Jill's Solutions

1. Read Burton §2.4 Summarize the mathematical topics discussed in these sections using at most two sentences.

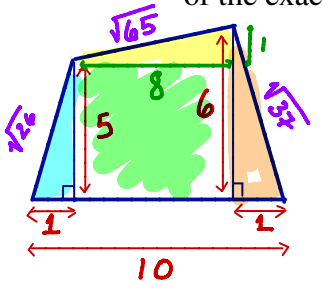
   The section discusses 2- and 3-dimensional geometry including formulas for the area of quadrilaterals and circles and the volume of a truncated pyramid.

2. Roughly when was the Moscow papyrus written? About 1850 BC (So, about 200 years before the Rhind papyrus)

3. On page 54 is an ancient Egyptian formula for the area of a quadrilateral: $A = \frac{1}{4}(a+c)(b+d)$.

   (a) Use it to find the area of a rectangle with side lengths a and b.
   In this case $a = c$ and $b = d$. Thus, the formula gives:
   $A = \frac{1}{4}(a+c)(b+d) = (1/4)(2a)(2b) = ab$, which is correct.

   (b) Use it to find the area of the quadrilateral below and compare that calculation to a correct calculation. Does the Egyptian formula give an over-estimate or an underestimate of the exact area?

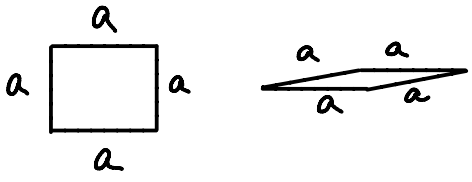


Correct Area $= \frac{1}{2}\cdot 1.5 + 5.8 + \frac{1}{2}\cdot 8.1 + \frac{1}{2}\,1.6 = 47\frac{5}{8} = 47.625$

Area formula $= \frac{1}{4}\left(10+\sqrt{65}\right)\left(\sqrt{26}+\sqrt{37}\right) = 50.492\ldots$

Egyptian formula gives an over estimate.

   (c) Give a simple argument or proof-by-picture to demonstrate that the formula the Egyptian were using is not only incorrect, but obviously so. In particular, that official using the formula must have known it was incorrect.



In both cases, the formula gives $A = a^2$ even though it is clear that the area of the second figure can be made arbitrarily small.

4. Write a sentence or two explaining **to a 5th grader** what π is.

   (a) It is the ratio of the circumference of a circle to its diameter. For context, it is a fact that if C is the circumference of a circle and d is the diameter of a circle, then C/d is always the same number. It does not matter what circle you choose – a big circle or a small circle. The ratio is the same and we use the symbol π to represent this number because it happens to be irrational so we don't really have a better way to represent it.

(b) It is the number 3.14159... Its decimal representation never terminates and never repeats. It is an example of an irrational number as it cannot be represented as a fraction a/b where a and b are integers.

(c) It is the number used in the formulas for circles such as $A = \pi r^2$ and $C = 2\pi r$.

5. How much of your answer is something an ancient Egyptian could understand? None. The first part of the first answer would be understandable.