

$$\log_{|\sin 2x|} |\cos x| \leq 1$$

STUDIO LE CONDIZIONI DI ESISTENZA

$$\log_a b$$

$$b > 0$$

$$a > 1 \quad 0 < a < 1$$

$$|\cos x| > 0$$

PER  $\forall x \in \mathbb{R}$  AD ESCLUSIONE DI  $\cos x = 0$

$$-1 \leq |\sin 2x| \leq 1$$

SEMPRE

QUINDI

SIAMO NEL CASO

$$0 < a < 1$$

$$0 < |\sin 2x| < 1$$

PER  $\forall x \in \mathbb{R}$  AD ESCLUSIONE

$$\text{DI } \sin 2x = 0$$

C.E

$$\cos x \neq 0$$

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

$\vee$

$$x \neq \frac{3\pi}{2}$$

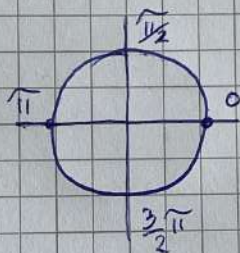
$$\sin 2x \neq 0$$

$$2x = t$$

$$\sin 2x \neq 1$$

$$\sin t \neq 0$$

$$\sin t \neq 1$$



$$t \neq \left(0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, 2\pi\right) + 2k\pi$$

$$2x \neq 0 + 2k\pi$$

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

$$2x \neq \pi + 2k\pi$$

$$2x \neq \frac{3\pi}{2} + 2k\pi$$

$$2x \neq 2\pi + 2k\pi$$

$$x \neq 0 + k\pi$$

$$x \neq \frac{\pi}{4} + k\pi$$

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

$$x \neq \frac{3\pi}{4} + k\pi$$

$$x \neq \pi + k\pi$$

$$k=0$$

$$x \neq 0, \frac{\pi}{4}, \frac{\pi}{2}, \frac{3\pi}{4}, \pi$$

$$k=1$$

$$x \neq \pi, \frac{5\pi}{4}, \frac{3\pi}{2}, \frac{7\pi}{4}, 2\pi$$



C.E.  $x \neq 0, \frac{\pi}{4}, \frac{\pi}{2}, \frac{3}{4}\pi, \pi, \frac{5}{4}\pi, \frac{3}{2}\pi, \frac{7}{4}\pi, 2\pi$

1°  $\cos x$

$$\begin{cases} \cos x \geq 0 \\ \sin 2x \geq 0 \\ \cos x - 2 \sin x \cos x \geq 0 \end{cases}$$

N.B.

$\log_{|\sin 2x|} |\cos x| \leq 1$

RIENTRIAMO NEL CASO  $0 < \cos x < 1$ ,  
LA FUNZIONE LOGARITMICA E' DECRESCENTE,  
AL CRESCERE DELL'ARGOMENTO DIMINUISCE  
IL LOGARITMO.

$|\cos x| \geq |\sin 2x|$

BISOGNA CAMBIARE SEGNO ALLA DISEQUAZIONE!

$|\cos x| \geq |2 \sin x \cos x|$

$\cos x \geq 0 \quad 0 \leq x \leq \frac{\pi}{2} \quad \cup \quad \frac{3}{2}\pi \leq x \leq 2\pi$

$\sin 2x \geq 0 \quad \sin(t) \geq 0 \quad 0 + 2k\pi \leq t \leq \pi + 2k\pi$

$0 + k\pi \leq x \leq \frac{\pi}{2} + k\pi$

$k=0 \quad 0 \leq x \leq \frac{\pi}{2} \quad \cup \quad \pi \leq x \leq \frac{3}{2}\pi$

$k=1 \quad \pi \leq x \leq \frac{3}{2}\pi$

PROVO AD APPLICARE  $\sin 2x = 2 \sin x \cos x$

$2 \sin x \cos x \geq 0$

$\sin x \cos x \geq 0$

$\sin x \geq 0 \quad 0 + + + + + + + + + \pi - - - - - - - - 2\pi$

$\cos x \geq 0 \quad 0 + + + + + \frac{\pi}{2} - - - - - - - - \frac{3}{2}\pi + + + 2\pi$

