INSTRUCTIONS: Books, notes, and electronic devices are **not** permitted. Write (1) **your full name**, (2) **1350/Exam 2**, (3) **lecture number/instructor name** and (4) **SPRING 2018** on the front of your bluebook. Make a **grading table** for 4 problems and a total. 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. The following problems are not related.

   (a)(12pts) Find the linearization $L(x)$ of the function $f(x) = \sqrt{1-x}$ at $a = 0$ and use it to approximate $\sqrt{0.9}$.

   (b)(12pts) Find dy/dx by implicit differentiation given that $y\cos(x) = x^2 + y^2$. Simplify your answer.

   (c)(4pts) Which choice below is the correct derivative of $g(x) = \sin^2\left(\frac{x}{\pi}\right)$? (**No justification necessary** - *Choose only one answer, copy down the entire answer.*)

   (A) $g'(x) = \frac{2}{\pi}\sin\left(\frac{x}{\pi}\right)$ (B) $g'(x) = \frac{2}{\pi}\cos\left(\frac{x}{\pi}\right)$ (C) $g'(x) = \frac{2}{\pi}\sin\left(\frac{x}{\pi}\right)\cos\left(\frac{x}{\pi}\right)$ (D) $g'(x) = 2\sin\left(\frac{x}{\pi}\right)\cos\left(\frac{x}{\pi}\right)\left(\frac{\pi - x}{\pi^2}\right)$

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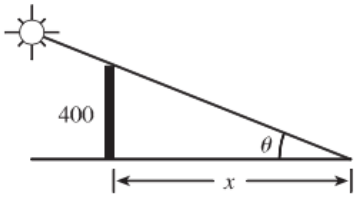
2. The following problems are not related. Justify your answers, show all work.

   (a)(12pts) In the diagram below, the angle of elevation of the sun, θ, is decreasing at a rate of 0.25 rad/h. How fast is the shadow cast by a 400-ft-tall building changing when the angle of elevation of the sun is $\pi/6$? Include units in your answer.



Problem 2: The variable x above represents the length of the building's shadow.

   (b)(12pts) (*i*)(6pts) State the Mean Value Theorem. (*ii*)(6pts) Find all numbers c that satisfy the conclusion of the Mean Value Theorem for the function $f(x) = 1/x$ over the interval $[1, 3]$.

PROBLEMS #3 & #4 ON THE OTHER SIDE

3. The following problems are not related.

(a)(12pts) Suppose x represents the edge length of a metal cube. (i)(6pts) If $V(x) = x^3$ find dV, the differential of V. (ii)(6pts) Suppose the edge of the cube was originally found to be 10 cm in length but expands due to heat to 10.01 cm, use differentials to estimate the change in the volume, ΔV.

(b)(12pts) Find the absolute minimum and maximum values of $f(x) = x^3 + 6x^2 + 1$ on the interval $[-1, 1]$. Give your answer in the form (x, y). Show all work, justify your answers and clearly label your answers.

(c)(4pts) Which choice below is the correct derivative of $f(x) = \dfrac{3x+2}{2x+3}$? (**No justification necessary** - *Choose only one answer, copy down the entire answer.*)

(A) $f'(x) = -\dfrac{1}{(2x+3)^2}$ (B) $f'(x) = \dfrac{3}{2}$ (C) $f'(x) = \dfrac{13}{(2x+3)^2}$ (D) $f'(x) = -\dfrac{5}{(2x+3)^2}$ (E) $f'(x) = \dfrac{5}{(2x+3)^2}$

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4. The following problems are not related. Justify your answers, show all work.

(a)(12pts) Given $g(x) = x^{1/3}(x+4)$, $g'(x) = \dfrac{4}{3}x^{-2/3}(x+1)$ and $g''(x) = \dfrac{4}{9}x^{-5/3}(x-2)$. (i)(6pts) Give local maximum and minimum values of $g(x)$ as an ordered pair (x, y) and justify your answer with either the 1st or 2nd Derivative Test. Clearly label your answers. (ii)(6pts) Give any inflection points of $g(x)$ as an ordered pair (x, y) and justify your answer.

(b)(8pts) In your blue book clearly sketch the graph of a function $f(x)$ that satisfies all the following properties (label all extrema, inflection points and asymptotes if any):

- $f(x)$ has a vertical asymptote at $x = 0$ and $f(-2) = -1$
- $f'(x) > 0$ if $x < -2$ and $f'(x) < 0$ if $x > -2$ (but $x \neq 0$)
- $f''(x) < 0$ if $x < 0$ and $f''(x) > 0$ if $x > 0$

The list of Appm 1350 Lecture Numbers/Instructor Names for the front of your blue book:

Lecture #	Instructor	Class Time	Class Location
120	Susan Hallowell	MWF 9-9:50	ECCR 135
130	Sujeet Bhat	MWF 10-10:50	ECCR 200
150	Sujeet Bhat	MWF 12-12:50	FLMG 154
170	Susan Hallowell	MWF 2-2:50	FLMG 104
801	Sandra Williams	MWF 2-2:50	ECCR 131

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