Pi Day 2025 Individual Round

Damian Burgess, Lisa Zheng

March 29, 2025

1   Introduction

You will have 40 minutes to complete 20 questions. The number of points will be next to each question. Harder questions will result in more points. Choose your strategy wisely and aim to collect as many points as possible. Keep in mind that some questions are challenging, so don't be discouraged if you get stuck, and skip to another question.

2   Easy Questions

Each question in this section will be worth π points.

1. Find the value of $3 - 1 + 4 - 5 + 9 - 2 + 6 - 5 + 3 - 5$.

2. Wallis uses 5 cups of flour to make 8 pies for her family. How many cups of flour does she need to make 24 pies for her neighborhood?

3. What is the remainder when the number 31415926535 is divided by 3?

4. Wallis can bench press 60 pounds. If a cherry pie weighs 3 pounds, and the bar weighs 40 pounds, how many cherry pies can she bench press, rounded to the nearest tenth?

```
YOUR PURCHASE on March 14, 2025
Cherry Pie ----------------------- $15.00
Apple Pie ------------------------ $16.00
Rhubarb Pie ---------------------- $20.00
Pecan Pie ------------------------ [redacted]
```

Figure 1: Safeway Receipt

5. See the receipt above. Wallis went to Safeway and bought four pies for this event. Given the average of her four pies' prices was $15.50, find the price of the pecan pie.

6. If $x \mathrel{\smile} y$ means $x^2 - y$, then compute $(3 \mathrel{\smile} 1) \mathrel{\smile} 4$

7. In how many ways can Wallis scramble up the letters word "pizza" to form different words? ("zapiz" and "aipzz" are two examples) Note that the two z's are indistinguishable!

8. Wallis buys a chocolate pie with volume 100 in^3. She loves to savor her food as long as possible, but her bites start big. If her first bite consumes 40 in^3, and each consecutive bite after that consumes half as much, how much pie is left after 5 bites?

9. If Willis also decides to eat the same pie as Wallis, but she has constant bites of 10 in^3, how much pie is left in Wallis' chocolate pie after 3 bites?

10. Wallis is practicing for a typing competition. His average typing speed is 80 wpm. There are two parts of the competition. One has 100 words and the other has 240 words. If there is a 10 minute break in between, how much time will it take for him to complete the competition?

3   Medium Questions

Each question in this section will be worth 3π points.

1. Wallis really wants to win his school's pi day memorization contest, but he's only memorized 10 digits so far and there are only 14 days exactly until the contest. He estimates that each new digit will take an additional 3 hours to memorize (with the eleventh digit taking 3 hours). If Wallis sleeps 10 hours a day and studies the rest of the time, how many digits of pi will he have memorized by the contest?

2. Wallis wants to fit as many cookies on the circular cookie pan as possible. There are 7 congruent cookies that are internally tangent to each other and externally tangent to the cookie pan. If the radius of one of the cookies is 1 inch, then what is the area of the cookie pan that isn't covered by the cookies (the shaded area)?

3. Wallis was overthinking her cinnamon rolls. All the circles are concentric. If the radius of the innermost circle is 3 units and each larger circle has a radius that is 1 unit larger, what is the total area of the shaded parts?

4. Suppose AC is the diameter of a circle and $AC = 25$. B and D are points on the circle on opposite sides of AC. If $CD = 7$ and $BC = 20$, then what is $AD + AC$? (In other words, what is $x + y$?)
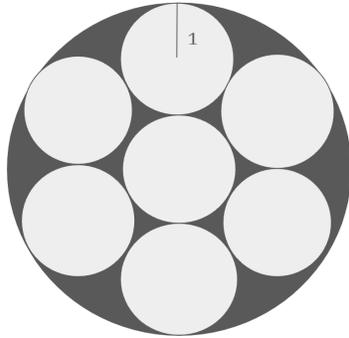
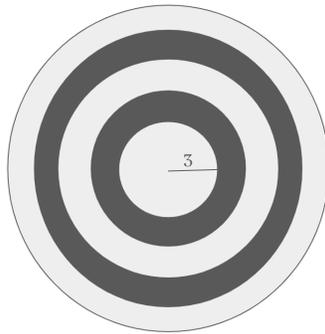5. Find the area of the shell.

