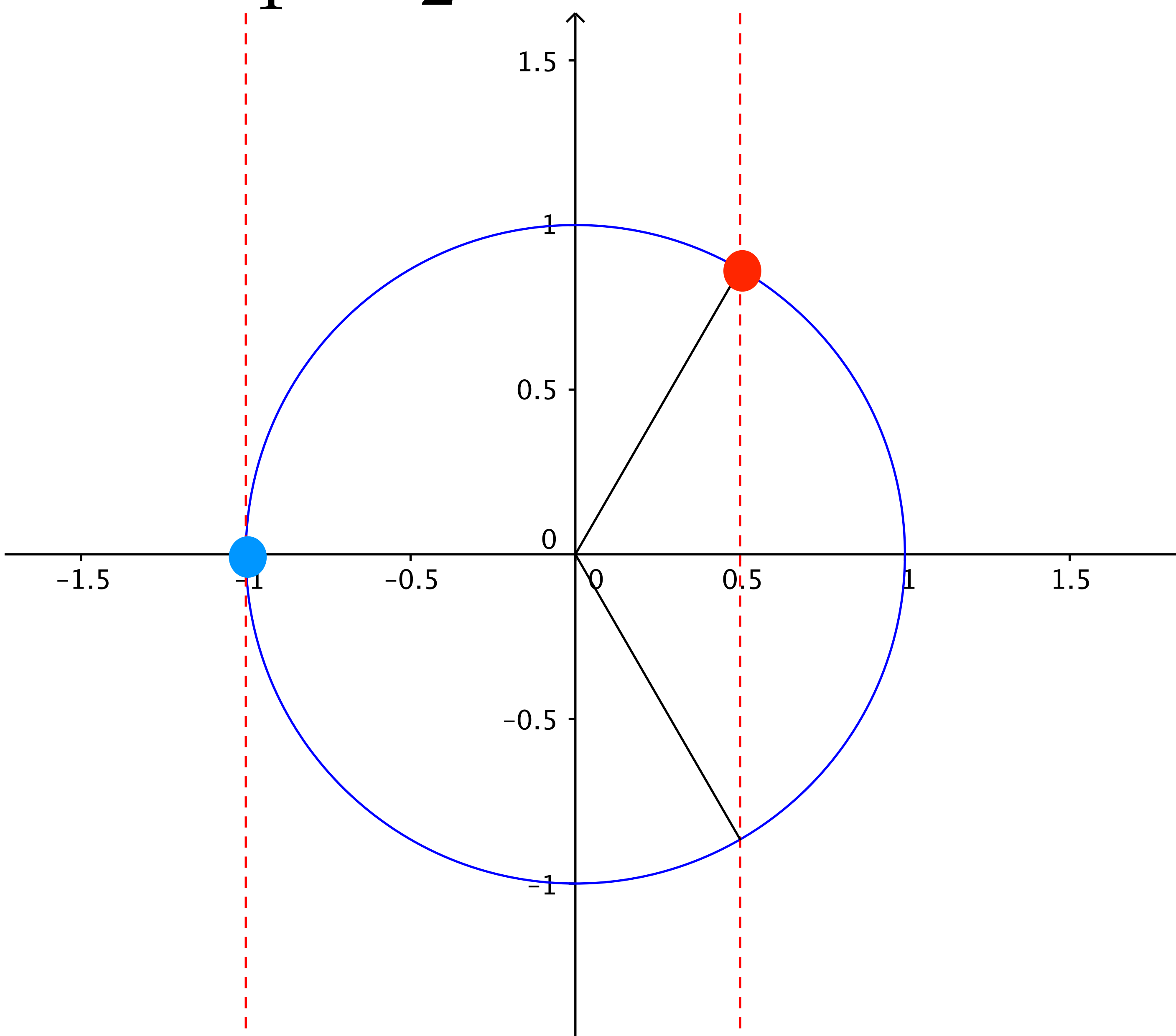

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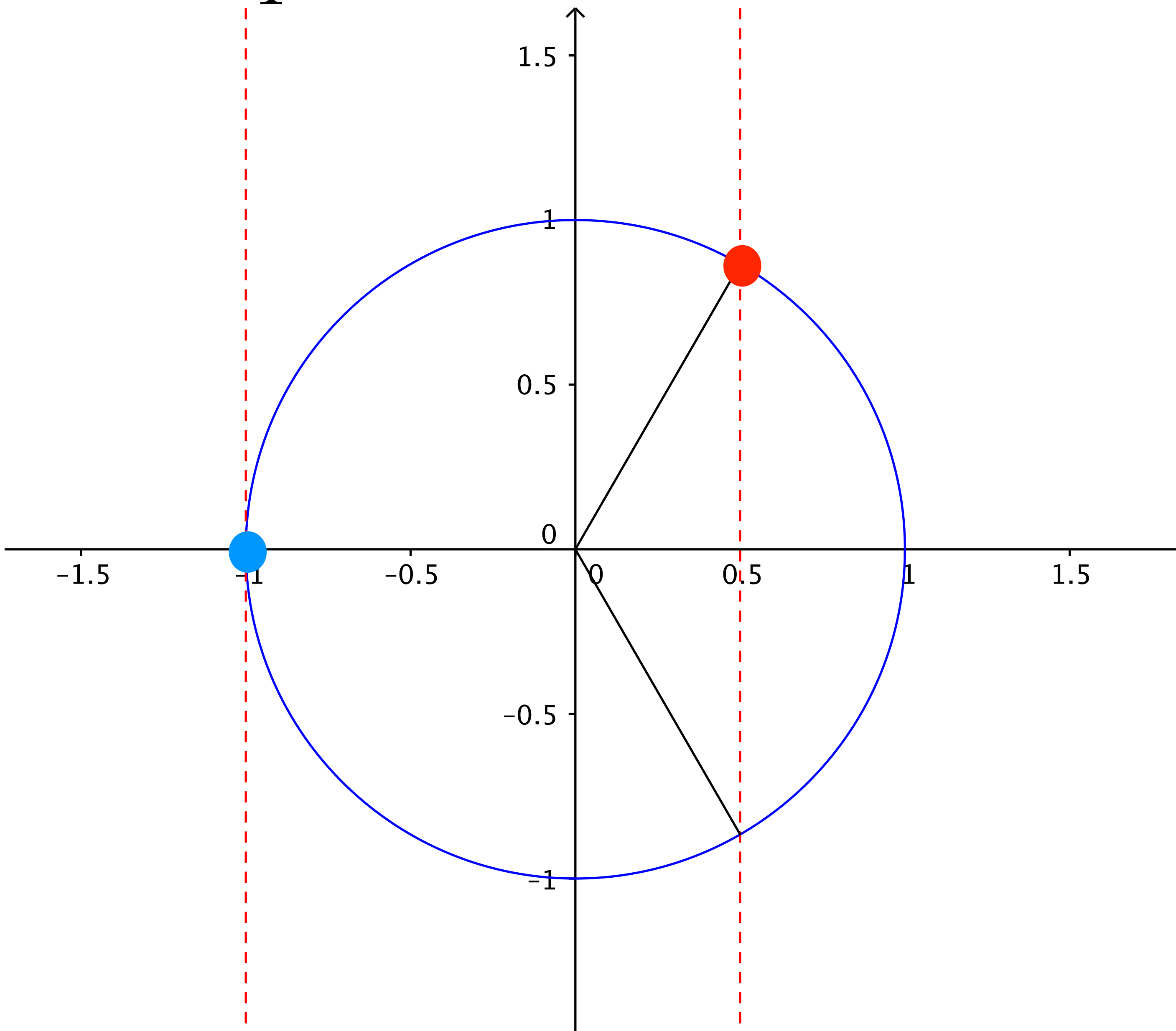

