MATH 131 **EXAM II** F05M131.1.1

NAME :_____ ID NUMBER_____

PART I consists of 12 multiple choice questions (worth 5 points each) for a total of 60 points. Mark the correct answer on the answer card . For part I only the answer on the card will be graded.
Part II consists of 4 handgraded problems (worth 10 points each) for a total of 40 points . A correct answer without supporting work may get no credit . Present a readable , orderly sequence of steps showing how you got your answer .

Part I (80 points) :

1) Find an equation for the **tangent line** to the curve $y = x\cos(x)$ at $(\pi, -\pi)$.

$A)\ y = x$
$B)\ x + y = 0$
$C)\ 2x - y = \pi$
$D)\ y = 3x - \pi$
$E)\ x + 2y = \frac{3\pi}{2}$
$F)\ x - y = 2\pi$
$G)\ y = \pi x - \pi$
$H)\ y = \pi x + \pi$
$I)\ x - 2\pi y = 2$
$J)\ 3x - 2y = \frac{\pi}{2}$

2) Find the **slope** of the tangent line to the curve $x^2 - 2xy + y^3 = 1$ *at* $(2, 1)$.

A) 1 B) -1 C) 2 D) -2 E) 3 F) -3 G) $\frac{2}{3}$ $H)\ -\frac{2}{3}$ $I)\ \frac{3}{2}$ $J)\ -\frac{3}{2}$

3) If $f(x) = \frac{1}{\sqrt{x^2+x+2}}$ then find $f'(1)$.

A) 0 B) -2 C) $\frac{3}{2}$ D) $-\frac{3}{18}$ E) $\frac{1}{4}$ F) $-\frac{3}{17}$ G) $\frac{3}{4}$ H) $-\frac{3}{16}$ I) $\frac{9}{2}$ J) $-\frac{1}{2}$

4) For the curve given by the parametric equations $x = t\sin(t)$ $y = t\cos(t)$,
find the value of $\frac{dy}{dx}$ at the point $(0, -\pi)$, where $\frac{\pi}{2} \leq t \leq \frac{3\pi}{2}$.
(From $x = 0$ and $y = -\pi$ you need to find the value of t in the above domain)

A) π B) $-\pi$ C) 2π D) -2π E) $\frac{\pi}{2}$ F) $-\frac{\pi}{2}$ G) $\frac{1}{\pi}$ H) $-\frac{1}{\pi}$ I) $\frac{3\pi}{2}$ J) $-\frac{3\pi}{2}$

5) If $f(x) = (\tan^{-1}(x))^2$ then $f'(1) =$:

A) $\frac{\pi}{6}$
B) $\frac{\pi}{3}$
C) $\frac{\pi}{4}$
D) $\frac{\pi}{8}$
E) $\frac{\pi}{2}$
F) $\frac{\pi}{12}$
G) $\frac{\pi}{9}$
H) π
I) 2π
J) 0

6) Solve for x in the equation $e^{2x+3} - 7 = 0$. :

A) $\frac{ln(7)+3}{2}$

B) $\frac{ln(3)+2}{7}$

C) $\frac{ln(2)+7}{3}$

D) $\frac{ln(2)+3}{7}$

E) $\frac{ln(7)+2}{3}$

F) $\frac{ln(7)-3}{2}$

G) $\frac{ln(3)-2}{7}$

H) $\frac{ln(2)-7}{3}$

I) $\frac{ln(7)-2}{3}$

7) Find L(x) , the **linear approximation** of the function $f(x) = \sqrt{4+2x}$ at $a = 0$ and use it to approximate the number $\sqrt{4.08}$.

$A)\ 2 + \frac{1}{10}$
$B)\ 2 + \frac{1}{15}$
$C)\ 2 + \frac{1}{20}$
$D)\ 2 + \frac{1}{25}$
$E)\ 2 + \frac{1}{30}$
$F)\ 2 + \frac{1}{35}$
$G)\ 2 + \frac{1}{45}$
$H)\ 2 + \frac{1}{50}$
$I)\ 2 + \frac{1}{55}$
$J)\ 2 + \frac{1}{65}$

8) If $f(x) = x^{e^x}$ then find $f'(1)$.

