MATH-1951
Quiz 4 - (3.2, 3.3, 3.4)
Answer the following questions, and show your work. Answers need not be simplified.
Scientific calculator only.

[1] (3 points total) Find the derivative of

\[ f(x) = \sin(-x^2) \]

\[ f'(x) = \cos(-x^2) \cdot (-x^2)' \]

\[ = \cos(-x^2) \cdot (-2x) \]

\[ = -2x \cos(-x^2) \]

[2] (3 points total) Find \( f'(x) \) and \( f''(x) \) of

\[ f(x) = 2x^5e^x \]

Rename \( h(x) = 2x^5e^x \)

\[ h''(x) = (2x^5 + 10x^4) \cdot e^x + (2x^5 + 10x^4)' \cdot e^x \]

\[ h''(x) = (2x^5 + 10x^4) \cdot e^x + (10x^4 + 40x^3) e^x \]

\[ h''(x) = (2x^5 + 10x^4) \cdot e^x \]
[3] (2 points total) Differentiate

\[ f(x) = \frac{x - 1}{x + 1} \]

\[ h(x) = \frac{g f' - f g'}{g^2} \]

\[ = \frac{(x + 1) \cdot 1 - (x - 1) \cdot 1}{(x + 1)^2} \]

\[ = \frac{x + 1 - (x - 1)}{(x + 1)^2} = \frac{2}{(x + 1)^2} \]

\[ h'(x) = \frac{2}{(x + 1)^2} \]

[4] (2 points total) For what value(s) of \( x \) does the graph of \( f \) have a horizontal tangent?

\[ f(x) = \frac{x^4 - 6x^3 + 9x^2}{3x} \]

\[ \text{Simplify first} \]
\[ f(x) = \frac{x^4}{3x} - 2x^2 + 3x \]
\[ f'(x) = \frac{1}{3} x^3 - 2x^2 + 3x \]

\[ \text{Taking derivative} \]
\[ f'(x) = x^2 - 4x + 3 \]

\[ \text{Horizontal tangent when } f'(x) = 0 \]
\[ x^2 - 4x + 3 = 0 \]
\[ (x - 3)(x - 1) = 0 \]
\[ x = 3, 1 \] are the values of \( x \) for which \( f \) has a horizontal tangent