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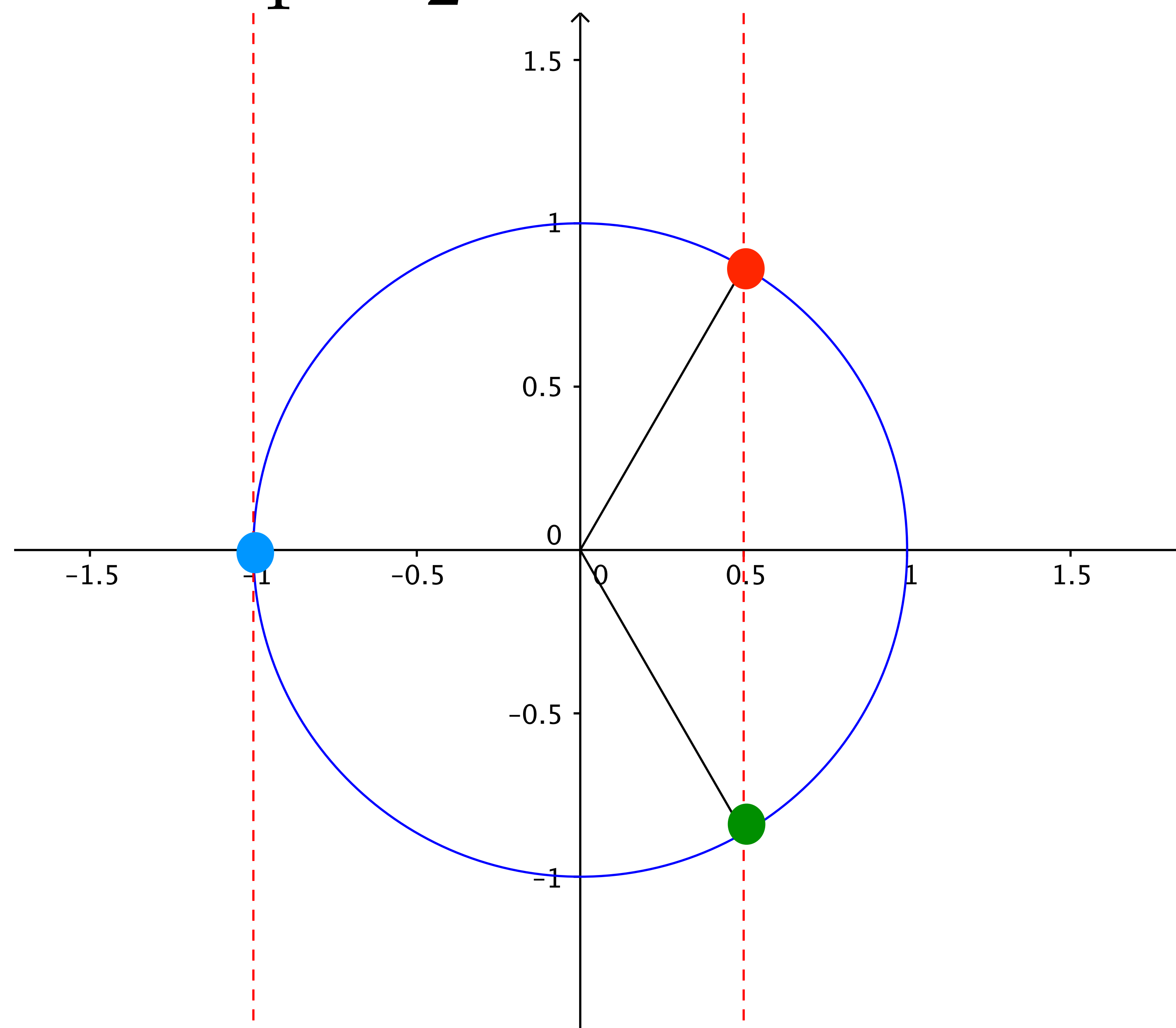

