

Find the derivatives of the following functions:

1. $f(x) = (x^2 - 3x + 4)^4,$

2. $f(x) = x^2(x^3 - 2x + 1)^3,$

3. $f(x) = \frac{e^{x^2}}{2x + 1} + \ln(x^2),$

4. $f(x) = (x^2 - e^{-x^2})^3.$

Find the derivative and sketch the curves of the functions below. Are these functions even, odd, or neither? List all maxima and minima for each graph. Find the second derivative of these functions, then locate the points of inflection. Also, give the x and y -intercepts and any asymptotes if they exist.

5. $y = 2e^{-x^2/2},$

6. $y = \ln(x^2 + 1),$

7. Hassell's model is used to study population of insects. Let P_n be the population of a species of moth in week n and suppose that Hassell's model is given by

$$P_{n+1} = H(P_n) = \frac{aP_n}{(1 + bP_n)^c}.$$

Suppose that the best fit to a set of data gives $a = 10$, $b = 0.004$, and $c = 2$. for this species of beetle.

- a. Let $P_0 = 100$, then find P_1 , P_2 , and P_3 .
- b. Sketch a graph of $H(P)$ with the identity function for $P \geq 0$, showing the intercepts, all extrema, and any asymptotes.
- c. Find all equilibria of the model and describe the behavior of these equilibria.

8. Repeat the process in Exercise 7 with gives $a = 5$, $b = 0.002$, and $c = 4$.