

Sep 2nd 5:06:31 pm

Nice to see you again. 😊 A tutor will be with you any moment.

Sep 2nd 5:06:34 pm

TUTOR FOUND, NOW REVIEWING PROBLEM

Sep 2nd 5:06:40 pm

SESSION STARTED AT 11:06 AM

Sep 2nd 5:06:58 pm

Hi Kathleen! I'm Ms.Raman and I'll be helping you out.

Sep 2nd 5:07:11 pm ✓ *(Greets student by name and introduces herself by last name)*

Hello

Sep 2nd 5:07:23 pm

Let's work together on this problem.

Sep 2nd 5:07:26 pm ✓ *C2: Use of "we" language*

How far have you progressed in solving it?

Sep 2nd 5:07:31 pm ✓ **A1: Determine the student's progress**

Not far. I for got how to do quotient

Sep 2nd 5:08:15 pm  
*(Student proactively shares understanding of relevant concepts)*

Okay, to start off, we just need to find the expressions for  $f(a+h)$  and  $f(a)$ , and substitute them in the given equation.

Sep 2nd 5:08:58 pm ✓ **B2: Explain approach upfront**

Do I just substitute  $f(x)$  in for the a's?

Sep 2nd 5:09:09 pm

Yes, since we are already given  $f(x)$ , what might  $f(a)$  be?

Sep 2nd 5:09:28 pm ✓ **C2: Guiding question**

$x^2-x+4$

Sep 2nd 5:09:53 pm

Almost there!  $f(x)$  is given to be  $x^2-x+4$ .

Sep 2nd 5:10:18 pm ✓ **C1: Tutor redirects student's mistake without causing stress**

So how might we find the expression for  $f(a)$  from this?

Sep 2nd 5:10:28 pm ✓ **C2: Guiding question**

Would I put that in for the a's into the difference quotient?

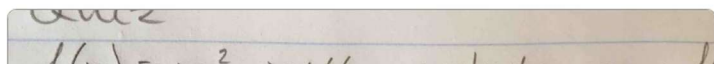
Sep 2nd 5:11:38 pm

Yes, to get  $f(a)$ , we need to substitute 'a' in place of 'x' in the expression for  $f(x)$ .

Sep 2nd 5:12:04 pm

Does that make sense?

Sep 2nd 5:12:10 pm ✓ **C1: Check with the student to ensure understanding**



$f(x) = x^2 - x + 4$  evaluate quo  $f$

$$\frac{(x^2 - x + 4 + h) - (x^2 - x + 4)}{h}$$

Sep 2nd 5:13:56 pm

Very close! Good effort here, but let's go over this step once more.

Slowest response Sep 2nd 5:14:57 pm ✓ **C2: Acknowledge student mistake without causing stress / C1: Adapt to student's needs**

We are told that  $f(x) = x^2 - x + 4$ .

Sep 2nd 5:15:05 pm

So if we need to find  $f(a)$ , we need to substitute  $a=x$  in the above equation.

Sep 2nd 5:15:20 pm ✓ **B2: Break down concept further to ensure understanding**

So we would get  $f(a) = a^2 - a + 4$

Sep 2nd 5:15:33 pm **(Note: Ideally the student would have completed this step independently.)**

Does this step make sense?

Sep 2nd 5:15:40 pm ✓ **C1: Check with the student to ensure understanding**

Oh so I use the a variable instead of x?

Sep 2nd 5:15:58 pm

That's right! :)

Sep 2nd 5:16:14 pm ✓ **C2: Encouraging words / punctuation**

If we need to find  $f(1)$  for example, we would substitute  $x=1$  in the equation to get  $f(1) = 1^2 - 1 + 4$

Sep 2nd 5:16:59 pm ✓ **B2: Present similar example to demonstrate concept**

Does this example make sense?

Sep 2nd 5:17:11 pm ✓ **C1: Check with the student to ensure understanding**

Yes

Sep 2nd 5:17:17 pm

Great! So now, we have found  $f(a)$ . We still need to find  $f(a+h)$ . How might we do that?