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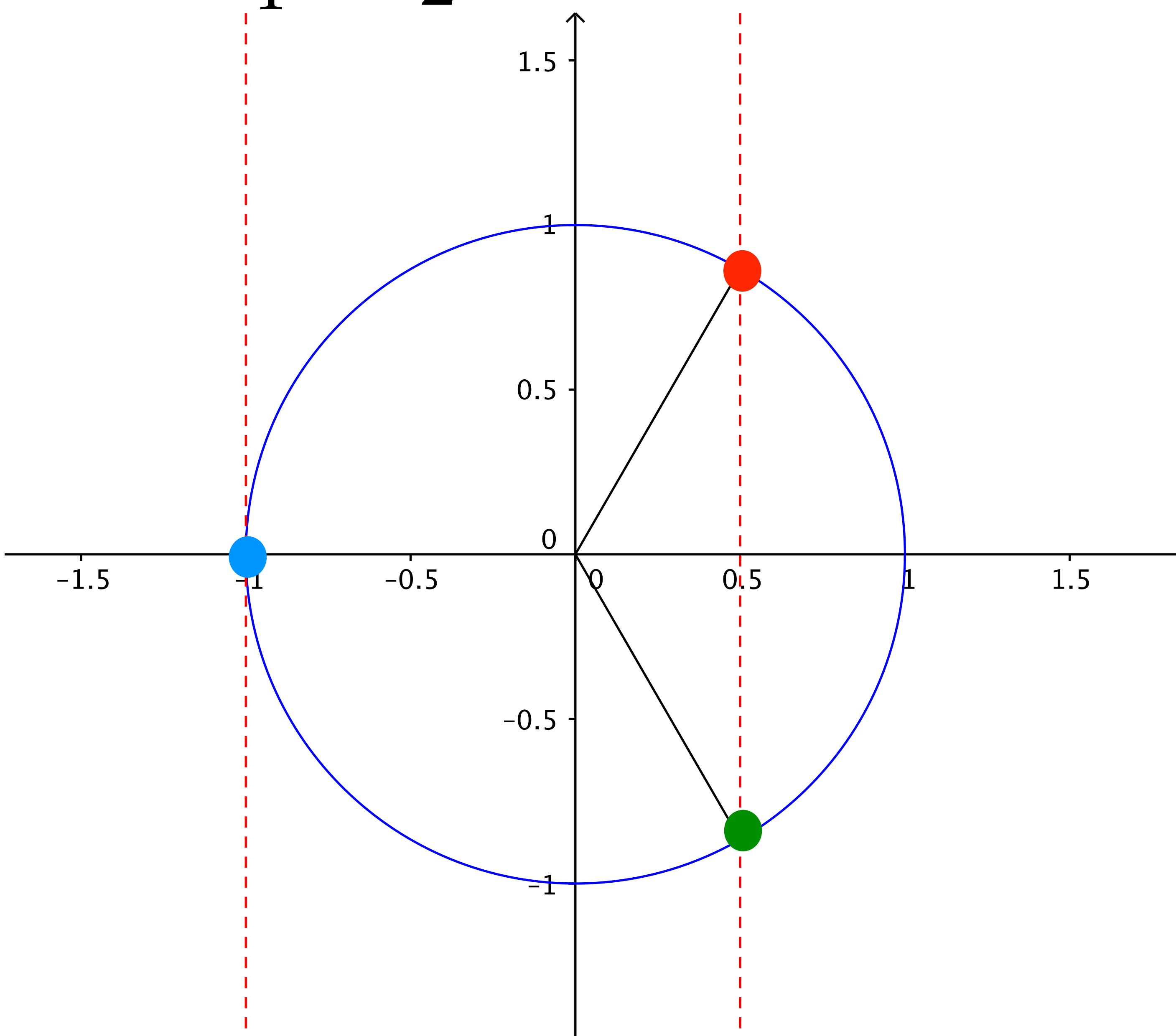

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$$\theta = \pi + k2\pi, k \in \mathbb{Z}$$

$$\theta = \frac{\pi}{3} + k2\pi, k \in \mathbb{Z}$$

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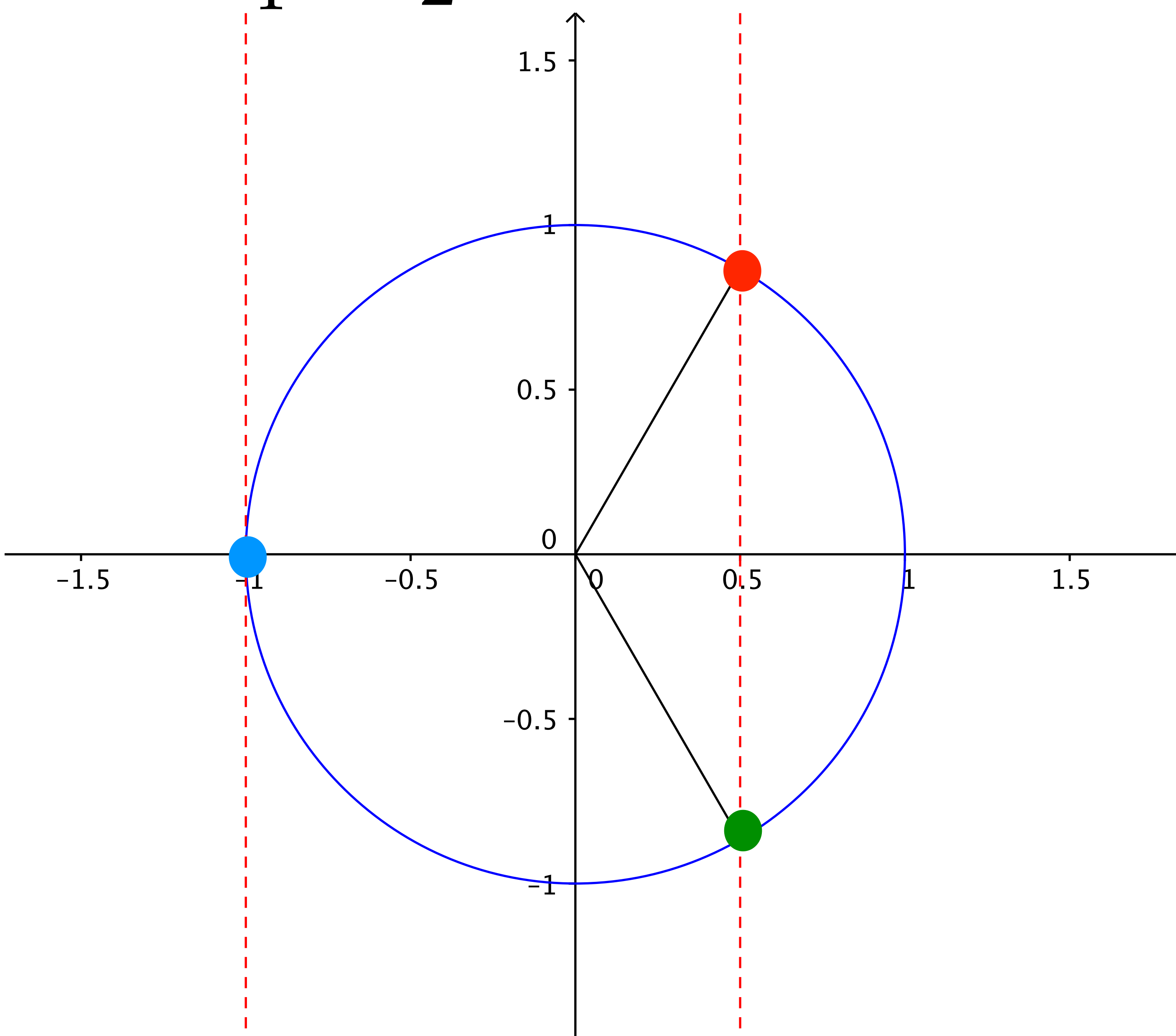

