

## Midterm Exam II

Fall 2013, MAT 175 Section C401[19514]

November 7th, 2013. 11:00AM–12:40PM.

**Instructions:** Print your name on the exam booklet. This exam is closed-book and closed-note. You cannot use any electronic device in this exam. You are not allowed to talk to other students. Write all details explicitly. Answers without justifications and/or calculation steps may receive no score. Hand-in blue booklet only, and keep the exam paper for your study.

- 1.(Sample Final I-1) Compute the derivative  $\frac{dy}{dx}$  for  $y = \sqrt{7} + \frac{1}{x^3} + 2\sqrt{x}$ .(5 Points)
- 2.(Sample Final I-1) Compute the derivative  $\frac{dy}{dx}$  for  $y = e^2 + \frac{1}{e} + 3e^x + 2 \ln x$ .(5 Points)
- 3.(Sample Final I-2) Compute the derivative  $f'(t)$  of the function  $f(t) = \frac{x^2}{t^2} + \frac{t^2}{x^2} + tx$ .(5 Points)  
*Hint: What is the variable? What are constants?*
- 4.(Sample Final I-2) Compute the derivative  $p'(c)$  of the function  $p(c) = \pi c \cos(\pi x) + \frac{x}{c} + c + ce^x$ .  
(5 Points) *Hint: What is the variable? What are constants?*
- 5.(Sample Final I-3) Write down an equation of the tangent line to the graph of  $y = e^{2x} + 2x$  at the point where  $x = 0$ .(5 Points)
- 6.(Sample Final I-3) Write down an equation of the tangent line to the graph of  $y = x + \cos x$  at the point where  $x = 0$ .(5 Points)
- 7.(Sample Final I-4) Determine the slope of the tangent line to the graph of the equation  $4x^2 + 9y^2 = 25$  at the point  $(2, 1)$ .(5 Points) *Hint: Implicit differentiation*
- 8.(Sample Final I-4) Determine the slope of the tangent line to the graph of the equation  $x^2 - y^2 = 1$  at the point  $(\sqrt{2}, 1)$ .(5 Points) *Hint: Implicit differentiation*
- 9.(Sample Final I-5) Compute the derivative  $\frac{dz}{dx}$  of the function  $z = x^3e^{3x}$ .(5 Points)
- 10.(Sample Final I-5) Compute the derivative  $\frac{dA}{d\theta}$  of the function  $A(\theta) = \theta e^\theta \cos \theta$ .(5 Points)
- 11.(Sample Final I-6) Compute the derivative  $P'(l)$  of the function  $P(l) = \ln(l^2 + \sin l)$ .(5 Points)
- 12.(Sample Final I-6) Compute the derivative  $Q'(\pi)$  of the function  $Q(\pi) = \cos(\sin(\pi^2))$ , where  $\pi$  is a variable and NOT a constant  $\pi = 3.141592\dots$ (5 Points)

- 13.(Sample Final I-12) If the position of an object dropped from a height of 64m is given by  $h(t) = 64 - \frac{1}{2}gt^2$  after  $t$  seconds, where  $g = 9.8m/s^2$  is the gravitational acceleration, find *both* the velocity *and* the acceleration of the object when it hits the ground. Note: It is not required to substitute  $g$  into a number. One can leave  $g$  in the answer.(5 Points)
- 14.(Sample Final I-12) If the position of a particle moving in a straight line is given by  $x(t) = t^4 + 2t$  after  $t$  seconds, find *both* the velocity *and* the acceleration of the particle when  $t = 1$ .(5 Points)
- 15.(Sample Final I-10) If the area  $A(a) = \frac{\sqrt{3}}{4}a^2$  of an equilateral triangle is increasing at the constant rate 3 square inches per second, how fast is the length  $a$  of the sides increasing when the area is  $4\sqrt{3}$  square inches?(5 Points)
- 16.(Sample Final I-10) If the volume  $V(a) = \frac{\sqrt{2}}{12}a^3$  of an expanding equilateral tetrahedron with the length  $a$  of sides is increasing at the constant rate of 120 cubic inches per second, how fast is the length  $a$  increasing when the volume is  $\frac{2\sqrt{2}}{3}$  cubic inches?(5 Points)
- 17.(Sample Final I-15) Show that the derivative of  $f(x) = 2x^2 - 1$  is  $f'(x) = 4x$  by using the definition of the derivative as the limit of a difference quotient.(10 Points)
- 18.(Sample Final I-15) Show that the derivative of  $f(x) = x^2 + x$  is  $f'(x) = 2x + 1$  by using the definition of the derivative as the limit of a difference quotient.(10 Points)