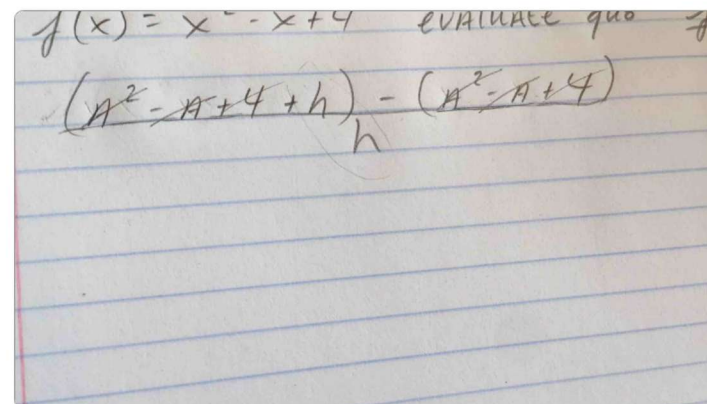
Sep 2nd 5:17:47 pm ✓ **C2: Use of "we" language / C3: Open question**

Is the answer h?

Sep 2nd 5:18:07 pm

Could you send across a snap of your work that leads to this answer?

Sep 2nd 5:18:36 pm ✓ **C3: Ask student to justify their thought process**



Sep 2nd 5:19:27 pm

Almost there! Let's take another look at how to find  $f(a+h)$ .

Sep 2nd 5:19:51 pm ✓ **C2: Acknowledge student's mistake without causing stress / C1: Adapt to student's needs**

When we have  $f(x) = x^2 - x + 4$ , what should we substitute in place of 'x' to get  $f(a+h)$ ?

Sep 2nd 5:20:17 pm ✓ **C3: Guiding question**

A  
Sep 2nd 5:20:46 pm

Close! Since we need to find  $f(a+h)$ , we need to substitute the whole of "a+h" in place of 'x'.

Sep 2nd 5:21:23 pm ✓ **B2: Break down step / C1: Adapt to student's needs**

Does that make sense?

Sep 2nd 5:21:31 pm ✓ **C1: Check with the student to ensure understanding**

No..

Sep 2nd 5:21:46 pm

Okay, let me give you an example here.

Sep 2nd 5:22:00 pm ✓ **B2: Present a similar example to demonstrate concept / C1: Adapt to student's need's**

Suppose  $f(x) = x^2$ .

Sep 2nd 5:22:10 pm

If we need to find  $f(3)$ , we would substitute '3' in place of 'x' to get  $f(3) = 3^2 = 9$

Sep 2nd 5:22:45 pm

And suppose we need to find  $f(r+3)$ , then we would substitute "r+3" in place of 'x'.

Sep 2nd 5:23:13 pm

So  $f(r+3)$  would be  $(r+3)^2 = r^2 + 9 + 6r$

Sep 2nd 5:23:43 pm

Does this example make sense?

Sep 2nd 5:23:55 pm ✓ **C1: Check with the student to ensure understanding**

Yes

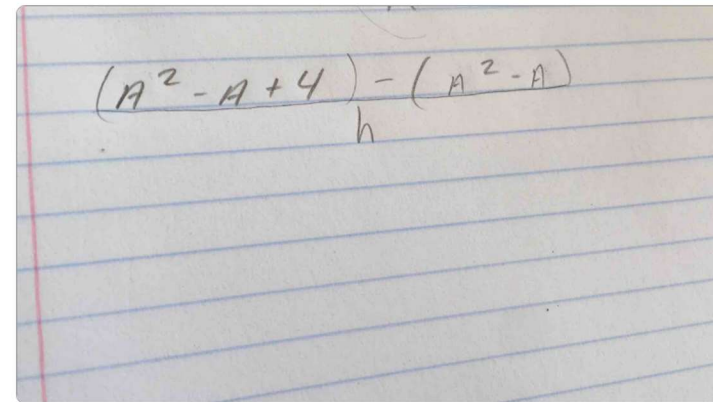
Sep 2nd 5:24:14 pm

Awesome!

Sep 2nd 5:24:22 pm ✓ **C2: Encouraging words / punctuation**

So in our present problem, how might we find  $f(a+h)$ ?