Exemple

$$\sec\theta + 4\csc\theta = 5\csc\theta$$

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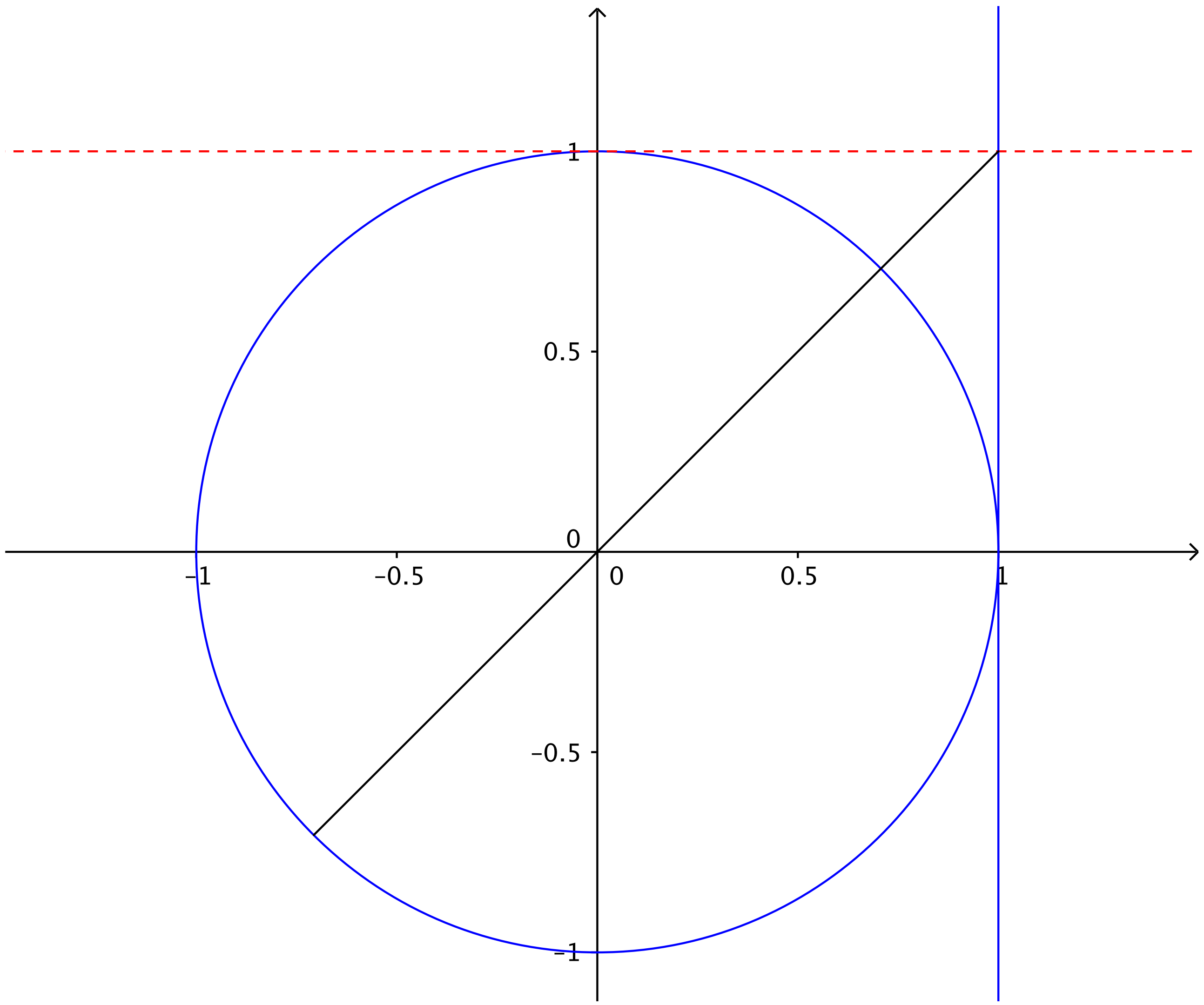

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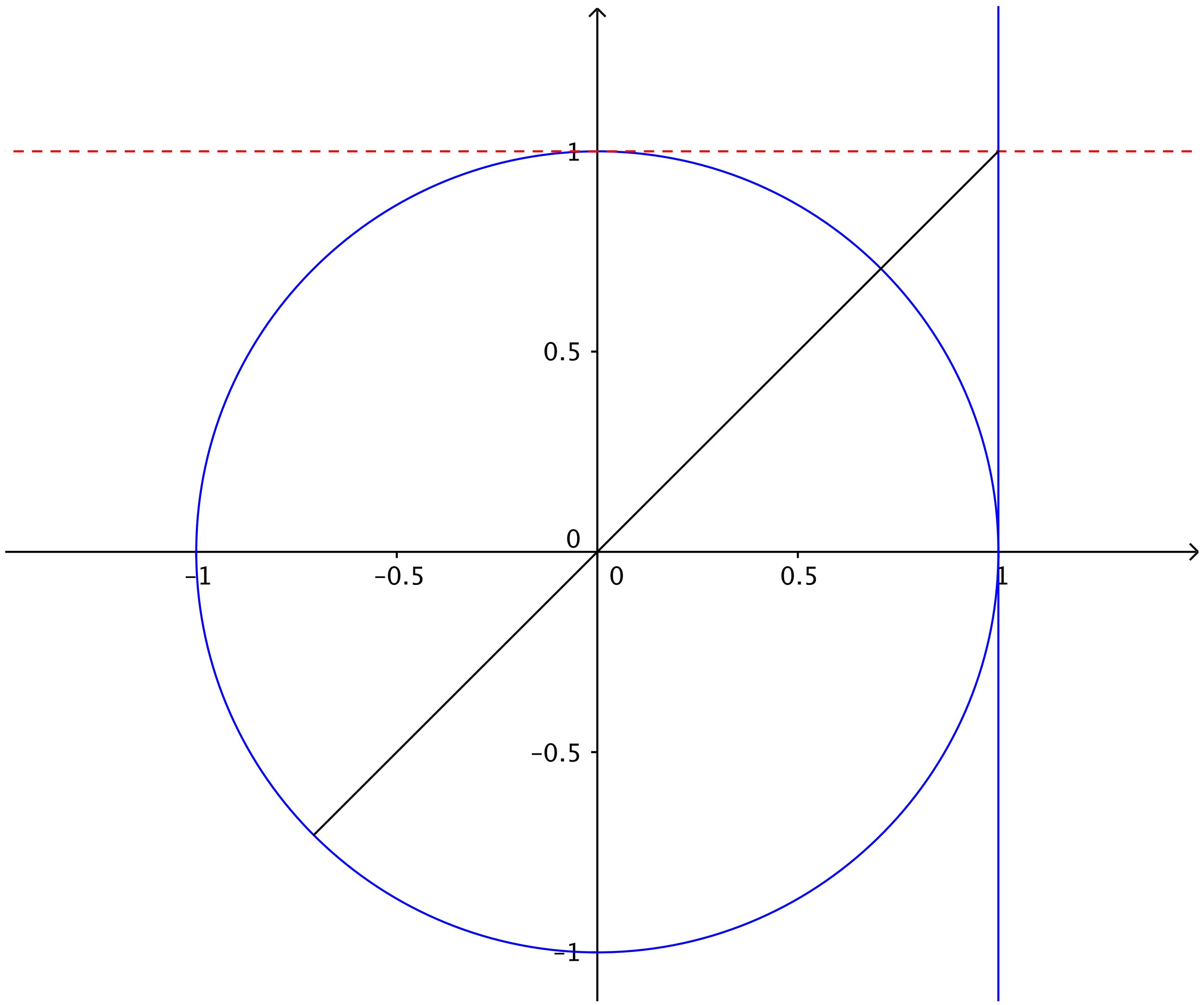
$$\theta = \frac{\pi}{4}$$