$0 + \frac{\pi}{2} - \pi + \frac{3}{2}\pi - 2\pi$

OTTENGO LO STESSO RISULTATO

$0 \leq x \leq \frac{\pi}{2} \quad \cup \quad \pi \leq x \leq \frac{3}{2}\pi$



RISOLVO

$$\cos x \geq 2 \sin x \cos x$$

$$\cos x (1 - 2 \sin x) \geq 0$$

1)  $\cos x \geq 0$

$$0 \leq x \leq \frac{\pi}{2}$$

$$\cup \frac{3\pi}{2} \leq x \leq 2\pi$$

2)  $-2 \sin x \geq -1$

$$\sin x \leq \frac{1}{2}$$

$$0 \leq x \leq \frac{\pi}{6}$$

$$\cup \frac{5\pi}{6} \leq x \leq 2\pi$$

1)  $0 \text{ } + + + + + \frac{\pi}{2} \text{ } - - - - - \frac{3\pi}{2} \text{ } + + + + + 2\pi$

2)  $0 \text{ } + \frac{\pi}{6} \text{ } - - - - - \frac{5\pi}{6} \text{ } + + + + + 2\pi$

$$0 \text{ } + \frac{\pi}{6} \text{ } - \frac{\pi}{2} \text{ } + \frac{5\pi}{6} \text{ } - \frac{3\pi}{2} \text{ } + 2\pi$$

$$0 \leq x \leq \frac{\pi}{6} \cup \frac{\pi}{2} \leq x \leq \frac{5\pi}{6} \cup \frac{3\pi}{2} \leq x \leq 2\pi$$

①  $0 \leq x \leq \frac{\pi}{2} \cup \frac{3\pi}{2} \leq x \leq 2\pi$

②  $0 \leq x \leq \frac{\pi}{2} \cup \pi \leq x \leq \frac{3\pi}{2}$

③  $0 \leq x \leq \frac{\pi}{6} \cup \frac{\pi}{2} \leq x \leq \frac{5\pi}{6} \cup \frac{3\pi}{2} \leq x \leq 2\pi$

④ C.E

①  $0 \text{ } + + + + + \frac{\pi}{2}$

$$\frac{3\pi}{2} \text{ } + + + + + 2\pi$$

②  $0 \text{ } + + + + + \frac{\pi}{2}$

$$\pi \text{ } + + + + + \frac{3\pi}{2} \text{ } 2\pi$$

③  $0 \text{ } + + + \frac{\pi}{6}$

$$\frac{\pi}{2} \text{ } + + + + + \frac{5\pi}{6}$$

$$\frac{3\pi}{2} \text{ } + + + + + 2\pi$$

④

$$\sum 0$$

$$\sum \frac{\pi}{4}$$

$$\sum \frac{\pi}{2}$$

$$\sum \frac{3\pi}{4}$$

$$\sum \pi$$

$$\sum \frac{5\pi}{4}$$

$$\sum \frac{3\pi}{2}$$

$$\sum \frac{7\pi}{4}$$

SOLUZIONE

1°

CASO

$$[0, \frac{\pi}{6}]$$



2° CASO

$$\begin{cases} \cos x < 0 \\ \sin 2x \geq 0 \\ -\cos x \geq \sin 2x \end{cases}$$

$$\begin{aligned} (1) & \quad \frac{\pi}{2} < x < \frac{3\pi}{2} \\ (2) & \quad \begin{cases} 0 \leq x \leq \frac{\pi}{2} \cup \pi \leq x \leq \frac{3\pi}{2} \\ \cos x \geq \sin 2x \end{cases} \end{aligned}$$

(3)

$$\cos x \leq -2\sin x \cos x$$

$$\cos x (1 + 2\sin x) \leq 0$$

(4)

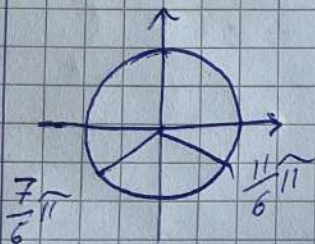
C.E.

