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:

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

Name (Print):_____

Section Number:_____

Section	Instructor	Class Start Time	Exam Location
001	Drew Butcher	MWF 8:00 AM	CP 139
002	Drew Butcher	MWF 10:00 AM	CB 106
003	Drew Butcher	MWF 1:00 PM	CB 118
004	Robert Wolf	MWF 9:00 AM	CB 122
005	Robert Wolf	MWF 11:00 AM	CB 122
006	Ian Barnett	TR 11:00 AM	CB 114
007	Ian Barnett	TR 12:30 PM	CB 114
008	Devin Willmott	TR 2:00 PM	CB 110
009	Devin Willmott	TR 3:30 PM	CB 110

UK: "Go CATS" Name:_____ Section:_____

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. $|a||b| = |ab|$

Try $a = 1, b = -1$

$|a|+|b| = |1|+|-1| = 2$ Not =

$|a+b| = |1+-1| = |0| = 0$

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 $a = 1$.

	Operation	Result
Step 1	multiply by a	$a^2 = a$
Step 2	subtract 1	$a^2 - 1 = a - 1$
Step 3	factor	$(a+1)(a-1) = a-1$
Step 4	divide by $a-1$ and cancel	$a+1 = 1$
Step 5	subtract 1	$a = 0$

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**?

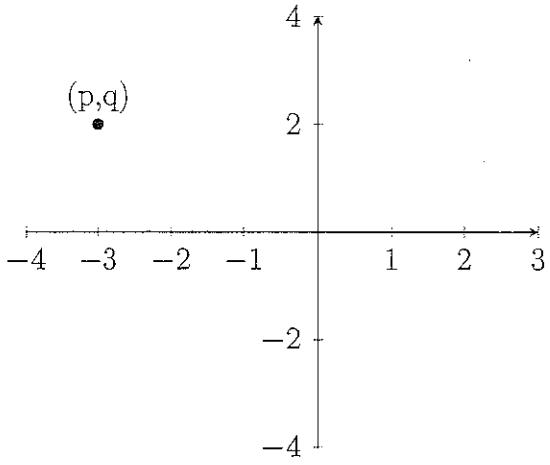
A. Step 1
B. Step 2
C. Step 3
D. Step 4
E. Step 5

$a - 1 = 1 - 1 = 0$

Divide by zero!

3. (5 points) Consider the graph

$p = -3$
$q = 2$



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

$|p+3| = |-3+3| = 0 \neq 3$

$p^2 + q^2 = (-3)^2 + 2^2 = 9 + 4 = 13 \neq 5$

$p = -3 < 0$

$q = 2$ $\quad -p+1 = -(-3) - 1 = 3 - 1 = 2$

So $q = -p - 1$

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

A. 1 Real-valued
B. 3
C. 0
D. 2
E. 4

$2x = 3 - x^2$

$x^2 + 2x - 3 = 0$

$(x+3)(x-1) = 0$

$x = 1, x = -3$

$\sqrt{2\cdot 1} \stackrel{?}{=} \sqrt{3 - 1^2}$

$\sqrt{2} = \sqrt{2}$ ✓

$\sqrt{2(-3)} \stackrel{?}{=} \sqrt{3 - (-3)^2}$

$\sqrt{-6} = \sqrt{-6}$ Not real

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

Possible Rational Roots are

$\pm 1, \pm \frac{1}{2}, \pm 3, \pm \frac{3}{2}$

① if $x = 1$: $2x^3 + 3x^2 - 2x - 3$

$= 2 + 3 - 2 - 3 = 0$

② if $x = -1$: $2x^3 + 3x^2 - 2x - 3$

$= -2 + 3 + 2 - 3 = 0$

③ if $x = 3/2$: $2(3/2)^3 + 3(3/2)^2 - 2(3/2) - 3 = 0$

6. (5 points) Solve the following system of equations for x and y.

$2x + y = 7$ $\rightsquigarrow y = 7 - 2x$

$x + 2y = 5$

$x + 2(7 - 2x) = 5$

$x + 14 - 4x = 5$

$-3x = -9$

$x = 3$

$2 \cdot 3 + y = 7$

$y = 7 - 6$

$y = 1$

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?

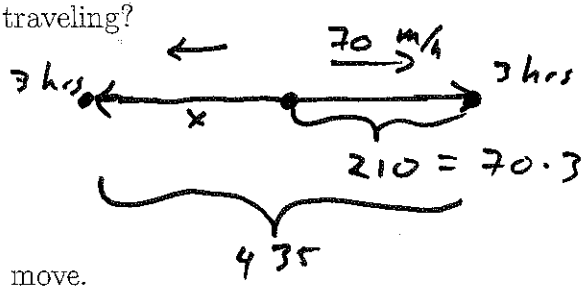
A. 70 mph

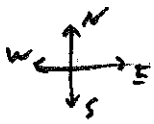
B. 75 mph

C. 65 mph

D. 80 mph

E. The west bound car doesn't move.





$x = 435 - 210$

$x = 225$ miles travelled in 3 hrs

Westbound car spd $= \frac{225}{3} = 75$ m/h

9. (5 points) Find the number of solutions to the equation

$$x^2 - 2x + 4 = -x^2 + 2x + 2.$$

$2x^2 - 4x + 2 = 0$

$2(x-1)^2 = 0$

$x = 1$

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.

