

3. [5 points]

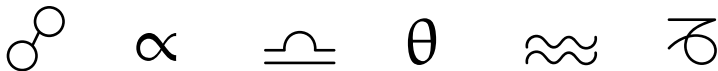
(a) Give an example of a set that has the **same cardinality** as the set of rational numbers.

(b) Give an example of a set that has a **different cardinality** from the set of rational numbers.

4. [5 points] A triangle sides of length 6 cm, 7 cm, and 9 cm. Does this triangle show that the Pythagorean Theorem is false? Explain in detail.

5. [5 points] An art gallery has 62 vertices. What is the most cameras necessary to watch the entire gallery?

6. [5 points] Use equivalence by distortion to categorize the following symbols:



7. [5 points] The long side of a Golden Rectangle is 12 meters long. Find the length of the short side.

8. [5 points] Each of the following statements describes a different Platonic Solid. Identify which one.

(a) Of all the Platonic Solids, this one has the most faces.

(b) This Platonic Solid is its own dual.

(c) It has six faces, each shaped like a square.

(d) It has 12 edges, and its faces are shaped like triangles.

(e) It has 12 faces, each shaped like a pentagon.

9. [10 points] Give a real world application of each of the following:

(a) Möbius strip

(b) cube

(c) symmetry

(d) Fibonacci Number

(e) prime number

10. [5 points] A planar graph has 28 vertices and 16 faces. How many edges does it have?

11. [10 points] For each of the following, define the term or identify the person.

(a) symmetry of scale

(b) pigeonhole principle

(c) Paul Erdős

(d) Georg Cantor

(e) Andrew Wiles

12. [5 points] A wealthy drop-out of the University of Tennessee decides to fund the No Hope Scholarship for students who have a GPA below 2.75. Arrangements were made for UT's Bursar's Office to handle the details of administering the scholarship. In Fall 2008, 4000 students applied for the No Hope Scholarship, and 40 scholarships were awarded. Students have been calling the Bursar's Office to find out whether they won. Unfortunately, the Bursar's Office only gives the right answer 90% of the time. If a student calls and is told that they got the scholarship, what percent of the time did they really win?

14. [5 points] You are trying to save \$2,000,000 by making monthly payments into your retirement account over the next 50 years. If you invest in a mutual fund paying 12%, how much do you have to deposit in the account each month?

15. [5 points] You buy a house in West Knoxville and borrow \$250,000 at an interest rate of 5.8%, and you will be making monthly payments for the next 30 years.

(a) Calculate the monthly payment.

(b) How much do you end up paying for the house?

16. [10 points] **Proof:** Choose **one** of the two options and *prove* it. You must give a complete, mathematical proof with the same level of detail and explanation as was done in class and in the textbook.

- There are infinitely many prime numbers.
- $\sqrt{2}$ is an irrational number.