
INSTRUCTIONS: **Simplify** and **box** all your answers. Write neatly and **justify all answers**. A correct answer with incorrect work or no justification may receive no credit. Books, notes, electronic devices, other unauthorized devices, and help from another person are not permitted while taking the exam. The exam is worth 100 points.

Potentially useful formulas:

$$(i) \ a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

$$(ii) \ a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

NOTE: YOU MAY TEAR OFF THIS FIRST PAGE AND USE (FRONT AND BACK) AS SCRATCH PAPER.

- i. DO NOT START UNTIL INSTRUCTED BY A PROCTOR.
- ii. THE EXAM IS ON BOTH SIDES OF EACH FOLLOWING EXAM PAGE
- iii. WRITE YOUR NAME ON THE NEXT PAGE.
- iv. WHEN YOU FINISH (IF BEFORE THE EXAM END TIME) PLEASE QUIETLY COLLECT YOUR THINGS AND FOLLOW PROCTOR INSTRUCTIONS IN UPLOADING YOUR EXAM WITH SUPPORTING WORK TO GRADESCOPE. ONLY WORK THAT'S SUBMITTED TO GRADESCOPE WILL BE GRADED.

Name: _____

1. The following are unrelated: (18 pts)

(a) Rewrite each of the following without the absolute value symbol:

i. $|\pi - 3|$

ii. $|x - 2|$ where $x < 2$

(b) Divide/Add as indicated: $-\frac{\frac{6}{5}}{\frac{8}{3}} + 10^{-1}$

(c) Let x , y , and z be real numbers such that $x > 3$, $y < 0$, and $1 \leq z \leq 3$. Answer the following:

i. Is x^7y^{24} positive, negative, or cannot be determined? No work is needed to justify your answer.

ii. Is $z - 2 + y$ positive, negative, or cannot be determined? No work is needed to justify your answer.

iii. Is $-z^4y^3$ positive, negative, or cannot be determined? No work is needed to justify your answer.

(d) Perform the multiplication and subtraction and simplify: $(x - 2)^2 - 3(x^2 + 4)$.

2. The following are unrelated: (24 pts)

(a) Simplify the expression: $\sqrt{45}$

(b) Simplify the expression: $\sqrt{2\sqrt{16}}$

(c) Rewrite with positive exponents and simplify: $(x^2 + 1)^{-1} (x^2 + 1)^{-4}$

(d) Simplify (Give your answer without negative exponents): $(-3b^5) (2c^5b^2a^{-3})^2$

(e) Multiply: $(\sqrt{x-4} - 2)^2$

(f) Multiply: $x^8 \left(x^{1/2} - \frac{3}{x^4} \right)$

3. The following are unrelated: (18 pts)

(a) Evaluate $18(-x)^3$ for $x = -\frac{1}{3}$

(b) Factor completely (If not factorable write NF): $8x^3 + 1$

(c) Multiply: $\frac{x^2 - 16}{x^2 - 5x + 6} \cdot \frac{x^3 - 2x^2}{3x - 12}$

(d) Simplify the compound fraction: $\frac{\frac{5}{x^2} - \frac{1}{x}}{1 - \frac{25}{x^2}}$

4. Solve the following equation over the complex numbers: $z^2 - 4z + 5 = 0$. (4 pts)

5. Solve each of the following equations: (12 pts)

(a) $\frac{1}{3}x - \frac{5}{6} = \frac{1}{2}x - 1$

(b) $x^3 - 18x = 17x^2$

(c) $\sqrt{3x + 3} - 2 = x - 1$

6. Solve each of the following equations: (12 pts)

(a) Solve for m : $T = mg + ma$

(b) $-\frac{1}{x^2 - x} - \frac{2}{x^2 - 1} = \frac{2}{x^2 + x}$

(c) $|x + 2| = 5$

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7. Solve the following inequalities. Justify your answers by using a number line or sign chart if needed. Answers without full justification will not receive full credit. Express all answers in interval notation. (8 pts)

(a) $2x^2 - 4x < 6$

(b) $\frac{-2}{x-3} \geq 0$

8. Suppose you know that a is a real number and that $\left(a - \frac{1}{2}i\right)\left(a + \frac{1}{2}i\right) = 3$. Find all possible value(s) of a that make this true. (4 pts)