# The Missing Function Task

**Teacher: Jamie Bassham**
**District: Hamilton County School District**
**Grade: High School**

*Chart Paper created during the "Launch "of the task, prior to the clip:*

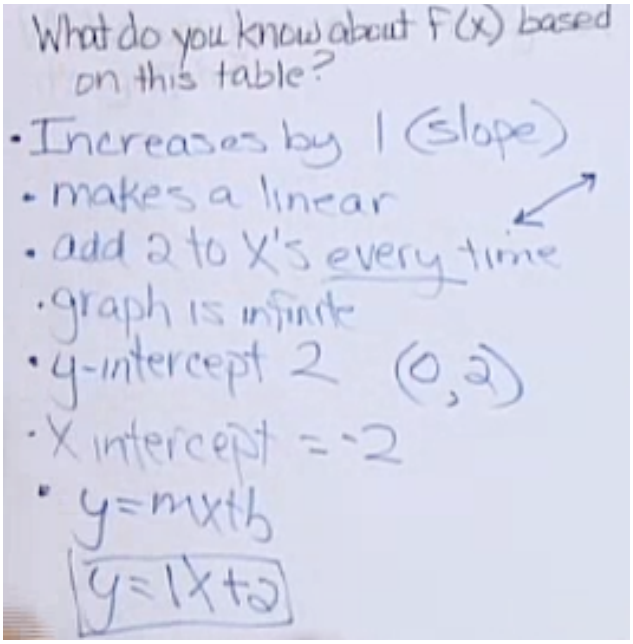



*Figure 1*

| | | |
|---|---|---|
| 1 | *Teacher:* | Alright, what are we thinking about here? |
| 2 | *Student:* | We're trying to figure out H. No, the G(*x*), I'm sorry. |
| 3 | *Teacher:* | G(*x*). How are you going about trying to think about it? |
| 4 5 | *Student:* | Well, we think we found F(*x*) and H(*x*), so we're trying to figure out, like, where the numbers come in and stuff. |
| 6 7 8 | *Teacher:* | Alright, so you think you found what now? Explain it to me one more time. You think you know – what do you mean you think you found, an equation, something on the graph, something with a point? |
| 9 10 | *Student:* | Like on the graph it said that the parabola was H(*x*) and that the line was F(*x*). |
| 11 | *Teacher:* | So what does that tell you G(*x*) must be? |

*Student:* The numbers, the plots.

*Teacher:* How are you going to get that? Think about it, okay. [*Teacher moves to new group.]*

Teacher What are we doing here?

*Student:* I was discussing with my friend. We landed on this.

*Teacher:* Are we in a disagreement here?

*Student:* No, we're trying to figure it out. No, no, because we're all frustrated.

*Teacher:* Now, let's look at our task right here. Our task is to take this that we know, you know it's linear. You know it's got an infinite number of points. They've given you a few right here. And we want to see what we're going to multiply by, what you can come up with this.

*Student:* Oh, so we can get the parabola points?

*Teacher:* That's one way you could do it, yes, possibly.

*Student:* Well, basically we're just trying to figure out what times that –

*[crosstalk].*

*Teacher:* Well, I'm going to leave you with that. I think you're on track. Think about that for a second. *[Teacher moves to new group.]*

*Teacher:* Let's see what we're doing. How are we doing over here, girls?

*Student:* Well, I don't know. One and –

*Teacher:* Now I hear Gabrielle over there calculating. What are we looking at? Share with your group now what you're doing so everybody can be –

*Student:* And one. Plotting the points. I'm plotting it, but it looks like it's running parallel to the F(*x*) line. So I was thinking that –

*Teacher:* Excellent. Keep along with those thoughts. I'm going to come back, but that's actually a good idea to plot that graph and see what you can figure out there. Very good, plot those points. [*Teacher moves to new group*.]

*Student:* We had, to multiply first, so we got them. We think you divide H(*x*) by F(*x*), because when you do it you get the answer G(*x*).

*Teacher:* OK, now a minute ago you multiplied.

*Student:* Yep, and then we divided – four divided by four is one. Zero divided by three is zero. Negative two divided by two is negative one and negative two divided by one is negative two.

*Teacher:* Okay. So why did you decide to divide instead of multiply?

*Student:* Because when you multiply –

*Student:* You see, we know G(*x*); say we don't know G(*x*). To get F of – not F(*x*), but to get G(*x*) you divide it. You see what I'm saying?