Figure 2: Cookies
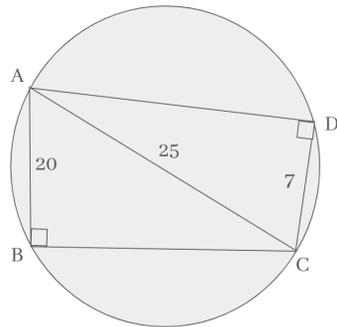

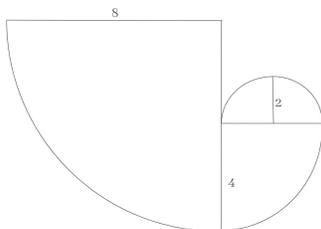Figure 3: Cinnamon Roll

Figure 4: Circle

Figure 5: Shell

4 Hard Questions

Each question in this section will be worth 7π points.

1. For integer abc (so if $a = 1$, $b = 2$, $c = 3$, then $abc = 123$), a, b, c form the sides of a right triangle and $a < b < c$. Find $a + b + c$.

2. Mathematicians approximate $\pi \approx 3.141592\ldots$ with the fraction $\frac{22}{7} = 3.142857\ldots$. It is the closest rational approximation of π. Given this information, what is $|\pi - \frac{22}{7}| + |\pi - 3.14|$?

3. The first few terms of the Fibonacci sequence are 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144. Each term is the sum of the two previous terms. Interestingly, the ratio between two consecutive Fibonacci numbers approaches the golden ratio $\Phi = \frac{1+\sqrt{5}}{2}$, which is incredibly close to the ratio between a mile and a kilometer. Wallis is traveling and sees a road sign saying her destination is 90 miles away, but wants to know how many kilometers that is. Use the Fibonacci Sequence to estimate how many kilometers she is away from her destination. Express your answer as an integer.

4. A cookie cutter of radius 2 is cut into four congruent arcs. The four arcs are joined to form the star figure shown. What is the ratio of the area of the star figure to the area of the original circle?

5. Wallis and Willis plan to meet at Pie Place. Both of them will arrive at any time between 9:00 am and 11:00 am, but they will only wait 40 minutes for each other. What is the probability that they will meet?

5 Brain Rot

If you are truly stuck, you can answer some of these silly questions. They are not worth any points.

1. You miraculously stumble upon the proof/disproof of the Riemann Hypothesis and the Hodge Conjecture, but now an immortal snail is chasing
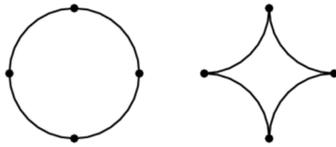
Figure 6: Cookie Cutter

you for the rest of your life. It knows where you are at all times and if it touches you, you die. It will stop chasing you if you erase your memory of the proof? What are you doing?

2. Lionel Messi or Cristiano Ronaldo? (Or Antony)

3. Whose more locked in?

4. If a pizza has radius z and height a, what is its volume? (Get it? hahaha...)

5. Is the low-taper fade meme still massive? Why or why not?

6   Formulas and Hints

1. Area of a circle: πr^2

2. Volume of a sphere: $\frac{4}{3}\pi r^3$

3. Volume of a cylinder: $\pi r^2 h$

4. Volume of a sphere: $\frac{1}{3}\pi r^2 h$

5. Any point on a circle when connected with the endpoints of the diameter forms a right angle.

6. Pythagorean Theorem: In a right triangle, $a^2 + b^2 = c^2$.

7. Distance = Rate $*$ Time