The Washington Post
FINAL
Inside: Food, Horizon
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Thursday: Partly sunny, warm, humid; thunderstorm possible. High 87. Low 66.
Yesterday: Temp. range: 61-80.
AQI: Moderate-55. Details on Page D2.
118th Year .... No. 282
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25¢

Update

The Genius Solution

For Those Who Asked: Problem 12 Explained

By Carolyn Hax
Washington Post Staff Writer

So you think you're smart. *Really* smart, a genius even. The question is, would Gary Gruber consider you a super genius?

Gruber's brain teaser, in this space last Tuesday, teased all right. And stumped. And enraged. And seems to have foiled the most mighty attempts at Question 12. Those who decided to "Find Out Fast" how smart they were, and found out they were one level shy of stunning, figured there was a choice missing from 12:

F.) Can't be done.

"No. 12 is obviously flawed for lack of information," complained Michael Broder, a PhD married to a college math teacher. "Some piece of information was left out that would enable us to solve it."

"As printed," said Philip Porter, a retired technical writer and electronics specialist, "you can get a whole range of possible answers." (Porter didn't think much of the George Washington analogy question either.)

"For my peace of mind," faxed John Krinos, another sub-super genius, "I would be grateful if you could please send me (or print) the step-by-step proof."

The explanation given, that triangle AEB is isosceles, was, to a noisy collection of engineers, advanced-degree holders, geometry teachers and just plain smart people, woefully inadequate.

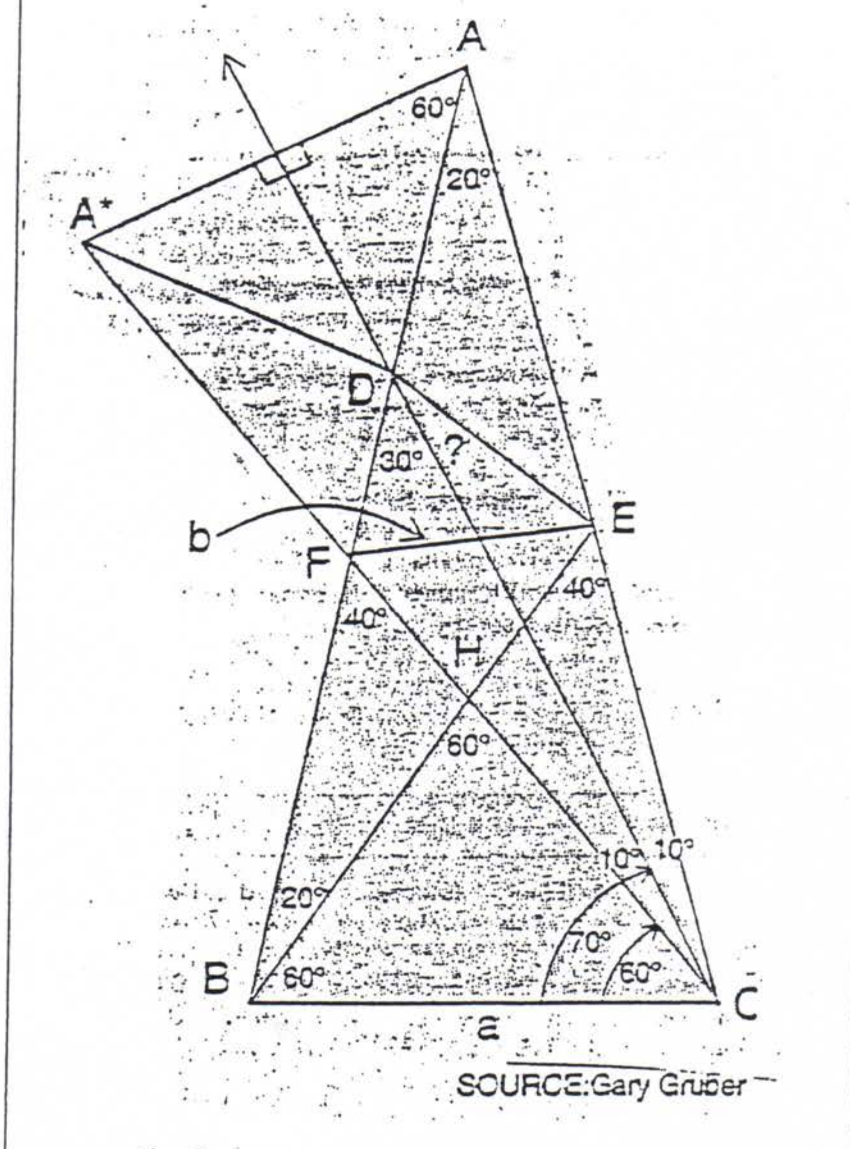
Universal Press Syndicate, which carried the quiz, offered this explanation: The solution was too long and involved for them to include in full.

