

Show your work. Each problem is worth 11 points.

I. For $f(x) = x^3 + 6x^2 - 7$

1. Use the $f'(x)$ to find where it is increasing and decreasing and coordinates of relative max and min points.
2. Use the $f''(x)$ to find where it is concave up and down, coordinates of inflection points, and sketch the graph of $y = f(x)$.

II. For $f(x) = \frac{3x^2}{x^2 - 4}$, find its domain, vertical, and horizontal asymptotes.

III. For $f(x) = 3x^{2/3} e^{x/3}$

1. Find $f'(x)$.
2. Find the coordinates of relative max/min points.

IV. Use logarithmic differentiation to find the first derivative of: $y = (x^2 + 1)^x$

V. How much longer would it take \$20,000 to grow to \$80,000 with a 3% annual rate compounded monthly versus a 6% annual rate compounded monthly?

IV. A storage 726 sq ft area is to be built along a back wall of a store as shown below. If the sides perpendicular to the store costs \$6 a foot and the side parallel to the store costs \$8 a foot to build, what dimensions would minimize the cost of building the storage area?



V. An 80 room motel in Reno Nevada is full on weekends when it charges \$60 a night. To increase profits the owner decides to increase the amount charged. However, every \$5 increase in the room rate, causes one room to go unrented. If it costs \$6 to clean each rented room, what should be charged to maximize profit (considering only rent and cleaning costs)? [Hint: let x = the number of \$5 increases]