Kyle C.
3rd Period Prealgebra
Mrs. Crabtree
January 25, 2020

[handwritten: 1/10 See me.]

Chapter 5: Pythagorean Pursuits

Textbook, problems 5.12, 5.14, 5.15-5.19 (odds)

All problems are adapted from *Malloy et al., 2003.*[1]

5.12) On a lazy Sunday, two cars leave Chico at twenty minutes past noon driving due north and due east, respectively. The first car drives an average of 80 mph while the second car averages 68 mph. When the cars stop for some munchies four hours later, how far apart are they, as the crow flies? Please round to the nearest mile. *[handwritten: We name vertices in alphabetical order.]*

Let the two cars and the city of Chico form the points of $\triangle CBD$ with C Chico and B and D the cars traveling north and east, respectively (Figure 1).
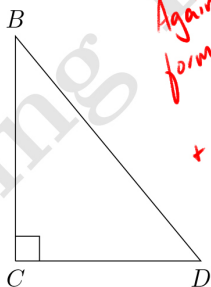
[handwritten: Again, formatting homework in LaTex is unnecessary. + The watermark is distracting!]

Figure 1: Chico (C), and the speedsters (B) and (D).

This question calls for an application of the so-called "Pythagorean Theorem" (1). [2]

$$a^2 + b^2 = c^2 \ *$$
(1)

*Note: Although debate regarding the true origin of the above relation rages on, we here avoid delving into the historical accuracy of such attributions and refer to this theorem simply as (1). *[handwritten: ← This is a math class.]*

$$\overline{CB} \perp \overline{CD} \implies \triangle CBD \text{ obeys (1).}$$

First, we apply $d = rt$ to determine that $\overline{CB} = 4\,h * 80\,mph \approx 320\,mi$.
By the same logic, we find that $\overline{CD} = 4\,h * 68\,mph \approx 272\,mi$.

[handwritten: Don't round until the END of the problem.]

1

By (1), $\sqrt{\overline{\mathrm{CB}}^2 + \overline{\mathrm{CD}}^2} = \pm\overline{\mathrm{BD}}$ [†].

[†] Note that a physical distance can only be represented by the positive root.[3]

Substituting our calculated distances and calculating according to PEM-DAS [4], we see that when the two cars stop at twenty-past-four, they are, rounding to the nearest mile, 420 miles apart. $\square$

5.14) TeleCon recently erected its tallest radio tower above Megalopolis. Because the 666 foot tower will be subjected to high winds, TeleCon has asked the Breaking Point cable company to secure the tower. What length of cable will Breaking Point need to supply in order to span the distance from the top of the tower to an anchor in the ground 888 feet from the tower's base?

Remember what happens when we assume?

~~Due to the dearth of information provided, I will take the liberty of assuming that the "cable" in question is in actuality a galvanized steel rope. If the manufacturer is worth its salt, the steel rope has been pre-stretched to avoid an unpredictable elongation during initial loading. Assuming a conservative 15% elongation upon loading, as well as an additional 25 foot allowance at either end for attachment to the respective anchors, we may proceed with the following calculation with γ the length of the loaded steel rope and L the length of the unloaded steel rope:~~

$$\gamma = \sqrt{((666ft)^2 + (888ft)^2)} + (2*25ft) \tag{2}$$

Again, this is a math class

$$L = 0.85(\gamma) \tag{3}$$

These assignments are to be done on your own. See me after class.

My father has assured me that this is simply a question based on a special* right triangle.[5] If that is indeed the case, 666 and 888 share a common factor: 222, and correspond to the legs of a "3-4-5" right triangle. The "cable" (avoiding questions of elongation and allowances for attachment) must be $5*222 = 1110 ft.$ $\square$

* Note: I have been assured that no triangle is as special as I am.[6] *ok.*

Full solutions to 5.15-5.19 (odds) can be found in the supplementary materials, available through Elsevier ~~within one month of publication~~ until the Chapter 5 test. The answers are reproduced here for your convenience:

5.15) $a = 8675$, $b = 309$ 5.17) $d > 6.9 \ inches$ 5.19) 42

Your work must be accessible. See my note at the end.

−3 (no work)

Appendix

Please find below the abstract for my upcoming presentation, to be delivered at the *53rd Semiannual Conference of Parents and Teachers*, held at McKinley Montessori, March 15th, 2020.

Error at the human-computer interface: a chapter test case study

Kyle C.[†] [*] and Kyle C.'s Mom[‡]

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[‡] Board Chair, McKinley Montessori Parent Teacher Association

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Grading discrepancies present the single most pressing problem in pedagogy today. With the advent of modern computing in the 1980s, instructors gained an invaluable resource in their unending quest for robust, reproducible evaluations of student performance. But despite the overwhelmingly positive impact of electronic computation on the overall veracity of academic calculations and records, accurate correlations between students' performance and their associated grades remain vulnerable to one lingering and insidious problem: human error. Here we invoke a real-world case study to examine this problem and its impact on one student's class standing as well as his intimately related self-esteem. In the process, we determine that Kyle C.'s recorded score on the Chapter 4 Test "Quadratic Quandaries" displays an inexplicably negative correlation with Kyle's demonstrated understanding of the exam material. The tight convergence of our statistical and machine learning models, trained on Kyle C.'s performances on the Chapters 1-3 exams, gives us confidence in asserting that Kyle's Chapter 4 performance merited a $99(\pm 0.5)\%$ rather than the 97% he received. At the same time, we acknowledge that the above conclusions are extremely narrow and stress that the techniques described here are entirely inapplicable to Grace B.'s 98% performance on the Chapter 4 Test. We challenge the powers that be to reëxamine the test in question and to rectify the offending grade book at the earliest possible date.

References

1. Carol Malloy, Jack Price, Teri Willard, Leon L. "Butch" Sloan. 2003. Pre-Algebra. Glencoe Mathematics and McGraw-Hill.

2. Of Samos, Pythagoras. c. 530 B.C.E. A novel approach to the quantitative determination of triangular hupoteinousa. *Croton Philosophical Forum*, Croton, Magna Graecia.

3. Crabtree, Mrs. 2020. Polynomial roots (square and otherwise): limitations, real and imaginary. *23rd Meeting of the 3rd Period Prealgebra Consortium*, McKinley Montessori, Sacramento, CA. Lecture.

4. Cahill, Mr. 2019. PEMDAS: An introduction to operations and the order of their application. *16th Pentaweekly Meeting of the 6th Period Pre-Prealgebra Society* McKinley Montessori, Sacramento, CA. Lecture.

5. Dad, My. 2020. On the way they taught it when I was in school. Home. (excessively long) Lecture.

6. Mom, My. 2020. "Those other kids are just jealous of you," and other words of encouragement. In the car. Personal communication.

Kyle,

Because of the online contract dispute currently ongoing between Elsevier + McKinley Montessori PTA, teachers don't have online access to publications—I'm sure your Mom is fully aware. Until the situation is rectified, please show all your work by hand (like your classmates) or I'll be forced to keep lowering your score.

Regarding your "abstract," I will stress for the third time: parent-teacher conferences are for parents & teachers only. You lost points on your last test for skipping steps in your solutions. It doesn't matter if you can do the work in your head — showing all your work is a Class Rule!

In any case, 97% is an excellent score, & you must remember that Grace B. is your classmate, NOT your opponent.

Good luck at the International Mathematical Olympiad. Enjoy St. Petersburg, & SHOW YOUR WORK! —Mrs. C