$m = \frac{7-3}{4-2} = \frac{4}{2} = 2$

Pt.-slope form: $y - 7 = 2(x-2)$

$y = 2x - 4 + 3$

$y = 2x - 1$

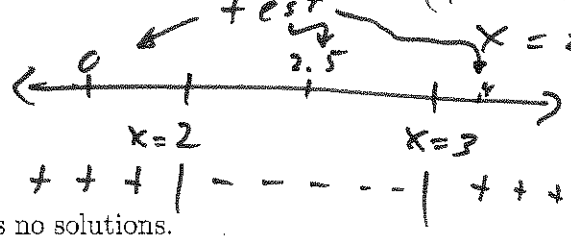
11. (5 points) Solve the following inequality

$$x^2 - 5x + 6 \leq 0$$

$x^2 - 5x + 6 = 0$

$(x-2)(x-3) = 0$

$x = 2, \; x = 3$



Critical vals

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. $\frac{\sqrt{a+h+2} - \sqrt{a+2}}{a}$

$= \frac{f(a+h) - f(a)}{a+h-a}$

13. (5 points) What is the Average rate of change of $f(x) = \dfrac{x}{x-3}$ from $x = 4$ to $x = 6$?

A. 2
B. 1
C. -1
D. 4
E. -2

$$\frac{\frac{6}{6-3} - \frac{4}{4-3}}{6-3} = \frac{\frac{6}{3} - 4}{3} = \frac{2-4}{3}$$

$$= -2$$

14. (5 points) Let $h(x) = \dfrac{\sqrt{x^2-1}}{x-1}$. What is $h(\sqrt{2})$?

A. 1
B. 0
C. $\sqrt{2}$
D. $\dfrac{1}{\sqrt{2}-1}$
E. $\dfrac{\sqrt{2}-1}{\sqrt{2}}$

$$\frac{\sqrt{(\sqrt{2})^2 - 1}}{\sqrt{2}-1} = \frac{\sqrt{2-1}}{\sqrt{2}-1} = \frac{\sqrt{1}}{\sqrt{2}-1}$$

$$= \frac{1}{\sqrt{2}-1}$$

15. (5 points) Let $f(x) = \sqrt{x+3}$ and $g(x) = \dfrac{9-x}{4}$. What is $f(g(1))$?

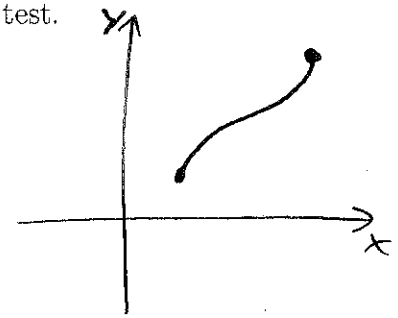
A. $\sqrt{5}$
B. 0
C. 2
D. $\dfrac{7}{4}$
E. 1

$$g(1) = \frac{9-1}{4} = \frac{8}{4} = 2$$

$$f(g(1)) = f(2) = \sqrt{2+3} = \sqrt{5}$$

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 ≈ $P(40) = 3{,}000\left(1 + \frac{.09}{365}\right)^{365 \cdot 40}$

B. \$94,228.26

C. \$13,800

D. \$3,270

E. None of the above

$P(t) = P_0 \cdot \left(1 + \frac{r}{n}\right)^{nt}$

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

$$w^x = z.$$

A. $\log_w(z) = x$ ← $\log_w z = x$

B. $\log_w(x) = z$

C. $\log_z(x) = w$

D. $\log_x(w) = z$

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

Need $8 - x > 0$

$8 > x$

$(-\infty, 8)$

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

$\ln e^{2x} = \ln 8$

$2x = \ln 8$

$x = \frac{\ln 8}{2}$

21. (5 points) Determine the end behavior for the graph of the function

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

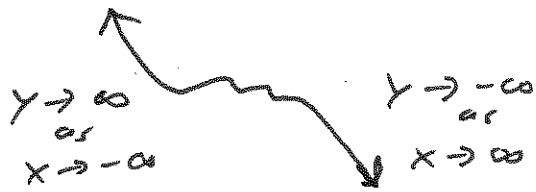
$a = -3 < 0$ & $n = 37$ which is odd

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 $P(x)$. $x - 2$ is a factor, not $x + 2$

(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:

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

$$P(t) = P_0 e^{rt} \qquad \text{(if compounded continuously)}.$$

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

$$\log_a(x) = \frac{\log_b(x)}{\log_b(a)}$$