Subject: Math Question #1 ***updated with the solution***
Posted by archerman on Sun, 09 Nov 2008 12:20:53 GMT
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i need a step by step solution for this "simple" math problem without using l'hopital's rule. you can tell the solution verbally.

enjoy.

File Attachments

1) math.JPG, downloaded 1250 times

$$\lim_{x\to 0} \frac{\sin(5x)}{2-2\cos x}$$

Subject: Re: Math Question #1
Posted by CarrierII on Sun, 09 Nov 2008 15:32:30 GMT
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If Y = Sin(5X) / 2 - 2 * Cos(2X)

then as X -> 0, Y -> infinity.

If X = 0 then

Sin(5X) = Sin(0) = 0.

2 - 2Cos(2*0) = 2 - 2Cos(0) = 2 - 2(1) = 0. - Can't divide by zero!

Thus if X is almost 0, we have

Sin(5X) / 2 - 2Cos(~0) which is
Sin(5X) / 2 - 2*(~1) which is
Some number / Some other number < 1 and close to 0. This causes the whole expression to increase in value because you're dividing by a fraction.

Subject: Re: Math Question #1
Posted by archerman on Sun, 09 Nov 2008 16:23:49 GMT

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CarrierII wrote on Sun, 09 November 2008 17:32If Y = Sin(5X) / 2 - 2 * Cos(2X)

then as X -> 0, Y -> infinity.

If X = 0 then

Sin(5X) = Sin(0) = 0.

2 - 2Cos(2*0) = 2 - 2Cos(0) = 2 - 2(1) = 0. - Can't divide by zero!

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Some number / Some other number < 1 and close to 0. This causes the whole expression to increase in value because you're dividing by a fraction.

maybe i didnt understand, but how would you know that the numerator increases more as the denominator increases less? maybe the numerator is a fraction too. sin5x is the closest to zero, and 2-2cosx is the closest to zero as well because 2-2cosx=2-2*1=~0. so its still 0/0.

Subject: Re: Math Question #1
Posted by StealthEye on Sun, 09 Nov 2008 16:26:31 GMT
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Your answer is correct, carrier, however the method is not. Try the same with assuming the divident is "some number" and your approach will lead you to the limit being 0, which is not correct.

I can't really come up with a correct prove either however. Closest I can get is to say that y=sin(a) behaves like y=a for x~0 and b=cos(a) behaves like 1 in that interval. Computing the limit after substituting those gives lim=+inf. This, however, is not solid prove either (actually, it's just disguised 'l hopital).

I would expect it would be possible to rewrite the 1-cos(x) to some sin variant or vice versa and then solve it to get rid of (one of) the trig functions. 'l hopital is much easier.

Subject: Re: Math Question #1
Posted by CarrierII on Sun, 09 Nov 2008 18:05:58 GMT

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My point about the "some number / some other number thing" was that the numerator doesn't matter, for small values of X, the denominator will always be a small fraction, and so the limit will always be +infinity even if the numerator is a fraction...

Oh: I should add (otherwise my reasoning is flawed) that for X < 33 degrees the numerator > denominator for this. I got that from trial and error informed by some graphs, but you could prove it by solving

Sin(5X) > 2 - 2CosX and find the values for which it is true.

Subject: Re: Math Question #1
Posted by StealthEye on Sun, 09 Nov 2008 21:39:29 GMT
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Solving that (without graphs) is probably just as hard as finding the limit though.

