Directions:

- This is a two hour exam. Clearly print your name on the first page and the top of the third page (second piece of paper). No books, notes, internet connection, or cell phone can be used during this exam. Any scratch paper must be provided to you by the proctor and turned in with the exam. A calculator maybe used; however, the calculator cannot have a Computer Algebra System (CAS) or a QWERTY keyboard. When you have completed the exam:
  1) Turn in the entire exam (including cover page, and any scratch papers) to the proctor
  2) Show your ID to the proctor
  3) Sign the “Sign Out Sheet”
- All answers must be fully filled in on the front page, like so:
  \[ \begin{array}{ccccc}
  A & B & C & D & E \\
  \end{array} \]
- The exam is out of 100 total points; however, it is possible to earn up to 110 points (5 points for each of the 22 questions). Only this front page will be graded and no partial credit will be awarded. Consequently, please double check to make sure that you have marked the answer you desire. Good Luck!

#1 A B C D E #9 A B C D E #17 A B C D E
#2 A B C D E #10 A B C D E #18 A B C D E
#3 A B C D E #11 A B C D E #19 A B C D E
#4 A B C D E #12 A B C D E #20 A B C D E
#5 A B C D E #13 A B C D E #21 A B C D E
#6 A B C D E #14 A B C D E #22 A B C D E
#7 A B C D E #15 A B C D E
#8 A B C D E #16 A B C D E

Name (Print):__________________________
Section Number:_______________________
<table>
<thead>
<tr>
<th>Section</th>
<th>Instructor</th>
<th>Class Start Time</th>
<th>Exam Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Drew Butcher</td>
<td>MWF 8:00 AM</td>
<td>CP 139</td>
</tr>
<tr>
<td>002</td>
<td>Drew Butcher</td>
<td>MWF 10:00 AM</td>
<td>CB 106</td>
</tr>
<tr>
<td>003</td>
<td>Drew Butcher</td>
<td>MWF 1:00 PM</td>
<td>CB 118</td>
</tr>
<tr>
<td>004</td>
<td>Robert Wolf</td>
<td>MWF 9:00 AM</td>
<td>CB 122</td>
</tr>
<tr>
<td>005</td>
<td>Robert Wolf</td>
<td>MWF 11:00 AM</td>
<td>CB 122</td>
</tr>
<tr>
<td>006</td>
<td>Ian Barnett</td>
<td>TR 11:00 AM</td>
<td>CB 114</td>
</tr>
<tr>
<td>007</td>
<td>Ian Barnett</td>
<td>TR 12:30 PM</td>
<td>CB 114</td>
</tr>
<tr>
<td>008</td>
<td>Devin Willmott</td>
<td>TR 2:00 PM</td>
<td>CB 110</td>
</tr>
<tr>
<td>009</td>
<td>Devin Willmott</td>
<td>TR 3:30 PM</td>
<td>CB 110</td>
</tr>
</tbody>
</table>
1. (5 points) Which of the following statements about absolute value are always true?

   I. $|a - b| = |b - a|$
   II. $|a| + |b| = |a + b|$
   III. $|a||b| = |ab|$

   A. Only I
   B. Only II
   C. Only III
   D. I and III
   E. I II and III

2. (5 points) A student performs the following operations on the equation $a = 1$.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 multiply by $a$</td>
<td>$a^2 = a$</td>
</tr>
<tr>
<td>Step 2 subtract 1</td>
<td>$a^2 - 1 = a - 1$</td>
</tr>
<tr>
<td>Step 3 factor</td>
<td>$(a + 1)(a - 1) = a - 1$</td>
</tr>
<tr>
<td>Step 4 divide by $a - 1$</td>
<td>$a + 1 = 1$</td>
</tr>
<tr>
<td>Step 5 subtract 1</td>
<td>$a = 0$</td>
</tr>
</tbody>
</table>

   We started out with $a = 1$ and ended up with $a = 0$. These equations are clearly not equivalent. Which step contains the operation that doesn’t produce an equivalent equation?

   A. Step 1
   B. Step 2
   C. Step 3
   D. Step 4
   E. Step 5
3. (5 points) Consider the graph

Which of the following is true?

A. $|p + 3| = 3$
B. $p^2 + q^2 = 5$
C. $p > 0$
D. $q = -p - 1$
E. None of the above

4. (5 points) How many solutions does the equation $\sqrt{2x} = \sqrt{3 - x^2}$ have?

A. 1
B. 3
C. 0
D. 2
E. 4

5. (5 points) How many solutions does the equation $2x^3 + 3x^2 - 2x - 3 = 0$ have?

A. 1
B. 0
C. 3
D. 2
E. Infinitely many
6. (5 points) Solve the following system of equations for $x$ and $y$.

\[
\begin{align*}
2x + y &= 7 \\
x + 2y &= 5
\end{align*}
\]

A. $x = 1$ and $y = 5$
B. $x = 1$ and $y = 2$
C. $x = 3$ and $y = 1$
D. $x = 2$ and $y = 3$
E. The system of equations is inconsistent.

7. (5 points) Find the number of solutions to the equation

\[(x + 1)^3 + 1 = (x + 1)^2 + 3x + 5.\]

A. 3
B. 1
C. 2
D. 5
E. 0

8. (5 points) Two cars leave a gas station at the same time. One travels east and the other travels west. The eastbound car travels at 70 miles per hour and after 3 hours the cars are 435 miles apart. How fast is the westbound car traveling?

