Math 220 Midterm 2

Name: _____

Recitation instructor: _____

Recitation time: _____

- This is a closed-book, closed-notes exam. No calculators or electronic aids are permitted.

- Read each question carefully and show your work unless explicitly told otherwise.

Grading

1	/30	2	/10
3	/10	4	/15
5	/10	6	/15
7	/10	**Total**	/100

Problem 1. (*30 points*)
(6 points each) Find the following derivatives. You **do not need to simplify** your answers or show all steps. However, showing your work may help you earn partial credit if your answer is incorrect.

A. $\dfrac{d}{dx}\left(5e^x - \log_5(x) + \arctan(x)\right)$

B. $\dfrac{d}{dx}\left(20^x \cdot \cos(x^{20})\right)$

C. $\dfrac{d}{dx}\arccos(\sqrt{x})$

D. $\dfrac{d}{d\theta}\csc\left(\sin(\theta^2)\right)$

E. $\dfrac{d}{dx}\left(\dfrac{e^{2x}+\ln(2x+1)}{x^6-7x}\right)$

Problem 2. (*10 points*) Find the derivative of $h(x) = 7^{x+5} \cdot x^{7\tan(x)}$.

Problem 3. (*10 points*) Find $\dfrac{dy}{dx}$ if $\cos(x^2 y^3) = e^x$.

Problem 4. (*15 points*) Let $f(x) = \dfrac{\sin(x)}{x - \pi + 1}$.

A. (*10 points*) Find the linearization for $f(x)$ at $x = \pi$.

B. (*5 points*) Use the linearization to approximate $f(\pi + 0.02)$.

Problem 5. (*10 points*) On an alien planet, Alice throws a softball vertically upward. For $t \geq 0$, it has height in feet given by $s(t) = 10 + 6t - t^2$, where t is in seconds.

A. (*6 points*) Calculate $s'(t)$. When is the softball going upward/downward?

B. (*2 points*) At what time does the softball obtain its maximum height?

C. (*2 points*) What is the acceleration $s''(t)$?

Problem 6. (*15 points*) Two airplanes are flying in the air at the same height: airplane A is flying east at 100 mi/h and airplane B is flying north at 200 mi/h. If they are both heading to the same airport, located 30 miles east of airplane A and 40 miles north of airplane B, at what rate is the distance between the airplanes changing?

Problem 7. (*10 points*) Let $f(x) = x^4 - 2x^2$.

(a) (*5 points*) Find all critical numbers of $f(x)$ on the interval $(-\infty, \infty)$.

(b) (*5 points*) Find the absolute maximum and absolute minimum of $f(x)$ on $[-2, 2]$.