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From your Digest

Nancy Mitchell · Updated September 14
used to be a teacher.

If x^2 + y^2 = 1, what is the minimum value of x + y?

If x^2+y^2=1, what is the minimum value of x+y?

Parametric equations for the points (x, y) on the unit circle

$$x^2 + y^2 = 1$$

are

$$x = \cos\theta \text{ and } y = \sin\theta, \theta \in [0, 2\pi].$$

Then

$$x + y = \cos\theta + \sin\theta$$

for x and y on the rim of the circle.

Minimize the function

$$f(\theta) = \cos\theta + \sin\theta$$

using derivatives:

$$f'(\theta) = -\sin\theta + \cos\theta = 0$$

when

$$\cos(\theta) = \sin\theta.$$

This implies that

$$\theta = \frac{\pi}{4}, \frac{5\pi}{4}.$$

Then

$$f''(\theta) = -\cos\theta - \sin\theta.$$

So,

$$f''\left(\frac{\pi}{4}\right) = -\cos\frac{\pi}{4} - \sin\frac{\pi}{4}$$

$$= -\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2}$$

$$= -2\left(\frac{\sqrt{2}}{2}\right) = -\sqrt{2} < 0$$

means there is a maximum at

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

And

$$f''\left(\frac{5\pi}{4}\right) = -\cos\frac{5\pi}{4} - \sin\frac{5\pi}{4}$$

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

$$= \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2}$$

$$= 2\left(\frac{\sqrt{2}}{2}\right) = \sqrt{2} > 0$$

means that a minimum is at

$$\theta = \frac{5\pi}{4}.$$

The minimum of f is

$$= -\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2} = -\sqrt{2}.$$

This is the sum $x + y$ when

$$x = -\frac{\sqrt{2}}{2} \text{ and } y = -\frac{\sqrt{2}}{2}.$$

So, the minimum value of $x + y$ on the unit circle is $\boxed{-\sqrt{2}}$.

127.8K views · View Upvoters · View Sharers · Answer requested by Yagya Joshi

136 3 24

Add a comment... Add Comment

Jan Willem Nienhuys · September 20

This is when you go through the whole machinery of calculus. But in this simple case you hardly need any calculation. The function x+y is constant on lines x+y=C. They are all lines parallel to the line x+y=0, or y= -x. Clearly the line that touches the circle at the lower left hand side will provi ... (more)

Upvote · 14 Reply

Nancy Mitchell · Sun

You should submit this as your own answer. I read it again. It is nice. Other answers and comments use methods you describe. Wrote my answer for calculus students.

Upvote · 1 Reply

Christian Gawron I think the point is not to "single out your answer", but to...

Jonathan McIntyre · Mon

This more visual way is exactly how I also solved it. It allows you to solve the problem in your head in a few seconds.

Upvote · 4 Reply

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Ondrej Popp · September 19

Ok, tx Nancy. I need to go look up the deal about the double derrivative giving you a measure to distinguish between a maximum and a minimum. I forgot about that 😃 Saddle points and all that. I probably once knew about it. So ok I am going to refresh that knowledge!

Upvote · 1 Reply

Nancy Mitchell · September 19

Thank you for commenting! There is a lot of information available out there about locating maximums and minimums by calculus.

Upvote · 1 Reply

Ondrej Popp Yup 😃 Found it over here, The Second Derivative. Finding...

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More from your Digest

intrigued by the job and wonder how they themselves can become data sci (more)

4.6K 270 88

Christophe Bal

What is your question or link?

Answer · Recommended for you

Younes Khadraoui · January 11, 2019
R&D Data Scientist

What don't they tell you about programming?

Most people have that mental picture of a developer: That brilliant young man, typing like hell on his keyboard, working very late at night and drinking tons of coffee, and if you ask him anything about computers, he can give you an an (more)

942 13 23

Answer · Recommended for you

Alon Amit · Updated August 3
Mostly C and Python

What are some programming problems that look hard at a first glance but are actually easy?

of connected components in such an image. In this example, there are thre (more)

3.7K 67 125

Questions for you

Question added · Puzzles and Trick Questions

What is the next number in the sequence 101,001, 66, _?