1)  $\cos x \geq 0$

$$0 \leq x \leq \frac{\pi}{2} \cup \frac{3\pi}{2} \leq x \leq 2\pi$$

2)  $\sin x \geq -\frac{1}{2}$

$$0 \leq x \leq \frac{7\pi}{6} \cup \frac{11\pi}{6} \leq x \leq 2\pi$$



1)  $0 \text{ } + + + + \frac{\pi}{2} \text{ } - - - - - \frac{3\pi}{2} \text{ } + + + + 2\pi$

2)  $0 \text{ } + + + + + \frac{7\pi}{6} \text{ } - - - - \frac{11\pi}{6} \text{ } + + + + 2\pi$

$0 \text{ } + \frac{\pi}{2} \text{ } - - - - \frac{7\pi}{6} \text{ } + \frac{3\pi}{2} \text{ } - \frac{11\pi}{6} \text{ } + 2\pi$

(3)  $\frac{\pi}{2} \leq x \leq \frac{7\pi}{6} \cup \frac{3\pi}{2} \leq x \leq \frac{11\pi}{6}$

(1)  $0 \quad \frac{\pi}{2} \text{ } + + + + + \text{ } + + + + + \text{ } \frac{3\pi}{2} \quad 2\pi$

(2)  $0 \text{ } + + + + + \text{ } \frac{\pi}{2} \quad \pi \text{ } + + + + + \text{ } \frac{3\pi}{2} \quad 2\pi$

(3)  $0 \quad \frac{\pi}{2} \text{ } + + + + \frac{7\pi}{6} \text{ } + + + \frac{7\pi}{6} \quad \frac{3\pi}{2} \text{ } + + + \frac{11\pi}{6} \quad 2\pi$

(4)  $\frac{\pi}{4} \quad \frac{3\pi}{4} \quad \frac{5\pi}{4} \quad \frac{7\pi}{4} \quad \pi \quad \frac{5\pi}{4} \quad \frac{3\pi}{2} \quad \frac{7\pi}{4} \quad \frac{3\pi}{4} \quad 2\pi$

SOLUZIONE 2° CASO  $[\frac{\pi}{2}, \frac{7\pi}{6}]$



3° CASO

$$\begin{cases} \cos x < 0 \\ \sin 2x < 0 \\ -\cos x \geq -\sin 2x \end{cases}$$

$$\begin{aligned} (1) & \quad \frac{\pi}{2} < x < \frac{3\pi}{2} \\ (2) & \quad \frac{\pi}{2} < x < \pi \cup \frac{3\pi}{2} < x < 2\pi \\ (4) & \quad \cos x \leq \sin 2x \\ & \quad \text{C.E.} \end{aligned}$$

$$\cos x - 2\sin x \cos x \leq 0$$

$$\cos x (1 - 2\sin x) \leq 0$$

$$\cos x \geq 0$$

$$0 \leq x \leq \frac{\pi}{2} \cup \frac{3\pi}{2} \leq x \leq 2\pi$$

$$-2\sin x \geq -1$$

$$\sin x \leq \frac{1}{2} \quad \frac{\pi}{6} \leq x \leq \frac{5\pi}{6} \cup \frac{7\pi}{6} \leq x \leq \frac{3\pi}{2}$$

$$0 \quad + + + + + \frac{\pi}{2} \quad - - - - - \frac{3\pi}{2} \quad + + + + + 2\pi$$

$$0 \quad + + + \frac{\pi}{6} \quad - - - - - \frac{5\pi}{6} \quad + + + + + \frac{7\pi}{6} \quad + + + + + 2\pi$$

$$0 \quad + + + \frac{\pi}{6} \quad - - \frac{\pi}{2} \quad + + + \frac{5\pi}{6} \quad - - - - - \frac{3\pi}{2} \quad + + + + + 2\pi$$

$$(3) \quad \frac{\pi}{6} < x < \frac{\pi}{2} \cup \frac{5\pi}{6} < x < \frac{3\pi}{2}$$

$$\begin{aligned} 1. & \quad 0 \quad + + + + + \frac{\pi}{2} \quad + + + + + \frac{3\pi}{2} \quad 2\pi \\ 2. & \quad 0 \quad \frac{\pi}{2} \quad + + + + + \pi \quad \frac{3\pi}{2} \quad + + + + + \\ 3. & \quad 0 \quad \frac{\pi}{6} \quad + + + \frac{\pi}{2} \quad \frac{5\pi}{6} \quad + + + + + \frac{3\pi}{2} \\ 4. & \end{aligned}$$