$A)\ 0$
$B)\ 1$
$C)\ -1$
$D)\ 2$
$E)\ -2$
$F)\ e$
$G)\ -e$
$H)\ 1/e$
$I)\ -1/e$
$J)$ Derivative DNE

9) If $f(x) = x \cdot \ln(e^{\sqrt{x}})$, find $f'(1)$.

A) $\frac{1}{2}$
B) 1
C) e
D) $\frac{2}{3}$
E) $\frac{e}{2}$
F) 2
G) $\frac{3}{2}$
H) $\frac{1}{e}$
I) $\frac{3}{e}$
J) $2e$

10) The **slope** of the tangent line to the curve $x \cdot \arctan(y) + x \cdot y = \frac{\pi+4}{4}$ at the point (1 , 1) is equal to :

A) $\frac{2}{3}(arctan(1) + 1)$
B) $-\frac{2}{3}(arctan(1) + 1)$
C) $\frac{1}{2}(arctan(1) + 2)$
D) $-\frac{1}{2}(arctan(1) + 2)$
E) $\frac{2}{3}(arctan(1) + 4)$
F) $-\frac{2}{3}(arctan(1) + 4)$
G) $\frac{1}{2}(arctan(1) + 4)$
H) $-\frac{1}{2}(arctan(1) + 4)$
I) $\frac{1}{4}(arctan(1) + 2)$
J) $-\frac{1}{4}(arctan(1) + 2)$

11) Eliminate the parameter to find a **Cartesian equation** for the curve

$x = -1 + 3\sec(t)$ $\quad$ $y = 2 + 3\tan(t)$

A) $(x-1)^2 + (y-2)^2 = 3$

B) $(x-1)^2 - (y-2)^2 = 3$

C) $(x+1)^2 + (y-2)^2 = 3$

D) $(x+1)^2 - (y-2)^2 = 3$

E) $(x-1)^2 + (y-2)^2 = 9$

F) $(x-1)^2 - (y-2)^2 = 9$

G) $(x+1)^2 + (y-2)^2 = 9$

H) $(x+1)^2 - (y-2)^2 = 9$

I) $(x+1)^2 + (y+2)^2 = 9$

J) $(x+1)^2 + (y+2)^2 = 9$

12) The length of a rectangle is **increasing** at a rate of 4 cm/s and its width is **decreasing** at the rate of 3 cm/s . When the length is 20 cm and the width is 10 cm , what is the **rate of change of the area** ?

A) increasing at 5 cm^2/s
B) decreasing at 5 cm^2/s
C) increasing at 10 cm^2/s
D) decreasing at 10 cm^2/s
E) increasing at 15 cm^2/s
F) decreasing at 15 cm^2/s
G) increasing at 20 cm^2/s
H) decreasing at 20 cm^2/s
I) increasing at 25 cm^2/s
J) decreasing at 25 cm^2/s

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PART II : Show the work you did to get the answer in a readable orderly form .

13) In each case below write a formula for $f'(x)$. **You don't have to simplify it .**

a) $f(x) = \sin^{-1}(\tan(x))$. (3 pts)

b) $f(x) = x \cdot 4^{-x^2}$. (3 pts)

c) $f(x) = \sqrt[4]{\frac{x^3+1}{x^3-1}}$. (4 *pts*)

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14) The curve $y^2 = x^3 + 3x^2$ is called the Tschirnhausen cubic .

a) Find an equation of the tangent line to this curve at (1 , − 2) . (5 pts)

b) Find the x & y coordinates of the **only** two points on the curve at which the tangent line is horizontal . (5 pts)

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15) If a bacteria population starts with 200 bacteria and triples every 4 hours , then the number of bacteria after t hours is given by the formula

$$n = 200 \cdot 3^{t/4} \quad .$$

a) Find the inverse of this function , describing t as a function of n . (5 pts)

b) At **what rate are the bacteria increasing** 8 hours after the start ?
(5 pts)

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16) At 2:00 PM sailboat **B** is 4 km south of sailboat **A** . After that **A** starts moving east at 4 km/hr and **B** starts moving east at 1 km/hr .

a) Draw a **diagram** of the movement of the two boats and calculate the **distance between** the two boats at 3:00 PM . (3 pts)

b) What is the **rate of change** of the distance between the two boats at 3:00 PM ? (7 pts)