2 Answers · Last followed 1h ago

Answer Follow · 3 Pass

Question added · Computers

What is the best time to buy a computer?

No answer yet · Last followed 7m ago

Answer Follow · 4 Pass

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AI is leading many of our technical industries.
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Answer · Recommended for you

Harley Austin · April 23
Software Engineer (1980–present)

I'm 26 and know nothing about programming. Would it be too late for me to start learning Python and R?

I'm one of the highest paid software engineers in America, in the top 1%. I work for a Fortune 50 international enterprise. I started programming in in the late 1970's with BASIC, COBOL, FORTRAN, PASCAL, then VB, classic ASP, SQL, ECMA. (more)

1.9K 44 27

Answer · Recommended for you

Henry Norman · Updated September 18
Retired Systems Software Developer

Why do errors occur in Python? What type of errors occur due to what types of mistakes?

developers — make mistakes. In Python as well as in any other language. 2. (more)

395 4 14

Promoted by monday.com

Mondaydotcom · Updated August 31

What is the best project management tool?

Teamwork makes the dream work, so finding a project management tool that best suits you and your teams needs can be challenging. monday.com is a versatile project management software that powers teams to run both small and larg (more)

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Upcoming Sessions

Jamia Wilson
Author & Executive Director/Publisher of t...
Answering Today at 12:09 am
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Crystal Fleming
Professor, author and sociologist
Answering Today at 12:00 am
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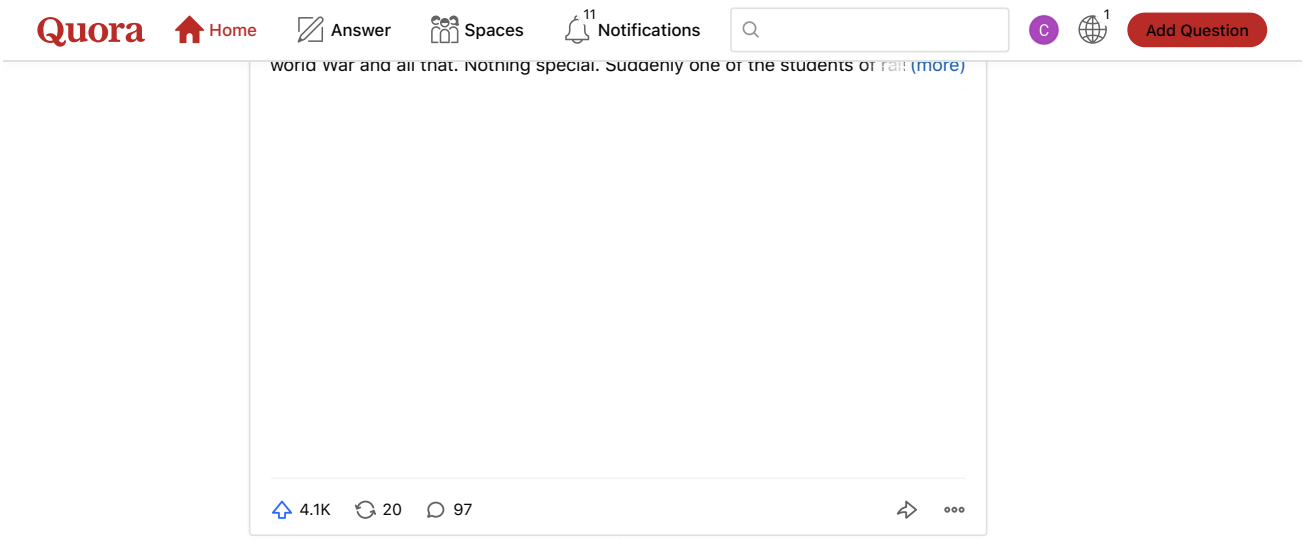
Answer · Recommended for you

Mirabella Royal · Wed
Young teacher

What is the most interesting fact that you know and I don't, but I should?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