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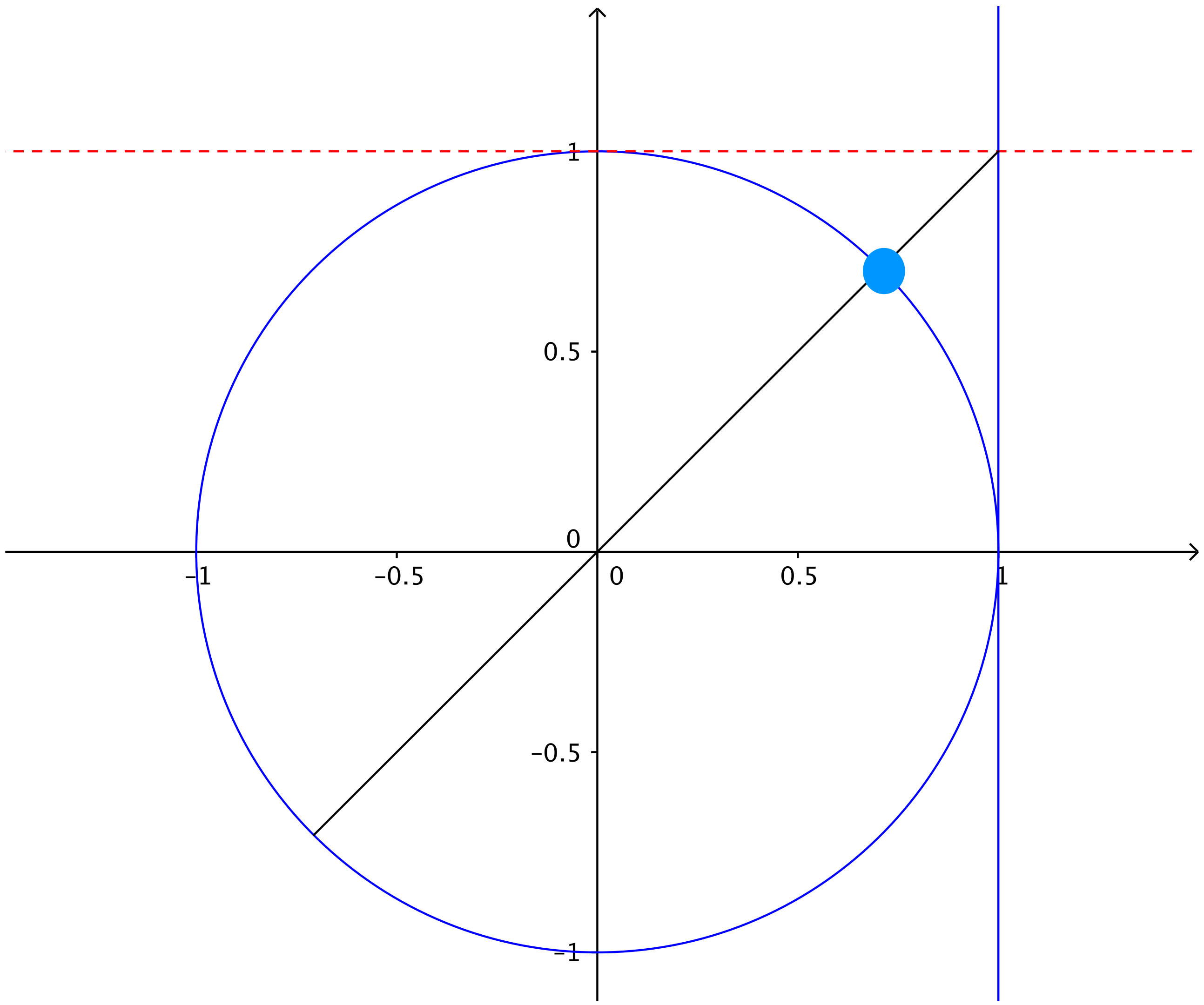