*Student:* But then you come into a question of how did they get *x* – I mean H(*x*)?

*Teacher:* No, where are they getting that and - say that again, Jerri.

*Student:* H(*x*) is on the parabola.

*Student:* Yeah.

*Teacher:* Ok. Look at that. We know that H(*x*) is on the parabola and that y'all's thinking is excellent. See if you can figure out that G(*x*) now and maybe look at it on the graph.

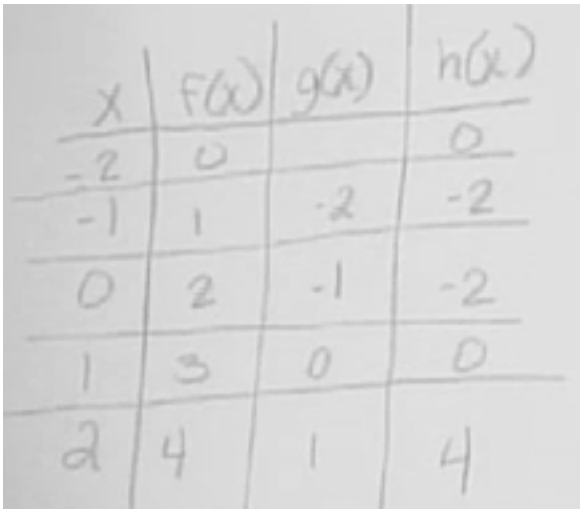
*Student:* What if the divide–

*Teacher:* You figured out some patterns.

*Student:* If the divide and what she said was right, then and the H(*x*) came from the –

*Teacher:* Think about it. Y'all are on the right track. Maybe even put it on that graph. [*Transition to whole-group discussion*.]

*Student:* We saw that this was the *y* and this was the *x* on the first line, but Jarron said that for the other two there wasn't an *x* and a *y* and she told us that all of these equal *y*. [*Student points to x, f(x), g(x), and h(x) in Figure 2 as she talks.]* So what we did was … graphed the *x* and the G(*x*) on another line and then got stuck after that.



| x | F(x) | g(x) | h(x) |
|---|---|---|---|
| -2 | 0 | | 0 |
| -1 | 1 | -2 | -2 |
| 0 | 2 | -1 | -2 |
| 1 | 3 | 0 | 0 |
| 2 | 4 | 1 | 4 |

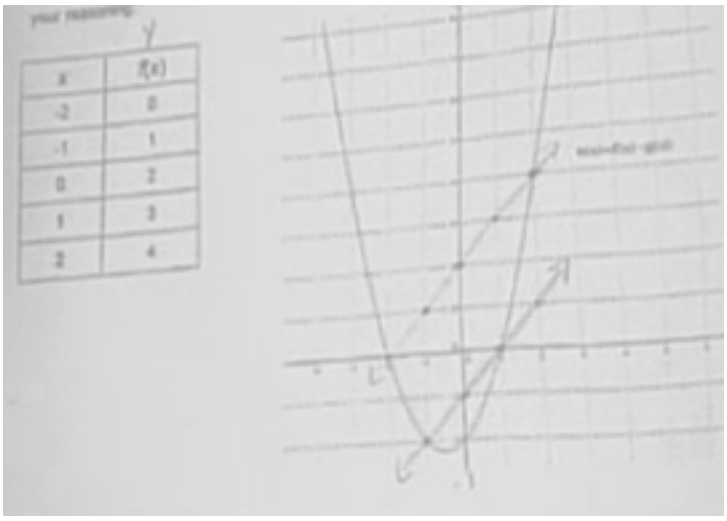


*Figure 2* *Figure 3*

*Teacher:* What do you notice about those two lines that they have graphed up there? [*See Figure 3.]* And I want to wait and I've got another thing somebody else in the group, we're making a connection. Take a look, we've got a line and another line and…

*Students:* They're parallel

*Teacher:* …Alright, I'm wondering if they're always going to be parallel, but that is something I wondered you would notice. On this particular one, yes they are parallel. What does that tell you about their slopes?

*Students:* They're the same.

*Teacher:* They're the same slope, but is that always going to be the case? We may want to check that out later on. We're running out of time right now…

*Student:* We really couldn't figured it out, [*student displays Figure 4]* but we got the same graph as everybody else, but the way we got our G(*x*) was we divided like the other group did, because when you multiply a number and you want to get the other number, you divide. So that's basically what we did to get our G(*x*).

