

Name: _____

Panther ID: _____

Exam 2 - MAC2311 -

Fall 2015

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. (18 points) State whether each of the following is true or false **and give a brief explanation of your answer**.

a) (3 points) If $p(x)$ is a degree n polynomial, then $p'(x)$ is a degree $n - 1$ polynomial.

b) (3 points) If $f'(2) = 5$, then

$$\frac{d}{dx} [4f(x) + x^3] \Big|_{x=2} = \frac{d}{dx} [4f(x) + 8] \Big|_{x=2} = 4f'(2) = 20.$$

c) (3 points) If $y = \sin(x)$, then $y'' = -y$.

d) (3 points) If $h(x) = \cos(g(x))$, then

$$h'(x) = -\sin(g(x)) + \cos(g'(x)).$$

e) (3 points) If $h(x) = \ln(g(x))$, then $h'(x) = g'(x)/g(x)$.

f) (3 points) The slope of the line tangent to $y = \ln(x)$ at $(a, \ln(a))$ approaches $+\infty$ as a approaches 0 from the right.

2. (35 pts) Compute $\frac{dy}{dx}$ for each of the following functions. You **do not** have to simplify your answer, but see the bonus point offer for part (d).

a) (7 points) $y = 3x^5 - 2\sqrt{x} + 10^x$

b) (7 points) $y = \frac{\arcsin x}{x^2+4}$

c) (7 points) $y = e^{\cos x} \tan x$

d) (7 points) $y = \ln(\sec(\arctan x))$ **+1 bonus point** if you correctly simplify your answer for this one.

e) (7 points) $y = (1 + x^2)^{1/x}$ **Hint:** Logarithmic differentiation

3. (12 points) A rocket is ascending vertically from a launch pad on the ground. A radar station on the ground is 30 kilometers from the launch pad. The radar station and the launch pad are not moving. At a certain moment the rocket is at a distance of 50 km from the radar station and that distance is increasing at a rate of 60 km/minute. At what rate is the height of the rocket above the launch pad increasing at that moment?

4. (12 points) a) (8 points) Find the local linear approximation of the function $f(x) = x^{1/4}$ at $x_0 = 1$.

b) (4 points) Use the result of part (a) to approximate $(0.92)^{1/4}$.

5. (12 points) Find the equation of the line tangent to the curve

$$2(x^2 + y^2)^2 = 25(x^2 - y^2)$$

at the point $(3, 1)$.

6. Do ONE of the following problems. Only one will be graded.

a) (12 points) Using the limit definition of the derivative and the angle addition formula

$$\cos(A + B) = \cos(A)\cos(B) - \sin(A)\sin(B),$$

prove the formula for $(\cos x)'$.

b) (12 points) Find, with proof, the formula for $(\arccos x)'$.

7. (BONUS 8 points) If $h(x) = f(g(x))$, find a formula for the second derivative $h''(x)$ in terms of the derivatives of f and g .