MA 16500
EXAM 2 INSTRUCTIONS
VERSION 02
October 19, 2016

Your name _____ Your TA's name _____

Student ID # _____ Section # and recitation time _____

1. You must use a #2 pencil on the scantron sheet (answer sheet).

2. Check that the cover of your question booklet is ORANGE and that it has VERSION 02 on the top. Write 02 in the TEST/QUIZ NUMBER boxes and blacken in the appropriate spaces below.

3. On the scantron sheet, fill in your TA's name (NOT the lecturer's name) and the course number.

4. Fill in your NAME and PURDUE ID NUMBER, and blacken in the appropriate spaces.

5. Fill in the four-digit SECTION NUMBER.

6. Sign the scantron sheet. All the answers should be marked on the scantron sheet.

7. Blacken your choice of the correct answer in the spaces provided for each of the questions 1–12. Do all your work on the question sheets. Show your work on the question sheets. Although no partial credit will be given, any disputes about grades or grading will be settled by examining your written work on the question sheets.

8. There are 12 questions, each worth 8 points. The maximum possible score is
$8 \times 12 + 4$ (for taking the exam) $= 100$ points.

9. NO calculators, electronic device, books, or papers are allowed. Use the back of the test pages for scrap paper.

10. After you finish the exam, turn in BOTH the scantron sheets and the exam booklets.

11. If you finish the exam before 7:25, you may leave the room after turning in the scantron sheets and the exam booklets. If you don't finish before 7:25, you should REMAIN SEATED until your TA comes and collects your scantron sheets and exam booklets.

Exam Policies

1. Students must take pre-assigned seats and/or follow TAs' seating instructions.
2. Students may not open the exam until instructed to do so.
3. No student may leave in the first 20 min or in the last 5 min of the exam.
4. Students late for more than 20 min will not be allowed to take the exam; they will have to contact their lecturer within one day for permission to take a make-up exam.
5. After time is called, the students have to put down all writing instruments and remain in their seats, while the TAs will collect the scantrons and the exams.
6. Any violation of the above rules may result in score of zero.

Rules Regarding Academic Dishonesty

1. You are not allowed to seek or obtain any kind of help from anyone to answer questions on the exam. If you have questions, consult only your instructor.
2. You are not allowed to look at the exam of another student. You may not compare answers with anyone else or consult another student until after you have finished your exam, handed it in to your instructor and left the room.
3. You may not consult notes, books, calculators. You may not handle cell phones or cameras, or any electronic devices until after you have finished your exam, handed it in to your instructor and left the room.
4. Anyone who violates these instructions will have committed an act of academic dishonesty. Penalties for academic dishonesty can be very severe and may include an F in the course. All cases of academic dishonesty will be reported immediately to the Office of the Dean of Students.

I have read and understand the exam policies and the rules regarding the academic dishonesty stated above:

STUDENT NAME: _____

STUDENT SIGNATURE: _____

Questions

1. Find the derivative $\dfrac{dy}{dx}$ when $y = x^{\tan x}$.

A. $\dfrac{dy}{dx} = (\ln x) \cdot x^{\tan x} \cdot \sec^2 x$

B. $\dfrac{dy}{dx} = (\tan x) \cdot x^{\tan x - 1}$

C. $\dfrac{dy}{dx} = x^{\tan x} \cdot \left(\sec^2 x \cdot \ln x + \dfrac{\tan x}{x} \right)$ (correct)

D. $\dfrac{dy}{dx} = x^{\tan x} \cdot \left(\sec^2 x \cdot \ln x \cdot \tan x \cdot \dfrac{1}{x} \right)$

E. $\dfrac{dy}{dx} = x^{\tan x} \cdot \left(\sec^2 x \cdot \dfrac{1}{x} \right)$

2. Find the slope of the tangent to the curve given by the equation

$$\sin(xy^2) = \tan(x) + y^2 - 1$$

at a point $(x, y) = (\pi, 1)$.

A. 0

B. $-\dfrac{1}{2}$

C. $-\dfrac{1}{1+\pi}$ (correct)

D. $\dfrac{1}{2(1+\pi)}$

E. $-\dfrac{1}{2(1+\pi)}$

3. Find an approximate value of $\sqrt[3]{27.05}$ by using the linear approximation of the function $f(x) = x^{1/3}$ at $a = 27$.