Subject: Re: Math Question #1
Posted by NukeIt15 on Sun, 09 Nov 2008 22:18:38 GMT
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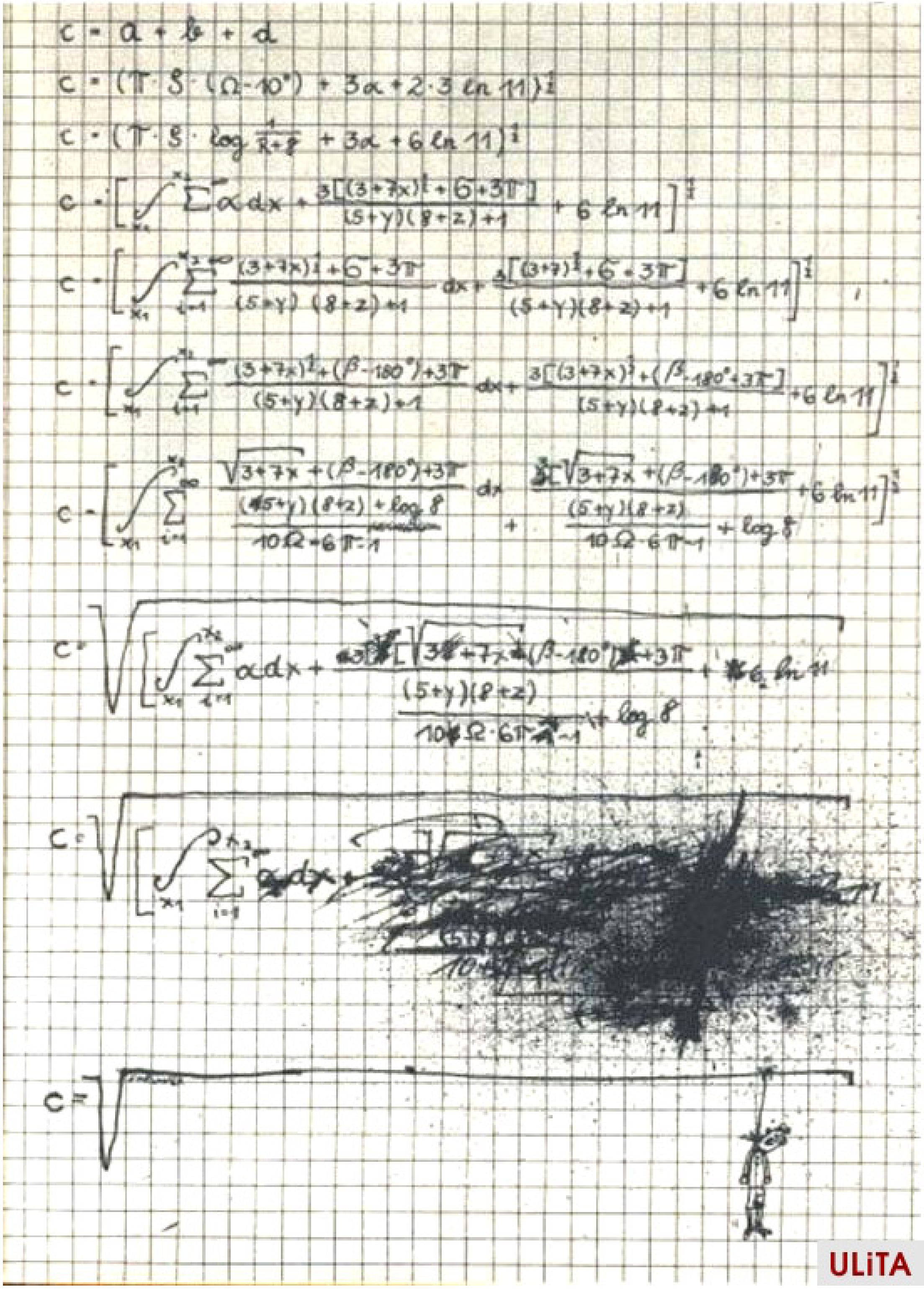
...because it just had to be posted.

File Attachments
1) halcyon_discontinue.jpg, downloaded 453 times



Subject: Re: Math Question #1
Posted by archerman on Tue, 11 Nov 2008 09:11:23 GMT
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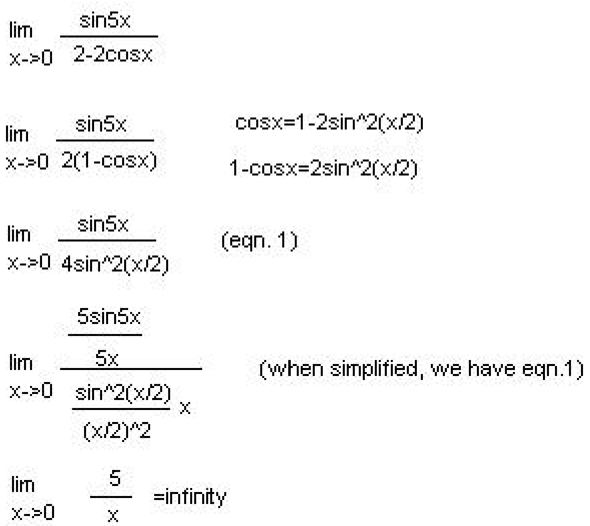
just got the solution:

File Attachments

1) solution.JPG, downloaded 908 times



Subject: Re: Math Question #1
Posted by nopol10 on Tue, 11 Nov 2008 09:38:15 GMT
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Actually, lim(5/x,x,0) (Limit of 5/x as x -> 0) is not infinity as limit of 5/x as x->0 from the negative side and the limit of 5/x as x->0 from the positive side are not equal. Therefore the limit is undefined. It is infinity only when x->0 from the positive side and negative infinity when x->0 from the negative side.