Sep 2nd 5:24:33 pm ✓ **C2: Invite student to take next step**



Sep 2nd 5:25:19 pm

Close! We have  $f(x) = x^2 - x + 4$

Sep 2nd 5:25:48 pm ✓ **C2: Redirect student's mistake without causing stress**

We earlier saw that  $f(a)$  is obtained by substituting 'a' in place of 'x' in this entire equation.

Sep 2nd 5:26:10 pm ✓ **B2: Tie steps together**

So we got  $f(a) = a^2 - a + 4$

Sep 2nd 5:26:25 pm

Are you clear till this point?

Sep 2nd 5:26:36 pm ✓ **C1: Check with the student to ensure understanding**

Yes

Sep 2nd 5:26:49 pm

Now, to get  $f(a+h)$ , we need to substitute "a+h" in place of 'x' wherever 'x' is found in this equation.

Sep 2nd 5:27:19 pm ✓ **B2: Break down step / C1: Adapt to student's needs**

So what might we get just by substituting a+h instead of 'x'?

Sep 2nd 5:27:56 pm ✓ **C2: Invite student to take next step**

$$\frac{(A+h)^2 - (A+h) + 4 - (A^2 - A + 4)}{h}$$

Sep 2nd 5:29:08 pm

Excellent work!

Sep 2nd 5:29:25 pm ✓ **C2: Encouraging words**

What might this evaluate to?

Sep 2nd 5:29:33 pm

Yay!

Sep 2nd 5:29:37 pm

Could you go ahead and simplify this equation?

Sep 2nd 5:30:24 pm ✓ **C3: Invite student to proceed independently**

I'm working on it

Sep 2nd 5:30:51 pm

Sure, please proceed. :)

Sep 2nd 5:31:04 pm ✓ **C2: Friendly punctuation**



$$\frac{A^2 + 2Ah + h^2 + 4 - A^2 + A - 4}{2Ah + A + h^2}$$

Sep 2nd 5:33:53 pm

Oh no I didn't finish.

Sep 2nd 5:34:51 pm

Good job! Although, looks like you subtly missed the '-(a+h)' on the numerator. Shall we add that up too?

Sep 2nd 5:35:48 pm ✓ **C2: Tutor redirects student's mistake without causing stress**

$$\frac{A^2 + 2Ah + h^2 - A - h + 4 - A^2 + A - 4}{2Ah - h + h^2}$$

Sep 2nd 5:37:00 pm

Brilliant! :)

Sep 2nd 5:37:37 pm ✓ **C2: Encouraging language / friendly punctuation**

What might this result in after division?

Sep 2nd 5:37:45 pm ✓ **B2: Guide student towards next step**



Handwritten mathematical derivation on lined paper:

$$\frac{A^2 + 2Ah + h^2 - A - h + 4}{h} - \frac{A^2 + A - 4}{h}$$

$$\frac{2Ah - h + h^2}{h} = \frac{h(2A - 1 + h)}{h} = \boxed{2A + h - 1}$$

Sep 2nd 5:38:48 pm

Well done! You're absolutely right! :)

Sep 2nd 5:39:13 pm ✓ **C2: Encouraging language**

Do you have doubts in any part of the solution?

Sep 2nd 5:39:27 pm ✓ **C1: Check with the student to ensure understanding**

No I don't think so.

Sep 2nd 5:39:53 pm

Great! Hope you feel confident enough to do similar problems easily in future! :)

Sep 2nd 5:40:09 pm

Is there any other problem I might assist you with?

Sep 2nd 5:40:16 pm ✓ **Tutor checks to make sure student doesn't need further help**

I just have to remember to substitute (a+h) and not just a in for x.

Sep 2nd 5:40:18 pm

That's a good way to summarize what we learnt in this problem!

Sep 2nd 5:40:48 pm

Thank you so much!

Sep 2nd 5:41:01 pm

You're always welcome! :) Is there any other problem I might assist you with?

Sep 2nd 5:41:15 pm ✓ **C2: Warm send-off**

Thanks for using Yup! Have a good one! :)

Sep 2nd 5:41:48 pm ✓ **Tutor thanks student for using Yup**

Sep 2nd 5:41:01 pm

Hmm not right now thank you.

Sep 2nd 5:41:27 pm

You too.

Sep 2nd 5:42:06 pm

Student ended session

Sep 2nd 5:42:09 pm