Instructions:

- Place your name on all of the pages.
- Do all of your work in this booklet. Do not tear off any sheets.
- Be clear and neat in your work. Any illegible work, or scribbling in the margins, will not be graded.
- All short answers and essays should be responded to with full sentences conveying thoughtful responses.
- If you need more space, you may use the **back of a page** and write *On back of page #* in the problem space or the **extra page**. **No other paper is allowed.**

Try to answer as many problems as possible. Provide as much information as possible. Show sufficient rationale for full credit.

Pay attention to the point distribution. Not all problems have the same weight. Pace yourself!

Page	Pts	Score
1	**32**	
2	**14**	
3	**10**	
4	**15**	
5	**10**	
6	**19**	
Total	**100**	

Note: $\sum_{k=1}^{n} k^2 = \frac{1}{6} n(n+1)(2n+1)$, $\sum_{k=1}^{n} k^3 = \frac{1}{4} n^2 (n+1)^2$.

Bonus: Name three famous mathematicians from the 1800s who passed away by 40.

_____ _____ _____

MAT 346 Exam II **Name _____**

1. (8 pts) Match the Mathematician with the country listed below.

   Abel _____ Agnesi _____ Cauchy _____ Euler _____
   Kovalevskaya _____ Lovelace _____ Leibniz _____ Riemann _____

   a. Norway b. France. c. Russia d. Germany e. England f. Switzerland g. Italy.

2. (8 pts) Select the century (1500, 1600, etc.) for each mathematician's major contribution.
   Germain _____ Galois _____ Bombelli _____ Newton _____
   Descartes _____ Lobachevsky _____ Gauss _____ Brunelleschi _____

3. (10 pts) Can you name that mathematician? [Hint: The names have been used above.]



A B C D E F G H I J

A. _____ E. _____ I. _____

B. _____ F. _____ J. _____

C. _____ G. _____

D. _____ H. _____

4. (6 pts) Biographical questions:
   a. Who was Lord Byron's daughter ? _____
   b. What was the full name of Euler's teacher? _____
   c. Who found 61 pairs of amicable numbers? _____
   d. Who was first person to find the area under a parabola. _____
   e. Who was Voltaire's lover? _____
   f. Women obtained the first doctorates in what country? _____

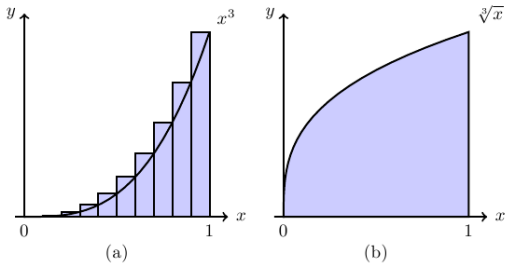
5. (4 pts) Answer the following questions by filling in the blank.
   a. Give a cube root of unity not equal to one. _____
   b. What is Fermat's Last Theorem? _____
   c. Write $e^{i\pi/6}$ in radical form. _____
   d. Who proved π was irrational? _____

6. (6 pts) Consider the following family of series: $f(s)=\sum_{n=1}^{\infty}\frac{1}{n^s}=\frac{1}{1^s}+\frac{1}{2^s}+\frac{1}{3^s}+\frac{1}{4^s}+\cdots.$
   a. What is the name of the series $f(1)$? _____
   b. What is the value of $f(1)$? _____
   c. The series $f(2)$ was the subject of a famous problem.
      i. What was the problem called? _____
      ii. Who solved it? _____
      iii. What is the value of $f(2)$? _____
   d. The general function, $f(s)$, is called the _____

7. (4 pts) When employing Cardano's method to solve the cubic $x^3+x=2,$ one obtains $x=\sqrt[3]{1+\frac{2}{3}\sqrt{\frac{7}{3}}}+\sqrt[3]{1-\frac{2}{3}\sqrt{\frac{7}{3}}}.$
   a. Knowing that one root is $x=1$, find the other two complex roots.

   b. Knowing that $\left(\frac{1}{2}\pm\frac{1}{2}\sqrt{\frac{7}{3}}\right)^3=1\pm\frac{2}{3}\sqrt{\frac{7}{3}},$ how does the Cardano solution simplify?

8. (5 pts) Use the figures to answer the following questions.



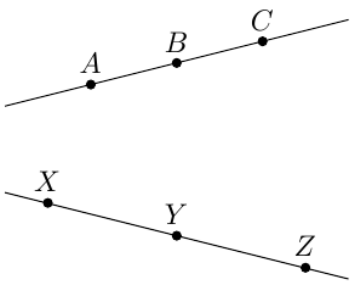
   a. Wallis knew how to compute $\int_0^1 x^3\,dx$. Use Figure (a) to demonstrate how this might have been done.

   b. In *Arithmetica Infinitorium* Wallis also treated fractional powers. Use Figure (b) to describe how he computed $\int_0^1 x^{1/3}\,dx$.

9. (3 pts) Newton found series expansions for functions and their inverses. Let $f(x) = x + x^2$ and $g(x) = f^{-1}(x)$. Find the first three terms of the expansion $g(x) = b_1x + b_2x^2 + b_3x^3 + \ldots$ using the identity $f(g(x)) = x$.

10. (2 pts) Show how the projective line is topologically a circle.

11. (3 pts) State Pappus' Theorem and use the following figure to demonstrate it.



12. (9 pts) There are three types of geometry represented by the figures. Fill in the table.



