Show all work for full credit. You may use a calculator, but no books or notes.

(9 pts.) 1. Find the $x$-coordinates of all inflection points of the curve $y = x^5 - 5x^4$. 
(9 pts.) 2. Find the interval where the function \( f(x) = x^3 + 3x^2 - 24x \) is decreasing.

(9 pts.) 3. Evaluate the indefinite integral \( \int t^2 \sin(t^3 - 1)dt \).
(8 pts.) 4. Compute the limit \( \lim_{z \to 3} \frac{z^2 - 2z - 3}{z^2 - 9} \).

(12 pts.) 5. Let \( y = f(x) = e^{1-x^2} \).

(8 pts) (a) Find an equation of the tangent line at \( x = -1 \).

(4 pts) (b) Use the tangent line to approximate \( f(-1.01) \).
(9 pts.) 6. Find the total area of the two finite regions bounded by the curve $y = x^3 + 3x^2$ and the line $y = 4x$. Note the intersection points are $(-4, -16)$, $(0, 0)$, and $(1, 4)$.

(9 pts.) 7. If an object moves with velocity $v = \frac{1}{4t^2 + 1}$ meters per second, use the left endpoint method with four subintervals to approximate the distance traveled between $t = 0$ and $t = 2$ seconds.
(9 pts.) 8. Find the derivative of $y = x^2 \tan^{-1}(x)$.

(12 pts.) 9. A ball is thrown from the roof of a building, and it hits the ground 3 seconds later with a velocity of -80 feet/sec. Find the speed at which the ball was thrown, and the height of the building. Note the acceleration of gravity is $a = -32$ feet/sec.
(9 pts.) 10. Find the absolute maximum and the absolute minimum of the function 
\[ f(x) = x^4 - 8x^2 \] on the closed interval \(-1 \leq x \leq 3\).

(9 pts.) 11. Use the washer method (cross sections) to find the volume of the solid of 
revolution obtained by rotating around the \(x\)-axis the region enclosed by the two 
curves \(y = x + 1\) and \(y = \sqrt{3x + 1}\). Note the curves intersect at the points \((0, 1)\) 
and \((1, 2)\).
(9 pts.) 12. Find the horizontal asymptote of the curve \( y = \frac{3 - 2x^2}{5x^2 + 4x} \). Show work!

(9 pts.) 13. Find the volume of the solid of revolution obtained by rotating the region between the two parabolas \( y = x^2 - 2x + 4 \) and \( y = 4x^2 - 8x + 4 \) around the \( y \)-axis. Note the parabolas intersect at the points \((0, 4)\) and \((2, 4)\).
(9 pts.) 14. Find the instantaneous rate of change of $x$ with respect to $t$ if $x = \frac{\ln(t)}{t^3}$.

(12 pts.) 15. A ladder 10 feet long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 3 feet per second, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is 8 feet from the wall?
(9 pts.) 16. Find the derivative \( \frac{dy}{dx} \) if \( xy^2 + y = \tan(x) \).

(12 pts.) 17. A rectangular garden is to have an area of 3000 square feet. Three sides are to be lined with a fence that costs 3 dollars per foot, and the fourth side is to be lined with a fence that costs 2 dollars per foot. Find the length and width of the garden which minimize the total cost of the fence. Use the Second Derivative Test to verify your answer is a minimum.
(9 pts.) 18. Find the area of the region enclosed by $y = x - 6$ and $x = y^2$.

(9 pts.) 19. Evaluate the indefinite integral $\int \sqrt{1 + \sqrt{x}} \, dx$. 
(9 pts.) 20. Let \( f(x) = \int_{5}^{x} \sqrt{t^3 + 1} \, dt \). Use the Fundamental Theorem of Calculus to evaluate \( \lim_{h \to 0} \frac{f(2 + h) - f(2)}{h} \).

(9 pts.) 21. Use the following graph of the derivative \( g'(x) \) to find all critical numbers of the function \( y = g(x) \), and to classify each critical number as a local maximum, local minimum, or neither.

The derivative \( g'(x) \)