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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.

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Potentially useful formulas:

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

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

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**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. JUST BEFORE YOU UPLOAD TO GRADESCOPE WRITE DOWN YOUR UPLOAD TIME ON THE NEXT PAGE.
- iv. WHEN YOU FINISH (IF BEFORE THE EXAM END TIME) PLEASE QUIETLY COLLECT YOUR THINGS AND MOVE TO THE SUBMISSION AREA TO UPLOAD YOUR ANSWERS WITH SUPPORTING WORK TO GRADESCOPE. ONLY WORK THAT'S SUBMITTED TO GRADESCOPE WILL BE GRADED.



Name: \_\_\_\_\_

Upload time: \_\_\_\_\_

1. The following are unrelated: (20 pts)

(a) Use the distributive property to rewrite the expression (you do not need to carry out any mathematical operations):

$$3(x+4)^5(x+1)^3 - (x-2)^4(4)(x+1)^3$$

(b) Add/Subtract as indicated:  $-\frac{5}{12} - \frac{1}{4} + \frac{5}{6^1} + 3\sqrt{2} + \sqrt{2}$

(c) Let  $a$  and  $b$  be real numbers such that  $a < 0$  and  $b > 0$ . Answer the following:

i. Is  $-a + b$  positive or negative? No work is needed to justify your answer.

ii. Is  $a^{18}$  positive or negative? No work is needed to justify your answer.

(d) Multiply as indicated (give answer in  $a + bi$  form):  $\left(\frac{1}{2}i\right)\left(-2 + \frac{1}{2}i\right)$

(e) Simplify:  $2 + (3 - x)(2x + 1) + x^2$ .

2. The following are unrelated: (24 pts)

(a) Evaluate the expression:  $\sqrt{24}$

(b) Evaluate the expression:  $\frac{\sqrt[3]{32}}{\sqrt[3]{4}}$

(c) Rewrite with only rational exponents (you do not need to carry out any mathematical operations, your answer should not have any roots):

$$\sqrt[4]{3} + \sqrt{x^2 - 9}$$

(d) Simplify (Give your answer without negative exponents):  $(6w^{-2}z^3)^2 (2z^3)$

(e) Simplify (Give your answer without negative exponents):  $4x^{1/2} (x^{1/2} - x^{-1/4})$

(f) Multiply:  $\left(4x^4 + \frac{1}{x^4}\right)^2$

3. The following are unrelated: (20 pts)

(a) Factor completely (If not factorable write NF):  $2x^2 - 12x + 16$

(b) Evaluate  $x^2 + 16 - \sqrt{2x}$  for  $x = 2$

(c) Factor completely (Hint, factor out the lowest power of  $x$ ):  $x^{5/2} - x^{1/2}$

(d) Simplify the complex fraction:  $\frac{-2 + \frac{4}{x+1}}{1 - \frac{1}{x}}$

(e) Subtract:  $\frac{1}{4x+8} - \frac{x+3}{x^2-4}$

4. Suppose you know that  $b$  is a constant and that the equation  $x^2 + bx + 2 = 0$  has a solution of  $x = 4$ . Find  $b$ . (4 pts)

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

(a)  $2 - \frac{3}{4}x = \frac{1}{2}x$

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

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

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

(a) Solve for  $x$ :  $T^2 = 2a(x - z)$

(b)  $\frac{1}{x^2 + 1} = \frac{4x + 1}{(x^2 + 1)^2}$

(c)  $|x - 3| = 7$

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

(a)  $1 - 4x < 3$

(b)  $x^3 + 2x^2 \geq 0$