A. $\dfrac{3241}{1080} = 3 + \dfrac{1}{1080}$

B. $\dfrac{811}{270} = 3 + \dfrac{1}{270}$

C. $\dfrac{1621}{540} = 3 + \dfrac{1}{540}$ (correct)

D. $\dfrac{905}{300} = 3 + \dfrac{5}{300}$

E. 3

4. Suppose that $F(x) = [f(g(x))]^3$ and that the functions f and g satisfy the following conditions:

$$\begin{cases} f(1) = 5, & f(2) = 3, & f(3) = -1 \\ f'(1) = 4, & f'(2) = 3, & f'(3) = -2 \\ g(1) = 3, & g(2) = 2, & g(3) = -1 \\ g'(1) = 2, & g'(2) = 3, & g'(3) = 4 \end{cases}$$

Find $F'(1)$.

A. 8

B. 4

C. -16

D. 12

E. -12 (correct)

5. Find the exact values for

(a) $\sin\left(\frac{1}{2}\arccos\left(\frac{1}{2}\right)\right)$

(b) $\tan(2\theta)$ when $\cos\theta = \frac{5}{13}$ and $-\pi/2 < \theta < 0$.

Hint: $\tan 2\theta = \dfrac{\sin 2\theta}{\cos 2\theta} = \dfrac{2\sin\theta\cos\theta}{\cos^2\theta - \sin^2\theta}$.

A. (a) $\frac{1}{2}$ (b) $\frac{120}{119}$ (correct)

B. (a) $\frac{1}{2}$ (b) $-\frac{120}{119}$

C. (a) $\frac{1}{\sqrt{3}}$ (b) $\frac{5}{12}$

D. (a) $\frac{1}{\sqrt{3}}$ (b) $\frac{12}{5}$

E. (a) $-\frac{1}{2}$ (b) $-\frac{12}{5}$

6. Let $f(x) = \tanh(\cos x)$.

Find the exact value of $f'\left(\frac{\pi}{2}\right)$.

A. 0

B. -1 (correct)

C. $\frac{e}{2}$

D. $-\frac{e^2}{2}$

E. $-\frac{4}{e^2}$

7. The position of a particle is given as a function of time in seconds by the formula $f(t) = t^3 - 9t^2 + 24t + 5$.

Find the total distance travelled by the particle during the first 5 seconds.

A. 30

B. 28 (correct)

C. 25

D. 21

E. 20.

8. Find the formula for $\sin(2\tan^{-1} x)$.

A. $\dfrac{x}{\sqrt{1-x^2}}$.

B. $\dfrac{2x}{\sqrt{1+x^2}}$

C. $\dfrac{1-x^2}{1+x^2}$

D. $1-2x^2$

E. $\dfrac{2x}{1+x^2}$ (correct)

HINT: Use the double angle formula for "sin".

9. A tank in the shape of an inverted circular cone with base radius 2 ft and height 4 ft leaks water at the rate of 5 ft^3/min. If the water is being poured into the tank at the rate of 7 ft^3/min, find the rate at which the water level is rising when the water is 3 ft deep.

A. $\left[\dfrac{4}{9\pi} - \dfrac{5}{\pi\left(\frac{3}{2}\right)^2}\right]$ ft/min

B. $\left[\dfrac{8}{9\pi} - \dfrac{5}{\pi\left(\frac{3}{2}\right)^2}\right]$ ft/min

C. $\dfrac{1}{9\pi}$ ft/min

D. $\dfrac{4}{9\pi}$ ft/min

E. $\dfrac{8}{9\pi}$ ft/min (correct)

10. The altitude of a triangle is increasing at a rate of 1 cm/min while the area of the triangle is increasing at a rate 2 cm^2/min. At what rate is the base of the triangle changing when the altitute is 10 cm and the area is 100 cm^2 ?

A. $\frac{2}{5}$ cm/min

B. 2 cm/min

C. $-\frac{9}{5}$ cm/min

D. $-\frac{8}{5}$ cm/min (correct)

E. $-\frac{3}{5}$ cm/min

11. A 15-foot ladder is resting against the wall. Initially the bottom of the ladder is 11 feet away from the wall, and then it is being pushed toward the wall at a constant speed of 1 ft/s. How fast is the top of the ladder moving after 2 seconds ?

A. 1 ft/s

B. $\frac{1}{2}$ ft/s

C. $\frac{2}{\sqrt{3}}$ ft/s

D. $\frac{5}{4}$ ft/s

E. $\frac{3}{4}$ ft/s (correct)

12. A kite 100 ft above the ground moves horizontally at a speed of 8 ft/s. At what rate is the angle between the string and the horizontal decreasing when 200 ft of string has been let out ?

A. $\frac{2}{\sqrt{3}}$ rad/s

B. $\frac{1}{50}$ rad/s (correct)

C. $\frac{1}{25}$ rad/s

D. $\frac{\pi}{3}$ rad/s

E. $\frac{\pi}{6}$ rad/s