MATHEMATICS

Calculus: existence of global maximum and global minimum for $f(x) = e^x \cdot x^3$

Asked 3 years, 11 months ago Active 3 years, 11 months ago Viewed 965 times

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$$f(x) = e^x \cdot x^3$$

How do i know if there exists global max and min if domain is from $-\infty$ to $+\infty$? Does there exist global max and min?

calculus optimization

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edited Sep 18 '17 at 14:57
Vikram
5,228 8 37 59

asked Sep 18 '17 at 14:48
Jun Jang
157 9

1 Are you familiar with calculating derivatives of the product of two functions $f(x) * g(x)$? – WaveX Sep 18 '17 at 14:50

From visualizing this function, it seems there should be a global minimum, but no global maximum. For a function like this one (that is not terribly complicated, and is clearly differentiable on its domain), taking derivatives and using the second derivative test to find the maxima/minima seems like the best approach for finding these. – RideTheWavelet Sep 18 '17 at 14:54

What is $\lim_{x\to\infty} f(x)$? Does this tell you something about the global maximum? Now, what is $\lim_{x\to-\infty} f(x)$? Does this tell you something about the global minimum? (Note that f is continuous.) – mfl Sep 18 '17 at 15:04

Use,

$$(uv)' = u'v + uv'$$

to find the first derivative. Use that to find the extrema and then use the second derivative test. Let us know if you get stuck. – George Coote Sep 18 '17 at 15:07

@GeorgeCoote He/She is not asked to find the extrema. He/She is asked about existence. – mfl Sep 18 '17 at 15:09

2 Answers

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HINT.- $f'(x) = e^x x^2(x+3) = 0 \Rightarrow x = 0, -3, -\infty$ and $f'(x) > 0$ for $x > 0$. You can deduce from this that a global minimum is taken at $x = -3$ and that there is not a global maximum (or it is $+\infty$ if you want).

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answered Sep 18 '17 at 15:39
Piquito
24.3k 3 22 45

Okay.. And x=0,−3,−∞ are the stationary(critical) points? – Jun Jang Sep 18 '17 at 15:51

$x \to -\infty$ would give an infimum or a supremum, not a maximum or minimum. For example $f(x) = \mathrm{e}^x$ has no minimum, although its infimum is 0. – Fly by Night Sep 18 '17 at 16:28

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Note:

$$f(0) = 0$$

$$\lim_{x\to-\infty} f(x) = 0$$

$$f(x) < 0, x < 0$$

and the function is continuous, so there is a global min at the interval $x < 0$.

There is no global max because:

$$\lim_{x\to+\infty} f(x) = +\infty.$$

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answered Sep 18 '17 at 16:00
farruhota
30.2k 2 15 49