

Math 120 A - Spring 2022
Midterm Exam Number Two
May 19th, 2022

Name: _____

Student ID no. : _____

Signature: _____

Section: _____

1	15	
2	15	
3	15	
4	15	
Total	60	

*This grid is purely decorative.
The exam is graded online.*

- This exam consists of **FOUR** problems on **FOUR** double-sided pages. The fourth page is left blank for scratch work.
- Show all work for full credit.
- You may use a TI-30X IIS (or equivalent) calculator during this exam. Other calculators and electronic devices are not permitted.
- You do not need to simplify your answers.
- If you use a trial-and-error or guess-and-check method when a more rigorous method is available, you will not receive full credit.
- Draw a box around your final answer to each problem.
- **Do not write within 1 centimeter of the edge!** Your exam will be scanned for grading.
- If you run out of room, write on one of the scratch work pages **and indicate that you have done so**. If you still need more room, raise your hand and ask for an extra page.
- You may use one hand-written double-sided 8.5" by 11" page of notes.
- You have 50 minutes to complete the exam.

You may use this page for scratch-work.

All work on this page will be ignored unless you write & circle “see first page” below a problem.

1. **[15 points]** Gomba is learning to climb a new set of stairs. The time it takes him to climb them on his n^{th} attempt is a linear-to-linear rational function of n .

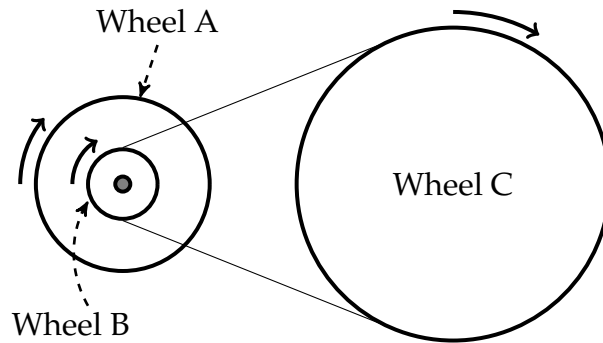
On his 1st attempt, it took him 31 seconds to climb the stairs.

On his 4th attempt, it took him 17 seconds to climb the stairs.

As Gomba continues to practice, the time it takes will approach (but not reach) 3 seconds.

How long does his 13th attempt take?

2. [15 points] Three wheels are connected as shown in the diagram below: Wheels A and B are connected by an axle, and Wheels B and C are connected by a belt.



Wheel A has a radius of 5 meters, and rotates at a linear speed of 10 meters per second.

Wheel C has a radius of 8 meters, and takes 9 seconds to make one complete rotation.

What is the radius of wheel B?

3. [5 points per part] For each part of this question, let $f(x) = 3 \log_2(x) + 2$.

(a) Find a formula for $f^{-1}(x)$. Write your answer in standard exponential form.

(b) Suppose $f(f(x)) = 11$. What's x ?

(c) Let $g(x) = \log_2(x)$. What transformations (shifting, scaling, reflecting) will lead you from the graph of $y = g(x)$ to the graph of $y = f(x)$?

Fill in the blanks:

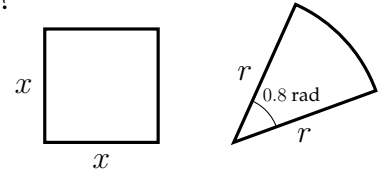
• First, you _____.

• Then, you _____.

4. [15 points] Steve is no longer invited to parties, because he keeps trying to entertain people with optimization problems. Here's his most notorious trick:

He takes a 16 cm piece of wire, breaks it into two pieces, and uses those pieces to construct two figures: a square, and a sector with angle 0.8 radians.

What is the **minimum possible total area** of these two shapes?



You may use this page for scratch-work.

All work on this page will be ignored unless you write & circle “see back page” below a problem.

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