LAST NAME, First name (print): _______________________________________

INSTRUCTOR: ________________________________________________________

SECTION NUMBER: ________________

UIN: ______________________________

SEAT NUMBER: ______________________

DIRECTIONS:

1. The use of a calculator, laptop or computer is prohibited.

2. In Part 1 (Problems 1-10), mark the correct choice on your ScanTron using a No. 2 pencil. *For your own records, also record your choices on your exam!* 

3. In Part 2 (Problems 11-15), present your solutions in the space provided. *Show all your work neatly and concisely and clearly indicate your final answer.* You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

4. Be sure to write your name, section number and version letter of the exam on the ScanTron form.

THE AGGIE CODE OF HONOR

“An Aggie does not lie, cheat or steal, or tolerate those who do.”

Signature: ________________________________________________

DO NOT WRITE BELOW!

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PART I: Multiple Choice

1. (5 pts) Find a unit vector perpendicular to the line described by the parametric equations $x = 3t + 1$ and $y = 2t + 5.$
   (a) $\left\langle \frac{3}{\sqrt{13}}, \frac{2}{\sqrt{13}} \right\rangle$
   (b) $\left\langle -\frac{1}{\sqrt{5}}, \frac{1}{\sqrt{5}} \right\rangle$
   (c) (3, 2)
   (d) $\left\langle \frac{2}{\sqrt{13}}, \frac{-3}{\sqrt{13}} \right\rangle$
   (e) (2, -3)

2. (5 pts) $\lim_{x \to 0} \frac{\sqrt{9 + x} - 3}{x} =$
   (a) $\frac{1}{6}$
   (b) 0
   (c) 1
   (d) $-\frac{1}{6}$
   (e) The limit does not exist.

3. (5 pts) If $H(x) = x^2 f(x),$ find $H'(2)$ if it is known that $f(2) = 4$ and $f'(2) = -3.$
   (a) 16
   (b) -12
   (c) 4
   (d) -22
   (e) -28
4. (5 pts) A wagon is pulled a distance of 25 feet along a horizontal path by a constant force of 8 pounds. The handle of the wagon is at an angle of 30° above the horizontal. How much work is done?

(a) $100\sqrt{3}$ foot pounds
(b) $100\sqrt{2}$ foot pounds
(c) 200 foot pounds
(d) 100 foot pounds
(e) $200\sqrt{3}$ foot pounds

5. (5 pts) Find the equation of the tangent line to the graph of $f(x) = \frac{x}{1+x}$ at $x = 2$.

(a) $y - \frac{2}{3} = \frac{5}{9}(x - 2)$
(b) $y - \frac{2}{3} = \frac{1}{9}(x - 2)$
(c) $y - \frac{2}{3} = -\frac{1}{9}(x - 2)$
(d) $y = \frac{1}{9}(x - 2)$
(e) $y - \frac{5}{9} = \frac{5}{9}(x - 2)$

6. (5 pts) Which of the following is a cartesian equation for the curve described by the parametric equations $x = 4 + \sin t$, $y = \cos t$, $0 \leq t \leq 2\pi$?

(a) $x^2 + y^2 = 1$
(b) $(x - 4)^2 + y^2 = 1$
(c) $x^2 + (y - 4)^2 = 1$
(d) $(x - 4)^2 - y^2 = 1$
(e) $x^2 - (y - 4)^2 = 1$
7. (5 pts) Where is \( f(x) = \begin{cases} 
2x + 1 & \text{if } x \leq -1 \\
x^2 - 2 & \text{if } -1 < x \leq 2 \\
\frac{1}{x} + \frac{1}{2} & \text{if } x > 2 
\end{cases} \) not continuous?

(a) \( x = 2 \)
(b) \( x = -1 \)
(c) \( x = -1 \) and \( x = 2 \)
(d) \( x = 0, x = -1 \) and \( x = 2 \)
(e) \( x = 0 \) and \( x = 2 \)

8. (5 pts) \( \lim_{x \to -3^-} \frac{x - 1}{x^2(x + 3)} = \)

(a) \( \frac{1}{3} \)
(b) \( -\infty \)
(c) \( \infty \)
(d) \( -\frac{1}{3} \)
(e) 0

9. (5 pts) Which of the following intervals contains a solution to the equation \( x^3 + x^2 = 3x + 10? \)

(a) \((-1, 0)\)
(b) \((-2, -1)\)
(c) \((1, 2)\)
(d) \((0, 1)\)
(e) \((2, 3)\)

10. (5 pts) Where is \( f(x) = |x^2 - 16| \) not differentiable?

(a) \( x = 0 \)
(b) \( x = 8 \)
(c) \( x = \pm 4 \)
(d) \( x = 0, x = \pm 4 \)
(e) \( f(x) \) is differentiable everywhere because it is a polynomial.
PART II WORK OUT

Directions: Present your solutions in the space provided. Show all your work neatly and concisely and Box your final answer. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

11. (10 pts) Find \( \lim_{x \to -\infty} \left( x + \sqrt{x^2 + 5x} \right) \).
12. (10 pts total)
   (i) (4 pts) Find the cosine of the angle between the vectors \( \langle 1, 2 \rangle \) and \( \langle 3, 4 \rangle \).

   (i) (3 pts) Find the scalar projection of \( \langle 1, 2 \rangle \) onto \( \langle 3, 4 \rangle \).

   (ii) (3 pts) Find the vector projection of \( \langle 1, 2 \rangle \) onto \( \langle 3, 4 \rangle \).
13. (10 pts) Using the definition of the derivative, find $f'(x)$ for $f(x) = \frac{3}{x-2}$. 
14. (10 pts) Two forces $F_1$ and $F_2$ with magnitudes 10 and 8 pounds respectively act on an object at a point $P$ as shown. Find the magnitude of the resultant force $F$ acting on the object. Do not simplify.
15. (a) (5 pts) Find \( \lim_{x \to 2} \frac{x - 2}{|x - 2|} \)

(b) (5 pts) Is there a value of \( a \) for which \( \lim_{x \to 1} \frac{3x^2 + ax + a + 5}{x^2 + 2x - 3} \) exists? If so, find the value of \( a \). If not, explain why.

End of Exam