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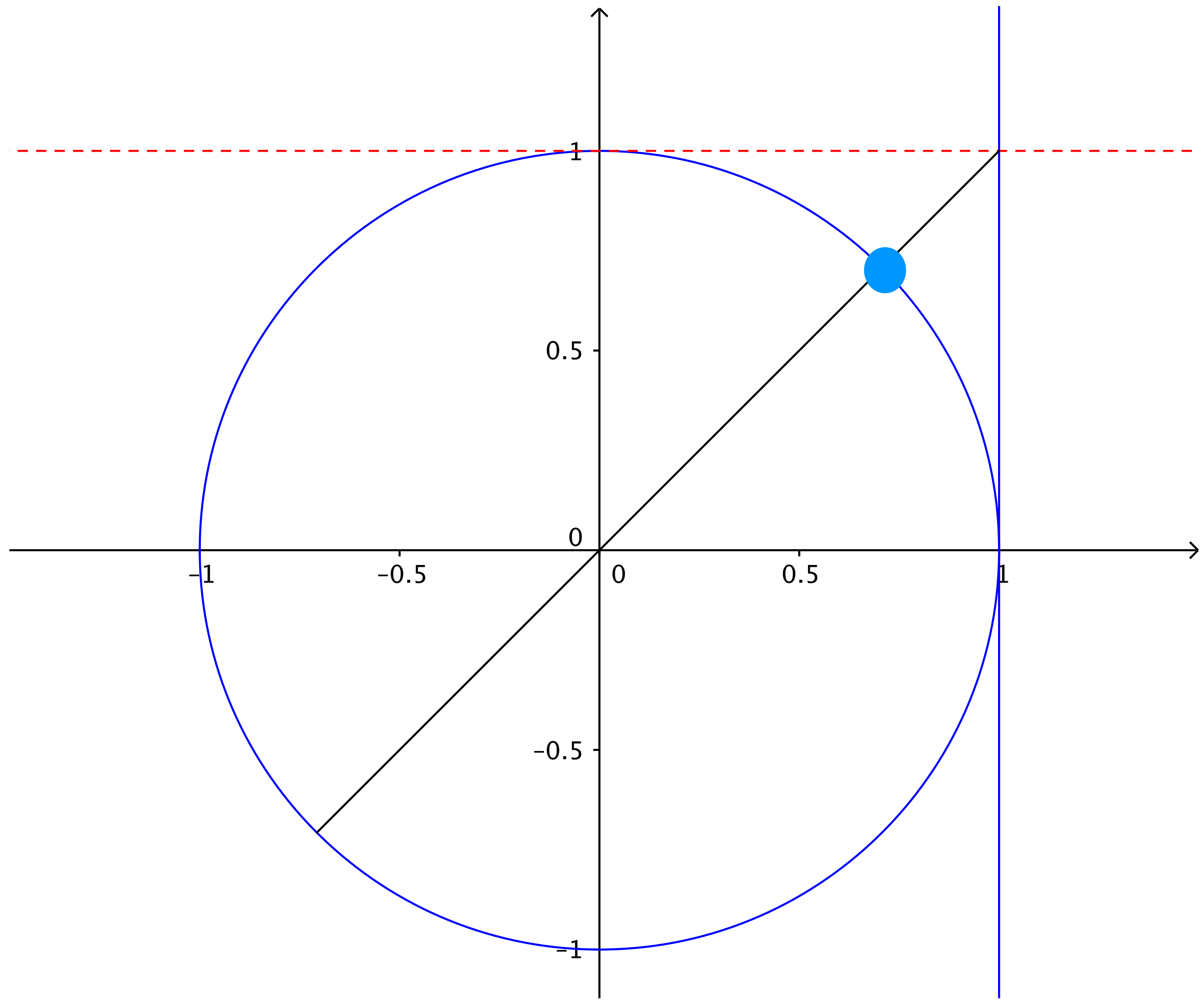

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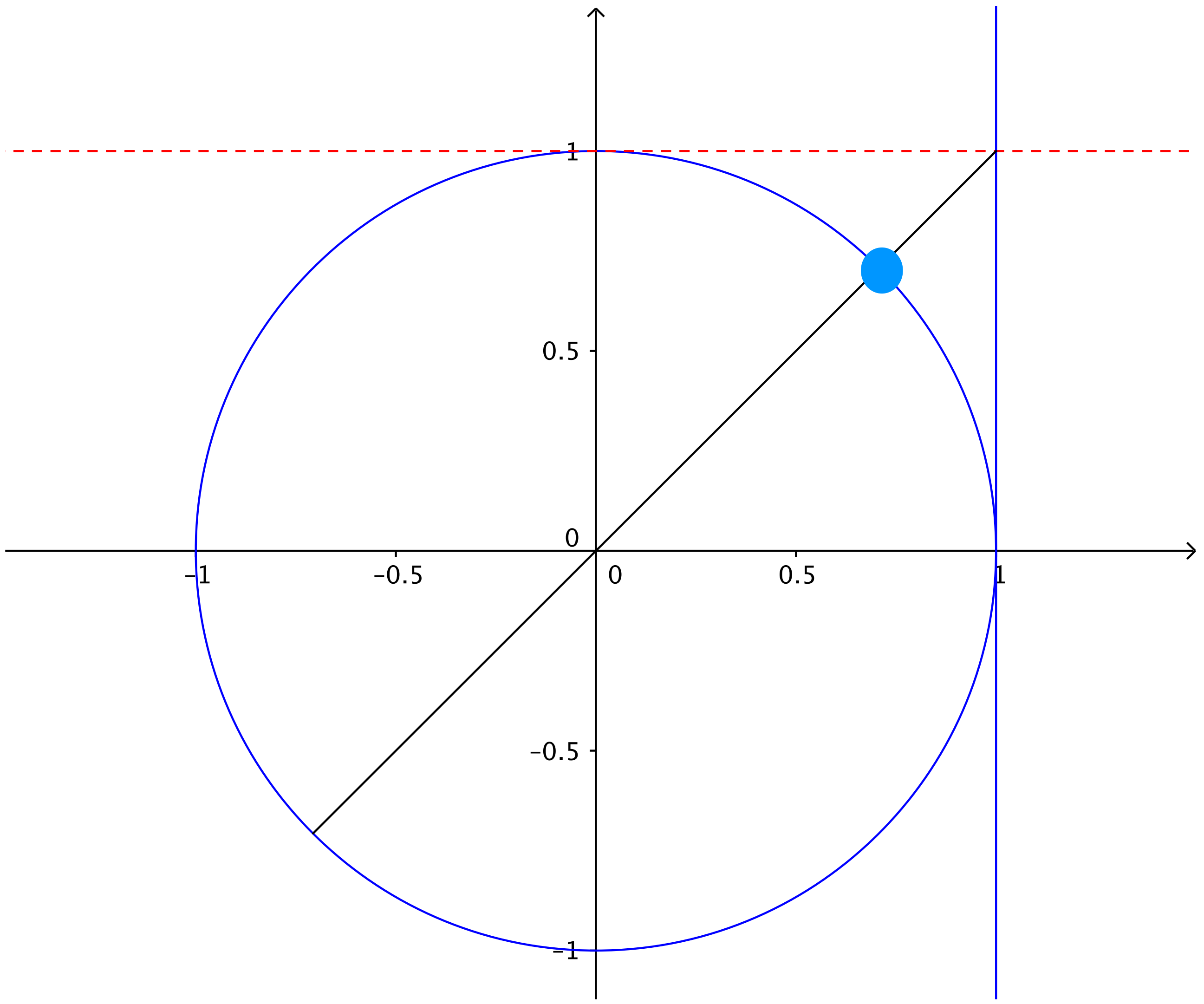

