Name: _____

Instructor: Dwyer

Exam I
September 21, 1999

- The Honor Code is in effect for this examination. All work is to be your own.
- No calculators.
- The exam lasts for one hour.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 11 pages of the test.

Good Luck!

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)
6.	(a)	(b)	(c)	(d)	(e)

DO NOT WRITE IN THIS BOX!

Total multiple choice: _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

Total: _____

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Multiple Choice

1.(5 pts.) Find the limit

$$\lim_{x \to 2} \frac{x^2 - 4}{x^2 + x - 6}$$

(a) $-\infty$ (b) $\frac{1}{2}$ (c) $\frac{2}{3}$ (d) $\frac{4}{5}$ (e) ∞

2.(5 pts.) Find the **average** rate of change of $f(x) = x^2 + 2$ on the interval $[1, 3]$.

(a) $\frac{1}{4}$ (b) $\frac{3}{2}$ (c) 4 (d) $\frac{11}{2}$ (e) 7

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3.(5 pts.) Find the limit

$$\lim_{t \to 1^-} \frac{1}{t^2 + t - 2}$$

(a) $-\infty$ (b) $\frac{-1}{2}$ (c) 0 (d) $\frac{1}{3}$ (e) ∞

4.(5 pts.) Differentiate the function

$$f(x) = \tan x + \sec x$$

(a) $-\cot x$

(b) $\tan^2 x + \sec^2 x$

(c) 0

(d) $\cot x + \csc x$

(e) $(\sec x)(\sec x + \tan x)$

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5.(5 pts.) Evaluate the derivative

$$\frac{d}{dx}(\sin x + 3\cos x)^{100}$$

at $x = \frac{\pi}{2}$.

(a) -300 (b) 0 (c) 1 (d) 100 (e) 3^{99}

6.(5 pts.) Let

$$f(x) = \frac{x}{x^2 + 3x + 2}$$

Calculate $f'(x)$.

(a) $\frac{1}{2x+3}$ (b) $\frac{1}{(x^2+3x+2)^2}$ (c) $\frac{3x^2+6x+2}{(x^2+3x+2)^2}$ (d) $\frac{-x^2+2}{(x^2+3x+2)^2}$ (e) $\frac{2x^2+5}{(x^2+3x+2)^2}$

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Partial Credit

7.(10 pts.) Compute the slope of the graph of the curve $y = \sqrt{x+1}$ at the point $(8, 3)$ using the **limit definition** of slope. Other methods will **not** receive credit.

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8.(10 pts.) The function $y = f(x)$ is defined by

$$f(x) = \begin{cases} \dfrac{\sin x}{x} & \text{for } x > 0 \\ -4x & \text{for } x \leq 0 \ . \end{cases}$$

For which values of x is $f(x)$ continuous? Justify your answer using limits.

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9.(10 pts.) Given the graph of the function below, sketch the graph of the derivative on the grid below. At which points is $g'(x)$ not defined?

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10.(10 pts.) Suppose that $f(x)$ and $g(x)$ are differentiable functions such that $f(2) = 4$, $f'(2) = 3$, $g(2) = 1$ and $g'(2) = 5$. If $h(x) = f(x) \cdot (g(x) + 1)$, compute $h'(2)$.

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11.(10 pts.) A particle moves along the y-axis with its position being given by the function $y(t) = t^4 - 2t^3 + 10t$ for $-10 \leq t \leq 10$. Find the velocity of the particle at each time for which the acceleration is zero.

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12.(10 pts.) Find an equation of the tangent line to the graph of the function $y = \sin(\pi x^4)$ at the point $(1, 0)$.

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13.(10 pts.) Given the function $f(x) = x^3 - 12x + 8$,

(1) Calculate $f(2)$ and $f(-2)$

(2) Show that the equation $f(x) = 0$ has a solution on the interval $[-2, 2]$.