

Essentials of Calculus

Homework 3.1

Derivative formulas

1. Find the derivative and second derivative for the following functions.

a) $f(x) = x^5$

b) $f(x) = \frac{1}{x^3}$

c) $g(t) = 2t^3$

d) $h(x) = 4/x^4$

e) $f(x) = 3\sqrt{x}$

f) $h(t) = 2t^3 - 5t + 9$

g) $f(x) = 3/\sqrt{x}$

h) $g(x) = (2t - 1)(t^2 + 1)$

i) $f(x) = 5x^3 - 6x^2 + 7x - 8$

j) $f(x) = \sqrt{x} - 1/\sqrt{x}$

k) $f(x) = (2x - 1)(3x + 5)$

2. For each of the following functions, find $f(1)$, $f'(1)$, $f''(1)$, $f(3)$, $f'(3)$ and $f''(3)$.

a) $f(x) = 5x^2 + 8x$

b) $f(x) = 2/x^3$

c) $f(x) = (x + 1)(x - 1)$

3. Let $f(x) = 2x^2 + 4 + 2/x^2$. Find the rate of change of f at $x = 2$.

4. Find the tangent lines to the following graphs.

a) $y = x^2 + x$ at $x = 2$.

b) $y = \sqrt{x}$ at $x = 4$.

5. The number of fish in a pond in t years is $P(t) = 100t^{1/3}$ fish. Find the population and the rate of growth of the population in 8 years.
6. It costs a company $C(q) = 0.1q^2 + 75q + 50$ dollars to make q doodads. Find the cost and marginal cost at $q = 20$ doodads.
7. A ball is thrown down from the top of a tall building. In t seconds, the ball's height will be $f(t) = 200 - 10t - 16t^2$ feet. What is the ball's height and velocity in $t = 2$ seconds?