Exemple

$$\sec\theta + 4\csc\theta = 5\csc\theta$$

$$\Longleftrightarrow \sec\theta = \csc\theta \quad \Longleftrightarrow \frac{1}{\cos\theta} = \frac{1}{\sin\theta}$$

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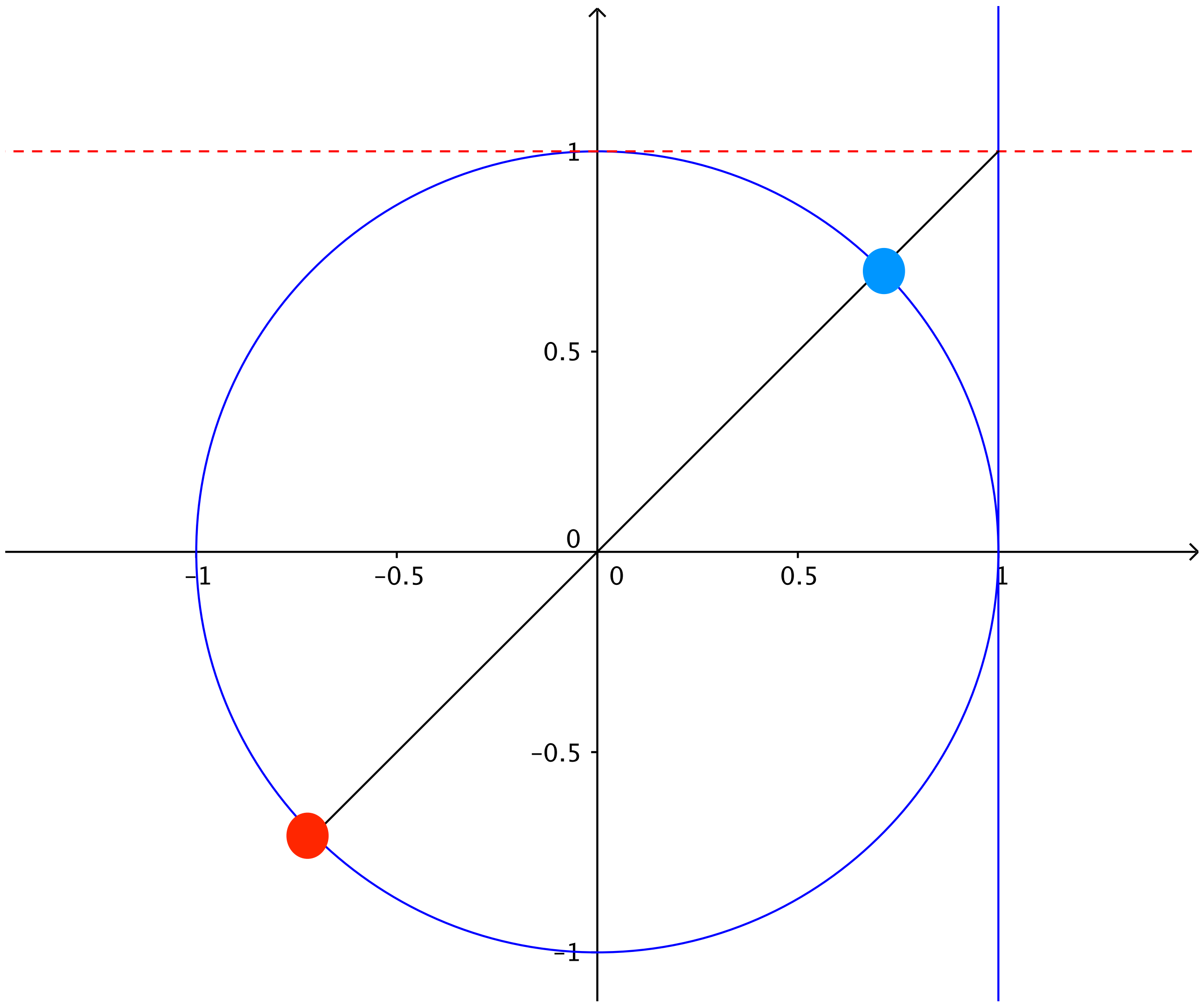