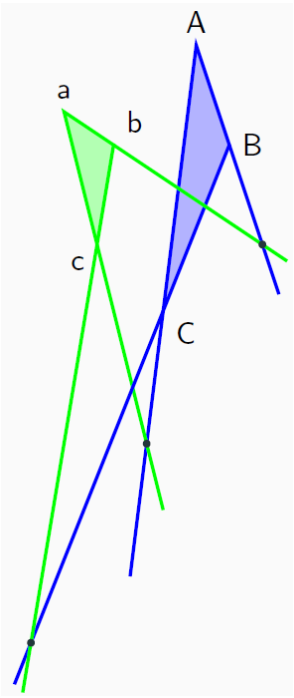
A B C

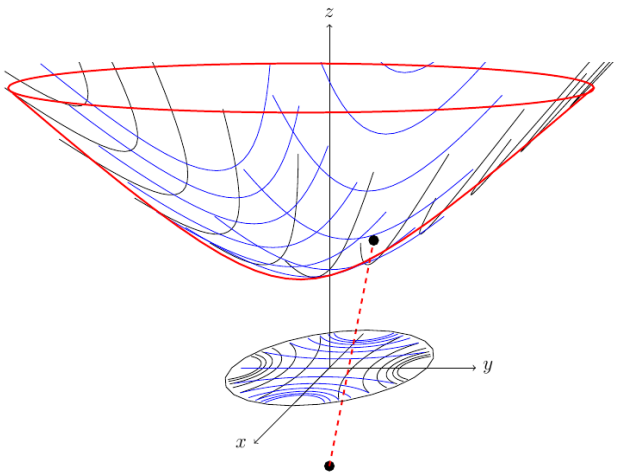
	A	B	C
Name the geometry.			
Who's name is attached?			
The sum of the angles of a triangle in this geometry =			

13. (3 pts) Find $AGM(1,5)$ to three decimal places.

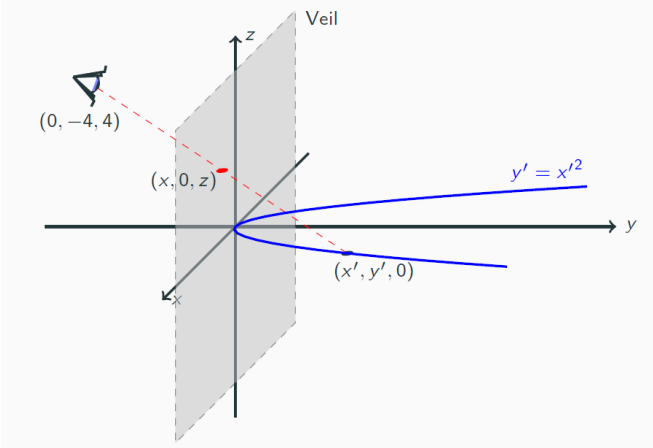
14. (6 pts) Use the figures below to answer the questions.
    a. Desargues Theorem states that two triangles are in perspective from a point if and only if they are in perspective from a line. Use the diagram to locate the Center of Perspectivity and the Axis of Perspectivity.

    b. In the right figure, what type of surface is shown? _____
    c. What is the disk below the surface called? _____



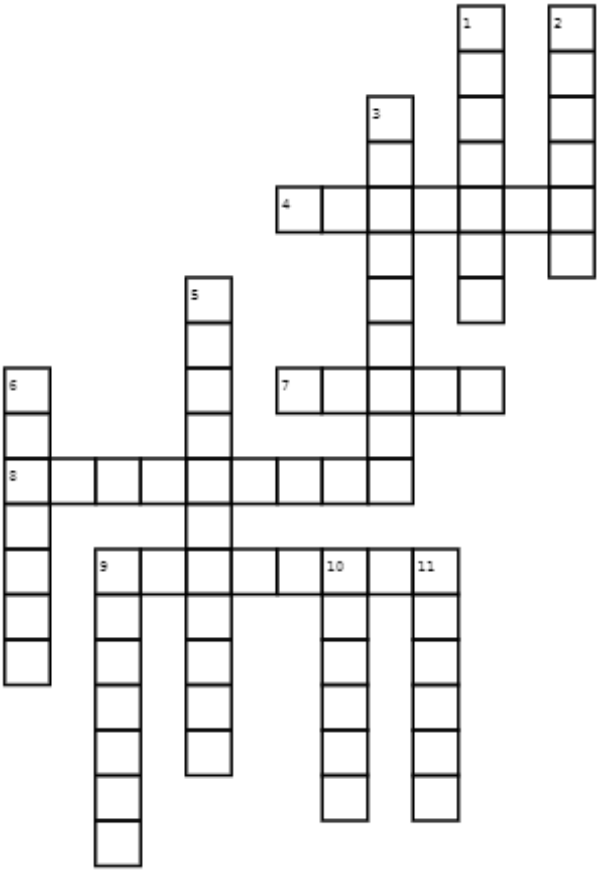


15. (4 pts) Consider Alberti's Veil depicted below.
    a. Find the image $(x, 0, z)$ in the Veil of the point $x' = 2, y' = 4$.
    b. Sketch the image of the parabola in the Veil.



16. (7 pts) Name an important contribution to mathematics by these people:
    a. Cavalieri _____
    b. Nightingale _____
    c. Lobachevsky _____
    d. Cauchy _____
    e. Kovalevskaya _____
    f. Lovelace _____
    g. Daniel Bernoulli _____

17. (12 pts) Fill in the answers.



Down:

1. Saved Gauss' life.
2. Died in a duel.
3. Euler's teacher.
5. Played with tops.
6. Father of accounting.
9. Gave us the integral sign.
10. First woman math professor.
11. Dutch graphic artist.

Across:

4. Solved the quartic equation.
7. Solved the Basel Problem.
8. Promoted infinitesimals.
9. First programmer.

Extra Page