NAME: ———————————————————— **Panther ID:** ——————————

Exam 2 - MAC 2281 Spring 2019

Important Rules:

1. Unless otherwise mentioned, to receive full credit you MUST SHOW ALL YOUR WORK. Answers which are not supported by work might receive no credit.

2. Please turn your cell phone off at the beginning of the exam and place it in your bag, NOT in your pocket.

3. No electronic devices (cell phones, calculators of any kind, etc.) should be used at any time during the examination. Notes, texts or formula sheets should NOT be used either. Concentrate on your own exam. Do not look at your neighbor's paper or try to communicate with your neighbor.

4. Solutions should be concise and clearly written. Incomprehensible work is worthless.

1. (40 pts) In each case, find the indicated derivative. Simplify your answer when possible (8 pts each).

(a) If $y = 3\arctan x - \dfrac{2}{\tan x}$, find dy/dx .

(b) If $y = \sqrt{1 + \cos(t^2)}$, find dy/dt .

(c) If $y = e^{\sin t}$, find d^2y/dt^2 .

(d) If $y = \sec^2(3x+1)$, find dy/dx .

(e) If $y = (\ln x)^x$, find dy/dx . Hint: Apply logarithmic differentiation.

2. (10 pts) The position of a particle moving along a coordinate line is $s = \sqrt{1 + 4t}$, with s in meters and t in seconds. Find the particle's velocity and acceleration at $t = 6$ seconds. Write the units for your answers.

3. (20 points) These are True or False questions. Circle your answer AND give a brief justification.

(a) If $h(x) = \tan(g(x))$, then $h'(x) = \sec^2(g(x)) + \tan(g'(x))$.   **True   False**

Justification:

(b) If $y = \sin(5x)$ then $y'' + 25y = 0$.   **True   False**

Justification:

(c) $\arcsin(\pi/2) = 1$ **True   False**

Justification:

(d) The function $f(x) = x^3 + 9x - 5$ is one-to-one over its domain $(-\infty, \infty)$.   **True   False**

Justification:

(e) If $g(x) = f(x^3)$, then $g'(1) = 3f'(1)$.   **True   False**

Justification:

4. (10 pts) Use implicit differentiation to find the slope of the tangent line to the curve
$x^2 + y^2 - xy = 7$ at $(x, y) = (-1, 2)$.

5. (10 pts) (a) (6 pts) Find the local linear approximation of $f(x) = \sqrt[3]{x}$ at $x_0 = 8$.

(b) (4 pts) Use part (a) to estimate $\sqrt[3]{7.97}$.

6. (10 pts) The voltage V (volts), current I (amperes), and resistance R (ohms) of an electric circuit are related by $V = IR$. Suppose that V, I, R all depend on time. At a certain moment, the voltage V is 12 volts and is increasing at the rate 0.5 volts/second, while the current I is 3 amps and decreasing at a rate of 0.2 amps/second. Find the rate at which R is changing at that moment. Is R increasing or decreasing?

7. (10 pts) Choose ONE:

(a) Use logarithmic differentiation to prove the general power rule for derivatives.

(b) Find, with proof, the formula for $(\arcsin x)'$.