

INSTRUCTIONS: Books, notes, and electronic devices are not permitted. Write **your full name** on every piece of paper that will be uploaded to gradescope. Do all problems. **Start each problem on a new page.** **Box** your answers. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit. **Justify your answers, show all work.**

1. (10pts) The following problems are not related. Short Answer. Do not justify.

(a) $|\sqrt{3} - \frac{3}{2}| =$

(b) Simplify: $\frac{a^6 (3a)^{-2}}{a^{-3} 6}$

(c) $\tan\left(\frac{5\pi}{3}\right) =$

(d) Is $f(x) = x^3 + 1$ odd, even, or neither?

(e) In the expanded form of $(x + 3y)^6$ what is the coefficient (number in front) of the x^4y^2 term?

2. (40pts) The following problems are not related. Show all work.

(a) For what values of c will $f(x) = 3x^2 - 10x + c$ have no real roots (complex roots)?

(b) Simplify

$$\frac{x^{-1} - 3^{-1}}{x^{-2} - 9^{-1}}$$

(c) Let $f(x) = x^3 + 6x^2 - x - 30$

- Verify $f(2) = 0$
- Factor $f(x)$

(d) Rationalize and Simplify:

$$\frac{\sqrt{t+2} - \sqrt{5}}{t^2 - 9}$$

3. (35pts) The following problems are not related. Show all work.

(a) Use $\sin(x+y) = \cos(x)\sin(y) + \cos(y)\sin(x)$ and $\frac{\pi}{4} + \frac{\pi}{3} = \frac{7\pi}{12}$, to find $\sin\left(\frac{7\pi}{12}\right)$.

(b) Given $\csc(x) = \frac{13}{5}$ find the remaining five trigonometric functions of x .

(c) Solve for x .

$$\left| \cos(x) + \frac{\sqrt{3}}{4} \right| = \frac{\sqrt{3}}{4}$$

(d) Simplify:

$$\frac{(\sin^4(x) + \cos^2(x)\sin^2(x))\cot^2(x)}{\sec^{-2}(x)}$$

4. (15pts) The following problems are not related. Show all work. Simplify your answers.

(a) Is $f(x) = x^2 \sin(x^3)$ odd, even, or neither. Justify!

(b) Let

$$f(x) = \begin{cases} 1 & \text{if } 0 \leq x < 1 \\ -1 & \text{if } 1 \leq x < 2 \\ x & \text{if } 2 \leq x < 3 \\ -x + 4 & \text{if } 3 \leq x \end{cases}$$

- Find $f(\sqrt{2})$, $f(\pi)$, $f(a^2 + 3)$ where a is a real number.
- Graph $f(x)$. Remember to be detailed (label axes etc.)