INSTRUCTIONS: Books, notes, and electronic devices are <u>**not**</u> permitted. Write (1) **your full name**, (2) **1340/Exam 3**, (3) **lecture number/instructor name** and (4) **FALL 2021** on the front of your bluebook. 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.**

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1. (24pts) The following problems are not related. Show all work.

   (a)(12pts) Use the *Quotient Rule* to find $f'(x)$ if $f(x) = \dfrac{x^2 - 2}{2x + 1}$. Simplify your answer.

   (b)(12pts) If $y = \sin\big(\cot(x)\big)$ find dy/dx. Simplify your answer.

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2. (28pts) Start this problem on a **new** page. The following problems are not related.

   (a)(12pts) Suppose y is a function of x, use *implicit differentiation* to find y' if $y\cos(x) = x^2 + y^2$.

   (b)(12pts) Find the equation of the *tangent line* to $y = \sqrt{x}$ at the point $(1, 1)$. Simplify your answer.

   (c)(4pts) Which of the choices below is equivalent to the limit $\displaystyle\lim_{x \to 1} \dfrac{x^4 + x - 2}{x - 1}$? **Choose only <u>one</u> answer.** *No justification necessary, copy down the entire answer. If you do not copy down the entire answer, points will be deducted.*

        (A) $4x^3 - 1$ (B) 5 (C) $\dfrac{0}{0}$ (D) 3 (E) None of these

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PROBLEMS #3 & #4 ON THE OTHER SIDE

3. (20pts) Start this problem on a **new** page. The following problems are not related.

(a)(10pts) For what value(s) of $x \in \mathbb{R}$ does the function $f(x) = 2x^3 + 3x^2 - 12x + 1$ have a *horizontal tangent*?

(b)(10pts) The position function of a particle is given by $s(t) = t^3 - 4.5t^2 - 7t$ where $t \geq 0$ is in seconds and distance is in feet. (i)(5pts) Find the velocity of the particle as a function of t. (ii)(5pts) When is the acceleration equal to 0?

4. (28pts) Start this problem on a **new** page. The following problems are not related.

(a)(12pts) If $y = \sec(x)$, find y''. Show all work.

(b)(12pts) For what values of a and b will the function $f(x) = \begin{cases} x^2 - 3x, & \text{if } x < 2 \\ ax^2 + b, & \text{if } x \geq 2 \end{cases}$ be differentiable at $x = 2$? Explain.

(c)(4pts) If $h(x) = \sqrt{4 + 3f(x)}$ where $f(1) = 7$ and $f'(1) = 4$, then $h'(1)$ is equal to which choice below? **Choose only one answer.** *No justification necessary, copy down the entire answer. If you do not copy down the entire answer, points will be deducted.*

    (A) 5   (B) $\dfrac{25}{2}$ (C) 10   (D) $\dfrac{6}{5}$ (E) None of these

— **END** —