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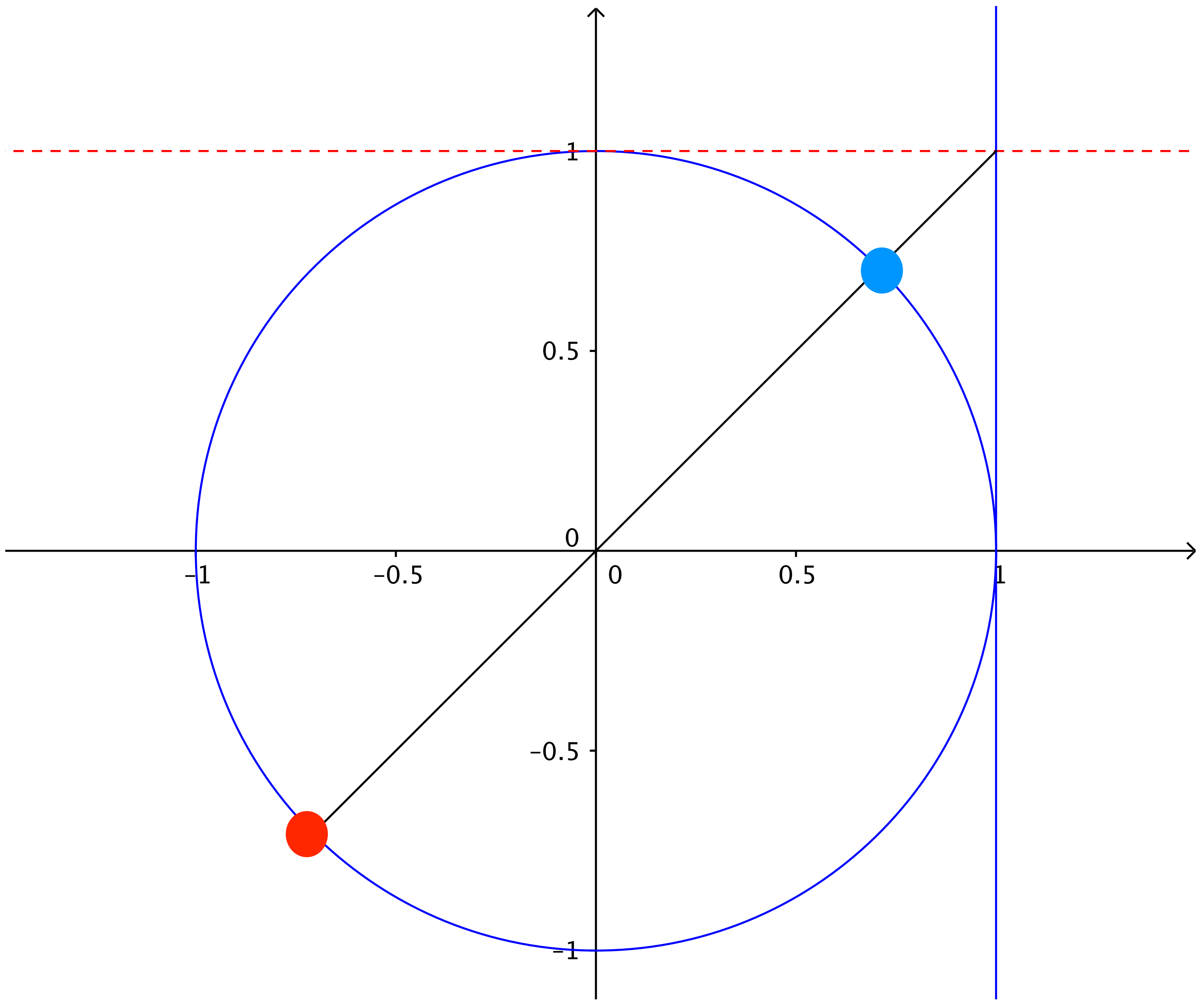

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$$\theta = \frac{\pi}{4} + k2\pi, k \in \mathbb{Z}$$

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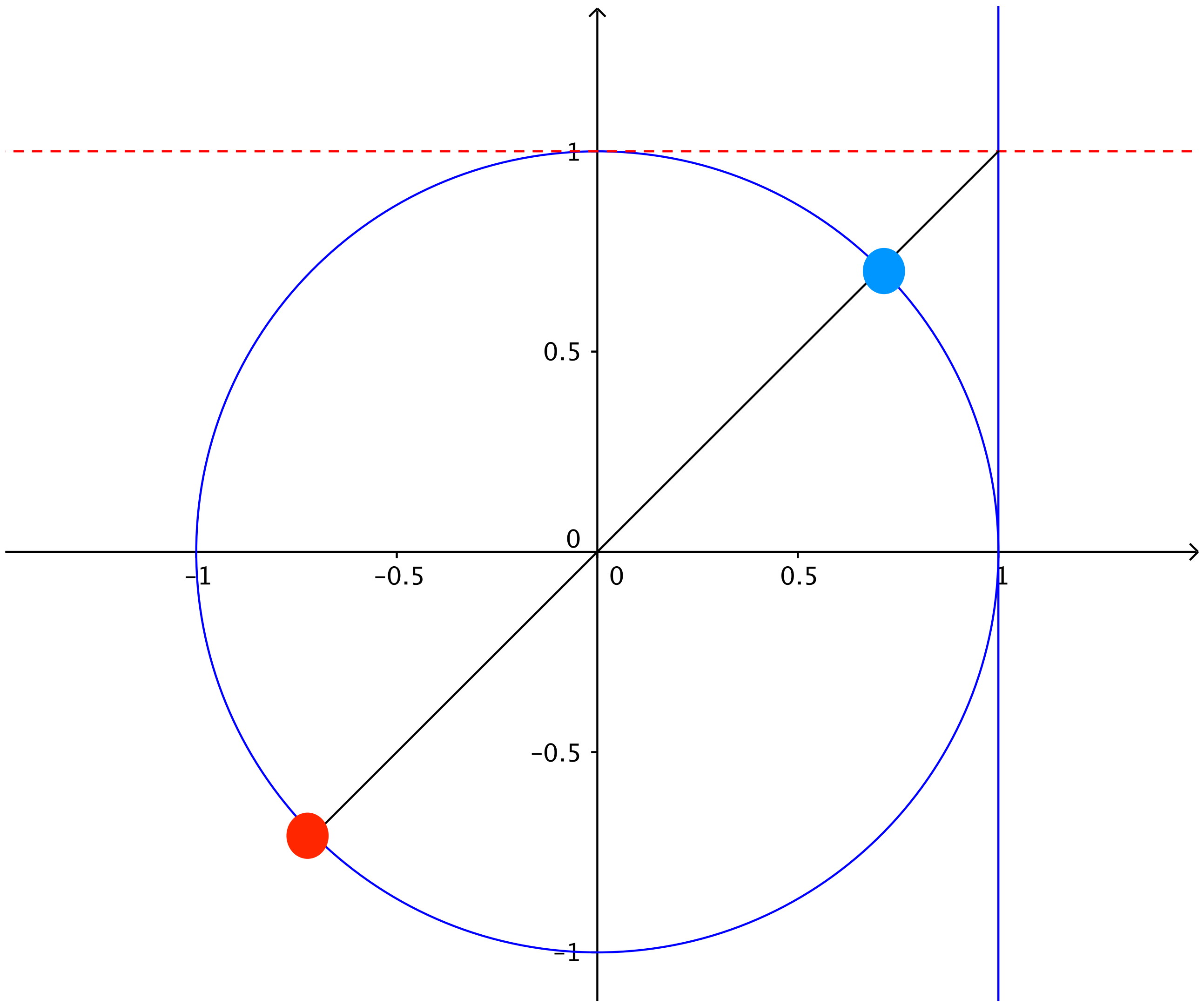

Faites les exercices suivants

p. 517 Ex. 13.10

Devoir: p. 521 # 17