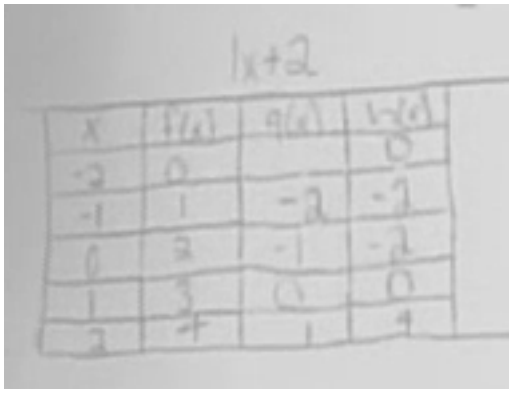



*Figure 4*

*Teacher:* Did your group happen to graph those points – the new function that you got? I think you guys explained how you could get those points. Did you guys happen to graph it?

*Student:* Hmm-mm, we never.

*Teacher:* But Taylor's group did do the actual graph on that.

*Student:* I mean basically what we found out was like we multiplied the F(*x*) with the G(*x*), which basically going to get the H(*x*). Then you said how did we get the G(*x*), so we had divided, but we didn't finish that.

*Teacher:* Okay. So if you work F(*x*) times G(*x*), that's going to get if you're working backwards –

*Student:* It's going to be the opposite of what you did, and then find that other one.

*Teacher:* Inverse operation – anybody heard that?

*Students:* Mm-hmm.

*Teacher:* Are we clear on that? Anybody disagree with that?

*Students:* No.

*Teacher:* …Gabrielle, if you don't mind.

*Student:* Yeah.

*Teacher:* Thank you.

*Student:* We used this that we used for F(*x*) and we used this as the *x* and we plotted this and G(*x*) and H(*x*). And after we plotted G(*x*), we noticed that

it was parallel to that one so we thought that if it combined together it could get H(*x*). So we went ahead and plotted H(*x*) and it was – it went along shape to the parabola and it shared some of the points with F(*x*) and G(*x*).

*Teacher:* What can you tell me? What are some key points that we're looking at? Y'all are coming up with some good stuff. We're getting there.

*Student:* The one key point we noticed was that they [*student displays Figure 5*]– the F(*x*) and the G(*x*) and the H(*x*) all share points right here, right here, right here and right here. Oh, and right there.

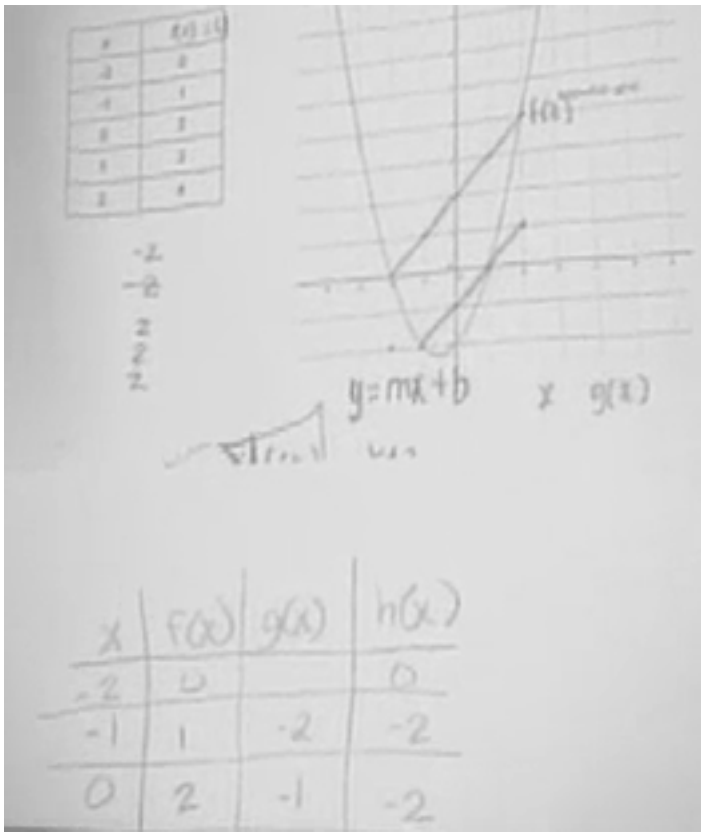



*Figure 5*

*Teacher:* So what are a couple of these points now that you pointed at? At least two of them have a specific name. Does somebody else want to help her out there, because we got – she showed four key points, but there is two especially that I want you go focus on.