SOLUZIONI 3° CASO  $[\frac{5\pi}{6}, \pi)$



4° CASO

$$\left\{ \begin{array}{l} \cos x \geq 0 \\ \sin 2x \geq 0 \\ \cos x \geq -\sin 2x \end{array} \right.$$

$$\begin{aligned} \textcircled{1} & \left\{ \begin{array}{l} 0 \leq x \leq \frac{\pi}{2} \quad \cup \quad \frac{3}{2}\pi \leq x \leq 2\pi \\ \frac{\pi}{2} < x < \pi \quad \cup \quad \frac{3}{2}\pi < x < 2\pi \end{array} \right. \end{aligned}$$

④ C.E

③  $\cos x (1 + 2 \sin x) \geq 0$

$$0 \leq x \leq \frac{\pi}{2} \quad \vee \quad \frac{7\pi}{6} \leq x \leq \frac{3\pi}{2} \quad \vee \quad \frac{11\pi}{6} \leq x \leq 2\pi$$

$$10 + + + + + + + \frac{11}{2}$$

$$\begin{array}{ccccccc} \widehat{3}_{-11} & + & + & + & + & + & + \\ 2 & & & & & & \end{array}$$

$$2.0 \quad \frac{1}{2} + + + + + \frac{1}{11}$$

$$\frac{3}{2}\pi + + + + + + + + 2\pi$$

3.  $0 + + + + + \frac{\infty}{2}$

$$\frac{7}{6}\pi + + + + + \frac{3}{2}\pi$$

$$\frac{11}{6} \pi + + + 2 \pi$$

$$4. \frac{5}{3} \quad \frac{5}{\pi} \quad \frac{5}{11} \quad \frac{3}{3} \pi$$

5/4

$$\frac{5\pi}{4} \quad \frac{3\pi}{2}$$

$$\frac{3}{2} \pi$$

$$\frac{7}{4}\pi$$

$$\frac{2}{21}$$

## SOLUTIONS

40

# CASO

$$\left[ \frac{11}{6}\pi, 2\pi \right)$$

## SOLUZIONE

TOTAL

$$(\frac{0}{6}, \frac{\pi}{6}] \cup (\frac{\pi}{6}, \frac{7\pi}{6}] \cup [\frac{5\pi}{6}, \pi) \cup [\frac{11\pi}{6}, 2\pi)$$



$$\pi n - \frac{\pi}{6} \leq x < \pi n$$

$$\pi n < x \leq \pi n + \frac{\pi}{6}$$

$$-\frac{\pi}{6} \leq x < 0$$

$$0 < x \leq \frac{\pi}{6}$$

$$k=0 \left[ \frac{11\pi}{6} \leq x < 2\pi \right]$$

$$0 < x \leq \frac{\pi}{6}$$

$$k=1 \left[ \pi - \frac{\pi}{6} \leq x < \pi \right]$$

$$\pi < x \leq \pi + \frac{\pi}{6}$$

$$\left[ \frac{5\pi}{6} \leq x < \pi \right]$$

$$\pi < x \leq \frac{7\pi}{6}$$



$$\log|\cos x|/\log|\sin(2x)| \leq 1$$



Assuming "log" is the natural logarithm ...

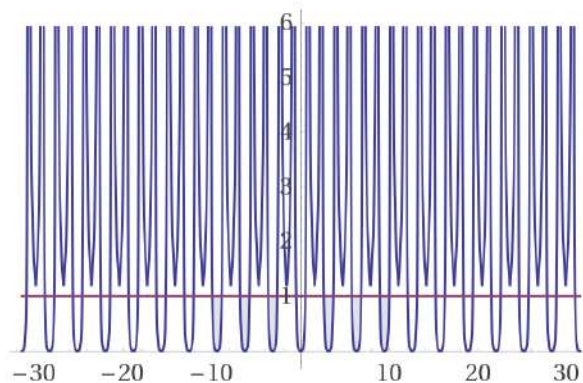


### Input

$$\frac{\log(|\cos(x)|)}{\log(|\sin(2x)|)} \leq 1$$



### Inequality plot



### Number line



### Real solutions

$$\pi n - \frac{\pi}{6} \leq x < \pi n, \quad n \in \mathbb{Z}$$

$$\pi n < x \leq \pi n + \frac{\pi}{6}, \quad n \in \mathbb{Z}$$

Approximate forms



Computation timed out. Try with more time »