PART 1: MULTIPLE-CHOICE PROBLEMS

Each problem is worth 4 points: NO partial credit will be given. Calculators may NOT be used on this part. ScanTron forms will be collected after 1 hour.

1. Find the derivative of $g(x) = 2 + 3x + 4x^2 + x^3$.

(a)
$$2x + \frac{3}{2}x^2 + \frac{4}{3}x^3 + \frac{1}{4}x^4$$

(b) $3 + 8x + 3x^2$
(c) $5 + 8x + 3x^2$
(d) $3 + 7x^2$
(e) $2 + 8x + 3x^2$

 $2. \ \text{If} \ \lim_{x \to a} f(x) = 9 \ \text{and} \ \lim_{x \to a} g(x) = 2 \,, \, \text{then} \ \lim_{x \to a} \left[4 \sqrt{f(x)} + 5g(x) \right] =$

.

- (a) $45 + 4\sqrt{2}$
- (b) 57
- (c) 22
- (d) 1
- (e) Can't be determined unless a is known.

3. Evaluate
$$\lim_{x \to \infty} \frac{3x^3 + 2x^2 + 5}{2x^3 + 7x}$$

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

- 4. Find the equation of the tangent line to the curve $y = f(x) = x^4 + 2x + 1$ at the point x = 1.
 - (a) y 4 = 6(x + 1)
 - (b) y 6 = 4(x 1)
 - (c) y 4 = -6(x 1)
 - (d) y 4 = 6(x 1)
 - (e) y 6 = 6(x 1)

- 5. A line is given by the parametric equations x = 2 + 3t, y = 4 + 12t. Find the slope of this line.
 - (a) $-\frac{1}{4}$ (b) $\frac{1}{4}$ (c) -4(d) 4(e) 36

- 6. Consider the function $f(x) = \begin{cases} 3x 1 & \text{if } x \leq 2 \\ x^2 + 2 & \text{if } x > 2 \end{cases}$. Which statement is true?
 - (a) f(2) = 6.
 - (b) f(2) is not defined.
 - (c) f(x) is continuous at x = 2.
 - (d) $\lim_{x \to 2^{-}} f(x) = 6$.
 - (e) $\lim_{x \to 2^+} f(x) = 6$.

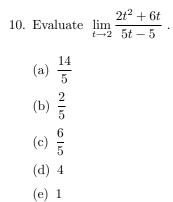
- 7. The displacement of a particle moving in a straight line is given by $s = \frac{t^4}{4} 8t + 3$. When is the velocity of the particle equal to zero?
 - (a) t = 0
 - (b) t = 1
 - (c) t = 2
 - (d) t = 4
 - (e) t = 8

8. If h(x) = f(x)g(x) and f(3) = 4, g(3) = 2, f'(3) = -6 and g'(3) = 5, then h'(3) = -6

- (a) -30
- (b) 8
- (c) 4
- (d) -14
- (e) −4

9. Only one of the following intervals contains a solution of the equation $2x^3 + x^2 + 2 = 0$. Which one?

- (a) (-2, -1)
- (b) (-3, -2)
- (c) (-51, -50)
- (d) (0,1)
- (e) (3, 8)



11. Find the value of x that makes the vectors $\langle 1,x\rangle$ and $\langle 3-4x,5\rangle$ orthogonal.

- (a) x = -3
- (b) x = -1
- (c) x = 0
- (d) x = 1
- (e) x = 3

PART 2: WORK-OUT PROBLEMS

Each problem is worth 8 points; partial credit is possible. Calculators are permitted ONLY AFTER the ScanTrons are collected. SHOW ALL WORK! If you use a calculator, explain how.

12. Find the derivative of $f(x) = \frac{1}{x}$ using **only** the **definition** of the **derivative** as a **limit**.

13. Find the vector projection of 5i+12j onto 3i-4j.

14. Differentiate $f(x) = \frac{x^2 - 1}{2x^2 + 1}$.

15. Differentiate $g(x) = (1 + x + 2x^2)(2 + x^2 + x^3)$.

16. Evaluate
$$\lim_{x \to -\infty} (x + \sqrt{x^2 + 6x})$$
.

17. Find the value of the constant c that makes the function $f(x) = \begin{cases} cx+1, & \text{if } x \leq 2\\ \frac{1}{4}cx^2-2 & \text{if } x > 2\\ \text{continuous on } (-\infty, \infty). \end{cases}$ Clearly EXPLAIN your answer!

18. A triangle has vertices at the points P(0,1), Q(2,1) and R(3,3). Using vector methods: (a) Find the distances from R to P and R to Q.

(b) Find the cosine of the angle of the triangle at the vertex R.