Short answer questions — you must show your work

1. [2 marks] Find the absolute maximum of $f(x) = e^{x^3 - 27x}$ on the interval $[0, 4]$.

Answer: 

2. [2 marks] The cost function of making $x$ candle-holders a week in your factory is given by $C(x) = 500 + 6x + \frac{4}{x}$ dollars. What is the marginal cost of making the $401^{st}$ candle?

Answer: 

3. [2 marks] The distance, in meters, of a cream-pie from a clowns face is given $d(t) = -t^2 - t + 6$ (time is measured in seconds). What is the velocity in which it hits the clowns face?

Answer: 
4. 2 marks A vending machine stands in an office buildings and sells $q$ cans of soft drink an hour for the price of $p$ dollars a can and the demand equation is given by $p^3q + q^2 = 72$. Currently the machine vends 8 cans an hour for $1$ a can. Use the price elasticity of demand to determine whether the price of a can should be lowered or raised in order to increase their revenue.

Answer:

5. 2 marks The number $q$ of umbrellas that a store will sell per week and the price $p$ (in dollars per item) are related by the demand equation $q^2 = 4,500 - 5p^2$. If the price of an umbrella is falling at the rate of $1$ per week, find how the sales will change if the current price is $20$.

Answer: