1. The daily demand quantity, $x$, for a certain product is 0 if the price per unit is $35 or more. The quantity demanded changes at the constant rate of 100 more units per $7 decrease in the price. The fixed cost is $1200 per day and the total cost increases at the constant rate of $21 per unit.

   a) Find the profit function, $P(x)$.

   b) Find the exact change in profit if $x$ increases from 75 to 76.

   c) Use the derivative to find the approximate change in profit if $x$ increases from 75 to 76.

   d) Use the derivative to find the approximate change in profit if $x$ increases from 200 to 201. Is profit increasing or decreasing at this production level?
2. A cost function is given by \( C(x) = 0.3x^2 + 24x + 2700 \) where \( x \) is the number of units produced.
   a) Find the average cost function.

b) Sketch the average cost function after graphing it in your calculator using the window 
   \( X_{\text{min}}=0 \)  \( X_{\text{max}}=400 \)  \( Y_{\text{min}}=0 \)  \( Y_{\text{max}}=200 \)

c) Use 2nd trace and select minimum to find the minimum value of the average cost function. Give both \( x \) and \( y \) coordinates. What is the value of the marginal cost at this \( x \)?

\[
x=\_\_\_\_\_\_\_\_\_
\ AC=\_\_\_\_\_\_\_\_\_
\ MC=\_\_\_\_\_\_\_\_\_
\]

d) Find the marginal average cost function and evaluate it at the \( x \)-value of the minimum average cost found in c above.

2 pt. bonus
e) You should have found the same values for AC and MC in part c above. Use the quotient rule on \( \frac{C(x)}{x} \) to show that AC and MC are always equal when the derivative of \( \frac{C(x)}{x} \) is 0.
3. Find the derivative of each function.

\[ a) \quad f(x) = (x + 1)^3 \sqrt{x - 2} \]

\[ b) \quad g(x) = \sqrt{x^2 + 6x} \]

\[ c) \quad h(x) = x \sqrt{x^3 - 8} \]
4. \( f(x) = \frac{12x}{x^2 + 4} \)

a) Graph \( f(x) \) in the standard window Zoom 6 and sketch it.

b) Find \( f'(x) \).

c) At what values of \( x \) is \( f'(x) \) equal to 0? What do you see in the graph at these \( x \) values?
4. \( f(x) = \frac{64x}{(x + 4)^2} \)

a) Find \( f'(x) \) and simplify it by factoring \( x + 4 \) out of the numerator.

b) Find the equation of the tangent line to \( f(x) \) at \( x = 0 \). Graph \( f(x) \) and this tangent line in the window \( X_{\text{min}}=-5 \) \( X_{\text{max}}=5 \) \( Y_{\text{min}} = -5 \) \( Y_{\text{max}} = 5 \)

c) Where is the tangent line horizontal? Find the equation of the tangent line to \( f(x) \) at this point. Graph \( f(x) \) and the tangent line in the window \( X_{\text{min}}=0 \) \( X_{\text{max}}=10 \) \( Y_{\text{min}}=0 \) \( Y_{\text{max}} = 6 \)