A. 70 mph
B. 75 mph
C. 65 mph
D. 80 mph
E. The west bound car doesn’t move.
9. (5 points) Find the number of solutions to the equation

\[ x^2 - 2x + 4 = -x^2 + 2x + 2. \]

A. 4  
B. 2  
C. 1  
D. 3  
E. Infinitely many

10. (5 points) Find the equation of the line that passes through the points (2, 3) and (4, 7).
   A. \( y = 2x - 1 \)  
   B. \( (y-2) = \frac{1}{2}(x-3) \)  
   C. \( y = 2x \)  
   D. \( y = \frac{10}{6}x - 1 \)  
   E. No line passes through these two points.

11. (5 points) Solve the following inequality

\[ x^2 - 5x + 6 \leq 0 \]

A. \( (-\infty, 2] \cup [3, \infty) \)  
B. \( (-\infty, 2) \cup (3, \infty) \)  
C. \( (2, 3) \)  
D. \( [2, 3] \)  
E. This inequality has no solutions.

12. (5 points) What is the rate of change of \( f(x) = \sqrt{x + 2} \) from \( a \) to \( a + h \)?
   A. \( \frac{\sqrt{a+h+2} - \sqrt{a+2}}{h-a} \)  
   B. \( \frac{\sqrt{a+h+2} - \sqrt{a+2}}{h} \)  
   C. \( \frac{\sqrt{a+h+2} - \sqrt{a+2}}{a-h} \)  
   D. \( \frac{\sqrt{a+2} - \sqrt{h+2}}{h} \)  
   E. \( \frac{\sqrt{a+h+2} - \sqrt{a+2}}{a} \)
13. (5 points) What is the rate of change of \( f(x) = \frac{x}{x - 3} \) from \( x = 4 \) to \( x = 6 \)?
   A. 2
   B. 1
   C. -1
   D. 4
   E. -2

14. (5 points) Let \( h(x) = \frac{\sqrt{x^2 - 1}}{x - 1} \). What is \( h(\sqrt{2}) \)?
   A. 1
   B. 0
   C. \( \sqrt{2} \)
   D. \( \frac{1}{\sqrt{2} - 1} \)
   E. \( \frac{\sqrt{2} - 1}{\sqrt{2}} \)

15. (5 points) Let \( f(x) = \sqrt{x + 3} \) and \( g(x) = \frac{9 - x}{4} \). What is \( f(g(1)) \)?
   A. \( \sqrt{5} \)
   B. 0
   C. 2
   D. \( \frac{7}{4} \)
   E. 1

16. (5 points) Let \( f \) be a one-to-one function. Which of the following is NOT always true?
   A. The graph of the function passes the horizontal line test.
   B. The graph of the function passes the vertical line test.
   C. The function has an inverse.
   D. The function's domain is \((-\infty, \infty)\).
   E. Each input of the function has a unique output.
17. (5 points) Suppose you invest $3,000 into an account that earns interest at 9% compounded daily. Determine the value of the account after 40 years. (Round your answer to the nearest cent).

A. $109,745.99
B. $94,228.26
C. $13,800
D. $3,270
E. None of the above

18. (5 points) Determine the equivalent logarithmic statement of the exponential statement

\[ w^x = z. \]

A. \( \log_w(z) = x \)
B. \( \log_w(x) = z \)
C. \( \log_z(x) = w \)
D. \( \log_z(w) = z \)
E. None of the above

19. (5 points) Find the domain of \( f(x) = \log(8 - x) \).

A. \(( -\infty, 8] \)
B. \(( -\infty, 8) \)
C. \((8, \infty) \)
D. \([8, \infty) \)
E. None of the above

20. (5 points) Solve the equation

\[ e^{2x} = 8. \]

A. \( x = 4 \)
B. \( x = \frac{\ln(8)}{2} \)
C. \( x = \frac{\ln(2)}{8} \)
D. \( x = 2 \ln(8) \)
E. None of the above
21. (5 points) Determine the end behavior for the graph of the function

\[ f(x) = -3x^{37} + 2x^{36} - 1. \]

A. \( y \to \infty \) as \( x \to \infty \) and \( y \to -\infty \) as \( x \to -\infty \)
B. \( y \to \infty \) as \( x \to \infty \) and \( y \to \infty \) as \( x \to -\infty \)
C. \( y \to -\infty \) as \( x \to \infty \) and \( y \to -\infty \) as \( x \to -\infty \)
D. \( y \to -\infty \) as \( x \to \infty \) and \( y \to \infty \) as \( x \to -\infty \)
E. None of the above

22. (5 points) Suppose that \( P(x) \) is a polynomial and \( P(2) = 0 \). Which of the following must be true:

(I) The graph of \( P(x) \) has an \( x \)-intercept at \( (2, 0) \).
(II) \( x + 2 \) is a factor of \( P(x) \).
(III) The remainder when dividing \( P(x) \) by \( (x - 2) \) is zero.

A. I, II
B. I, III
C. I only
D. III only
E. I, II, and III
**Formula Sheet**

**Compound Interest**: If a principal $P_0$ is invested at an interest rate $r$ for a period of $t$ years, then the amount $P(t)$ of the investment is given by:

\[ P(t) = P_0 \left(1 + \frac{r}{n}\right)^{nt} \quad \text{(if compounded $n$ times per year)} \]

\[ P(t) = P_0 e^{rt} \quad \text{(if compounded continuously)} \]

**Change of Base Formula**: Let $a$ and $b$ be two positive numbers with $a, b \neq 1$. If $x > 0$, then:

\[ \log_a(x) = \frac{\log_b(x)}{\log_b(a)} \]