*Student:* They have two points and they are *x*-intercepts.

*Teacher:* The *x*-intercepts.

*Student:* This one right here is (1, 0) and then this one right here is the second *x*-intercept point and that's (-2, 0).

*Teacher:* And would you write those up there for me, please? I want to see what you –

*Student:* On this here?

*Teacher* Over here, mm-hmm, that point. [*Transition.*]

*Teacher:* I want you to think and see if you can tell me what's the relationship between this equation and what we know up here?

*Student:* Okay. So when you say x + 2 = 0, that gives you negative two when you solve it for it. So that's your point on the graph and you can do the same thing to the x-1, that'll be a point on the graph.

*Teacher:* Now what did you do again, say that one more time or somebody re-voice for me. Why did she – yes ma'am, Taylor J.

*Student:* It's that because you have to set *x* of, I think minus two, to zero.

*Student:* x + 2.

*Student:* x + 2 to zero, I'm sorry.

*Teacher:* x + 2 = 0. Why do we set them equal to zeros?

*Student:* So you can get them –

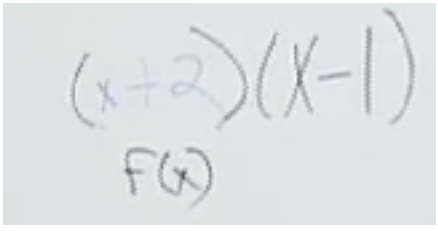
*Student:* To find the *x*.

*Student:* To find the *x*.

*Teacher:* Is that where the cross the *x*-axis?

*Student:* Yes.

*Teacher:* Now, let me ask you this. This is our F(*x*). What must this be?



148 *Student:* The G(*x*).

149 *Teacher:* G(*x*). Will, if this is F(*x*) – and I want you to think for a second – we already
150 found that a long time ago. Correct?

151 *Student:* Correct.

152 *Teacher:* You think this is G(*x*). Why do you think this is G(*x*)?

153 *Student:* Because the point is there.

154 *Student:* Because it's on the G(*x*) line.

155 *Teacher:* It's on the G(*x*) line, what else?

156 *Student:* It goes steady.

157 *Student:* So that's it. That's what I said…[*crosstalk]*.

158 *Teacher:* Talk with your partner for a second.

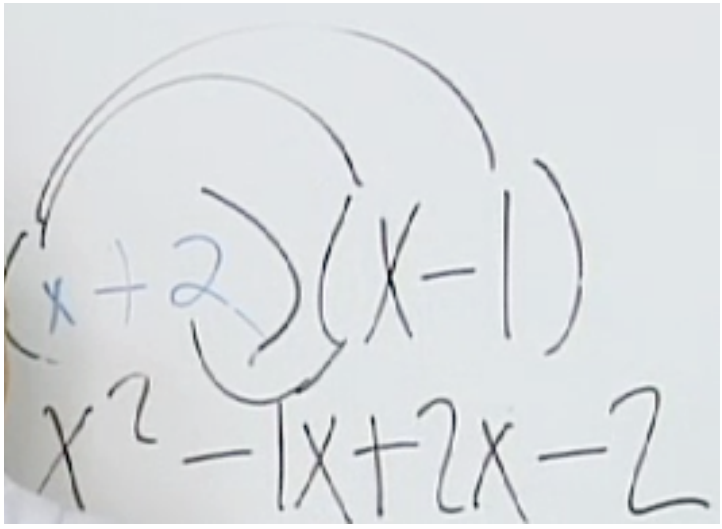
159 *Student:* Can I go to the board and do it.

160 *Teacher:* Excellent, thank you.

161 *Student:* Can I erase this?

162 *Teacher:* Of course.

163 *Student:* *[Figure 6: Student at the board uses "FOIL" to expand (x+2)(x-1)].*

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165 *Figure 6*

166 *Teacher:* Alright. Why did you do that?

167 *Student:* Well, you'd like that in the calculator it would give you your H(*x*).

168 *Teacher:* And you did check it in the calculator? You verified it in the calculator?

169 *Student:* Mm-hmm.

170 *[End of Audio]*