Subject: Re: Math Question #1
Posted by archerman on Tue, 11 Nov 2008 11:08:33 GMT
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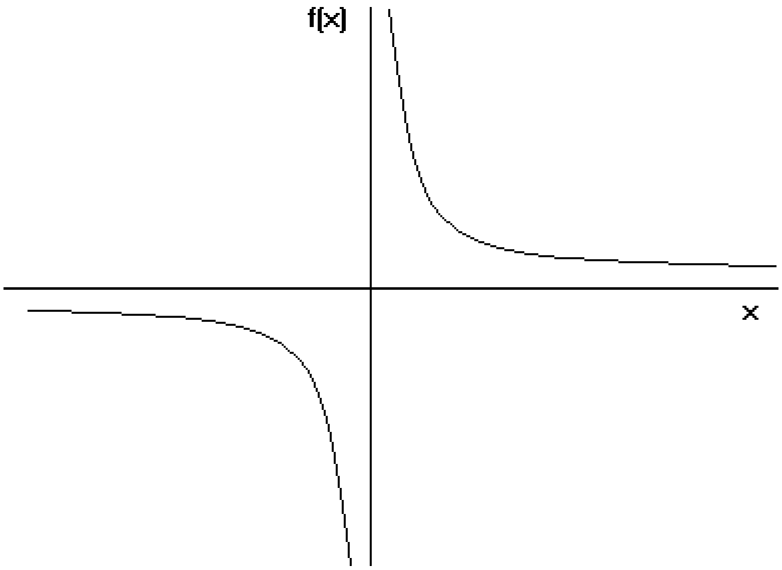
nopol10 wrote on Tue, 11 November 2008 11:38Actually, lim(5/x,x,0) (Limit of 5/x as x -> 0) is not infinity as limit of 5/x as x->0 from the negative side and the limit of 5/x as x->0 from the positive side are not equal. Therefore the limit is undefined. It is infinity only when x->0 from the positive side and negative infinity when x->0 from the negative side.

you are right. the graph of y=5/x is similar to y=1/x which is like:

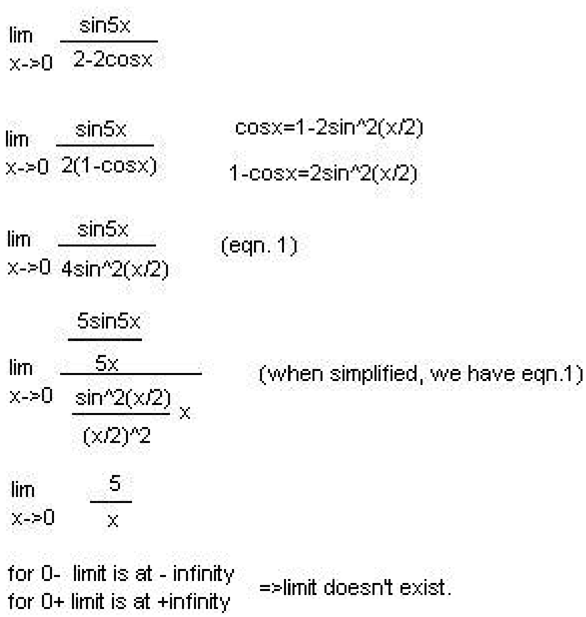
so limit doesn't exist.

File Attachments

1) 1overx.gif, downloaded 1069 times



2) solution.JPG, downloaded 917 times



$$\lim_{x \to 0} \frac{\sin 5x}{2-2\cos x}$$

$$\lim_{x \to 0} \frac{\sin 5x}{2(1-\cos x)}$$

cosx=1-2sin^2(x/2)

1-cosx=2sin^2(x/2)

$$\lim_{x \to 0} \frac{\sin 5x}{4\sin^2(x/2)}$$

(eqn. 1)

$$\lim_{x \to 0} \frac{\frac{5\sin 5x}{5x}}{\frac{\sin^2(x/2)}{(x/2)^2} x}$$

(when simplified, we have eqn.1)

$$\lim_{x \to 0} \frac{5}{x}$$

for 0- limit is at - infinity
for 0+ limit is at +infinity

=>limit doesn't exist.