

3. Cheyenne wants to have \$1,000,000 in her account 40 years from now. She will make monthly payments into the account and expects to earn 4% interest.
 - (a) How much does she need to put into the account each month?

 - (b) How much of the million dollars comes from her deposits?

 - (c) How much comes from interest?

4. One glass is half full of grape juice and another glass twice its size is one-quarter full of grape juice. Both glasses are filled with water and the contents mixed in a third container. What part of the mixture is grape juice?

5.
 - (a) List the first few Fibonacci numbers.

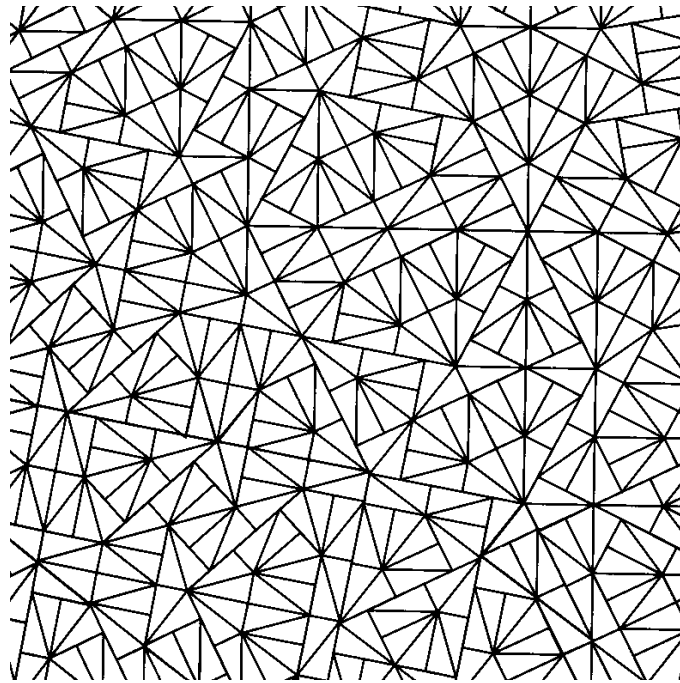
 - (b) State the rule for generating the next number on the list.

 - (c) List one way that the Fibonacci numbers appear in nature.

6. (a) What is the remainder when $(1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 \times 13 \times 14 \times 15 \times 16 \times 17 \times 18 \times 19 \times 20 \times 21 \times 22 \times 23 \times 24 \times 25 \times 26 \times 27 \times 28 \times 29 \times 30 \times 31 \times 32 \times 33 \times 34 \times 35 \times 36 \times 37 \times 38 \times 39 \times 40 \times 41 \times 42 \times 43 \times 44 \times 45 \times 46 \times 47 \times 48 \times 49 \times 50) + 1$ is divided by 7?
- (b) Is 247 a prime number? How do you know?

7. In the following piece of the Pinwheel Pattern:

- (a) Outline a 5-unit supertile.
(b) Outline a 25-unit super-supertile



8. When a piece of toast with peanut butter falls on the floor, it could land either peanut butter side up or bread side up. How would you determine the probability that it would fall peanut butter side up?

9. Lincoln owes \$3000 on his credit card, which charges 22% interest. He has decided to stop charging anything else on his credit card and to pay off the balance in 3 years.
- (a) How much would he need to pay each month to accomplish this?

 - (b) What financial advice would you give Lincoln?
10. (a) Name one mathematician mentioned in the textbook. What is this person known for?
- (b) List one real-world application of one of the ideas that we've studied in this course.
11. (a) Is the pairing that matches each person in the United States to his or her phone number a one-to-one correspondence? Why or why not?
- (b) Why can you be certain that two people in this room were born in the same month?
12. (a) Explain how to make a Möbius strip.
- (b) A planar graph has 100 regions. How many more edges than faces does it have?

13. Dover borrowed \$25,000 from the bank at a rate of 7.2% and will be paying this loan off for the next 10 years, making monthly payments of \$292.85.
- (a) How many payments will Dover make?

 - (b) What is the total value of all the payments?

 - (c) How much goes to interest?

 - (d) Dover tells you, “The bank says that I can lower my monthly payments to only \$230.33 a month by spreading the loan out over 15 years, but they’d have to raise the interest rate to 7.4%.” What do you advise? You do not need to do any computations, just back up your opinion with general principles from financial math.
14. Let G be a Golden Rectangle having base ϕ^2 and height ϕ , and let G' be the smaller Golden Rectangle made by removing the largest square possible from G . Compute the ratio of the area of G to the area of G' .
15. A weird event has a 1 in 10,000 chance of happening each day. What is the probability that you will avoid it for 50 years?

16. For each number, determine whether it is **rational** or **irrational**.

(a) $7.575575557555575555755555755555 \dots$

(b) $\frac{1 + \sqrt{5}}{2}$

(c) $\frac{2}{49}$

(d) $0.2222222 \dots$

(e) $\sqrt{2}$

17. In each case, identify the Platonic Solid:

(a) Its faces are pentagons.

(b) It has eight faces, six vertices, and 12 edges.

(c) It has 20 faces, 12 vertices, and 30 edges.

(d) Its dual is itself.

(e) Three edges meet at each vertex; each face has four edges.

18. Convert the repeating decimal $1.10110110110110110 \dots$ into a fraction or explain why it is impossible.

19. (a) A doughnut passes through the two-dimensional world. What would the 2D creatures see?

(b) A four-dimensional sphere passes through our world. What would we see?

20. State and prove the Pythagorean Theorem.