Indeed.

Clearly the peeved had no other choice but to tap *the* super genius, Gary Gruber.

Gary Gruber who swears the problem can be solved.

Gary Gruber, who couldn't remember how.



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The author of the quiz, a PhD in physics, said he solved the problem—after two or three hours of grueling geekdom—in 1957 as a junior at Brooklyn Technical High School in New York. "It's solvable all right. I don't know whether I've lost brain power or what." No one in the country, he boasted, can do this problem. "If you get it," said the author of "Gruber's Complete Preparation for the New SAT" (HarperCollins), "let me know."

Now wait just a dang minute, Gary Gruber. We insist you sit right down and solve that problem using your own clues, even if it takes all day.

He did. But it took him all weekend.

"It's an elegant proof," he said, sounding somewhat relieved. He did have some help, though. "I contacted about 40 geniuses around the nation and they all gave me insights about the problem without being able to solve it."

The problem (as originally published): Suppose you are given a triangle ABC with sides AB equals AC. Draw a line from C to side AB. Call the line CD. Now draw a line from B to side AC. Call that line BE. If angle EBC equals 60 degrees, angle BCD equals 70 degrees, angle ABE equals 20 degrees and angle DCE equals 10 degrees, find what angle EDC is. (Do not do this trigonometrically; do it geometrically and get an exact answer.)

(A) 10 degrees (B) 15 degrees (C) 20 degrees (D) 25 degrees (E) none of these

The answer (as originally published): (C) 20 degrees. Use the fact that angle ABE is equal to 20 degrees and angle A is equal to 20 degrees to make the triangle AEB isosceles.

The *FULL* answer (see accompanying figure):

PART 1

Begin with triangle ABC. Label angles using the fact that the sum of the interior angles of a triangle is 180 degrees.

Establish that AD = BC by the following:

1. Reflect AC and AD across the ray CD, giving triangle A*DC. Draw connecting line A*A to get triangle A*AC. (That is, just reflect triangle ADC

GENIUS QUIZ SOLUTION

EVERYONE HAD TROUBLE with this question, so we're running the solution.

about line CD to get a mirror image of triangle ADC, which becomes A*DC. Note that we have made triangle A*DC congruent to triangle ADC). Since angle A*AC = 80 degrees (because triangle A*AC is isosceles and angle A*CA = 20 degrees) and angle BAC = 20 degrees, angle A*AD = 60 degrees, by subtraction.

2. AD = A*D (from congruent triangles ADC and A*DC). Thus since angle A*AD = 60 degrees from #1 above, angle DA*A = 60 degrees and so the remaining angle A*DA = 60 degrees and the triangle A*DA is equilateral. Thus AD = AA*.

3. AA* = BC since both are the bases of congruent 20-80-80 triangles ACA* and ABC.

4. Conclude that AD = BC, since we have shown that AA* = AD from #2 and AA* = BC from #3.

PART 2

We want to establish that DF = FE.

1. Define CB = a and FE = b. Triangle FBC is congruent to triangle EBC, so BE = FC and since HB = HC, by subtraction we get FH = HE, so triangle FHE is equilateral. Then using the equilateral triangles CBH and FHE, we have BE = a + b.

2. Triangle AEF is isosceles because AC = AB (given) and EC = FB (because triangles FBC and EBC are congruent), so by subtraction, AF = AE.

3. Since triangles AEB and AEF are both isosceles (this is the important hint given in original answer), we have BE = AE = AF, which in turn is a + b.

4. Now we have from Part 1 that AD = BC, so that AD = a. So DF = AF minus AD = (a + b) minus a = b. But FE = b (from #1, above). So DF = FE.

CONCLUSION

1. Since DF = FE from above, triangle FDE is isosceles.

2. Since angle DFE = 80 degrees (because triangle AEF is isosceles from #3 in part 2, and because angle DAE = 20 degrees), angle FDE = angle FED = 50 degrees, because of triangle FDE being isosceles from #1 above. But angle FDC = 30 degrees, so angle EDC = angle FDE minus angle FDC = 50 degrees minus 30 degrees = 20 degrees.

3. Therefore, angle EDC = 20 degrees.