Reviews on Derivative and its Application

Rules for Derivatives

Practice.

1. Find the derivatives of the following functions.

a) $f(x) = 2x^3 - 3$
b) $f(x) = 8x^{-2} + x$
c) $f(x) = (x^2 + 1)(2x^{-1} - 2)$
d) $f(x) = \pi^3 + 1$
e) $f(x) = 2e^{4x}$
f) $f(x) = e^{-x}$
g) $f(x) = e^{\frac{-2x}{3}}$
h) $f(x) = e^{\pi}$
i) $f(x) = \sqrt{x} + 1$
j) $f(x) = \frac{2}{x^3} + x$

Application of Derivatives

Increasing/decreasing

How do you tell when a function $f(x)$ is increasing/decreasing?

Practice.

2. Determine the intervals on which the function is increasing/decreasing.

a) $f(x) = 3x + 1$
b) $f(x) = 4x^2 + 2x + 1$
c) $f(x) = 3x^2 - 4x - 10$
d) $f(x) = x^3 - 3x$
e) $f(x) = -2x^3 + 3x - 10$

Local maximum/minimum

How do you tell when a function $f(x)$ has a local maximum/local minimum?

Practice.

3. Find the local extremum (y-value) of the following functions. Determine whether it is a local maximum or a local minimum.

a) $f(x) = 2x^2 - 3x + 8$
b) $f(x) = x^2 + 9x - 10$
c) $f(x) = -4x^2 + x + 34$

Concavity

How do you tell when a function $f(x)$ is concave up/concave down?

Practice.

4. Determine the intervals on which the function is concave up/ concave down.
a) $f(x) = -6x^2 + 2x + 1$
b) $f(x) = x^3 + x^2 + x + 1$
c) $f(x) = 2x^3 - x^2 + 10$
d) $f(x) = \frac{1}{12}x^4 - \frac{1}{3}x^3 + \frac{1}{2}x^2 - 9$

Tangent line & approximation

How do we find equation of a tangent line and how do we use it to approximate the function?

Practice.

5. Let $f(x) = 4x^4 + x^3 - 1$. Find the equation of tangent line at $x = 1$. Use the tangent line to approximate $f(1.1)$.
6. Let $f(x) = e^{7x} + x + 1$. Find the equation of tangnet line at $x = 0$. Use the tangent line to approximate $f(-0.01)$.
7. Let $f(x) = \sqrt{x}$. Use tangent line approximation to estimate $\sqrt{10}$. (Hint: What should the base point of the tangent line be?)
8. Use a tangent line approximation to estimiate $\sqrt{9}$. (Hint: What function f should we use? What should be the base point of the tangent line?)

Applying derivative on a word problem.

The key point is to know that

**Derivative of f= Rate of change of f **

If you need practice, do problem from the textbook:
p.140 - p.141 - increasing/decreasing
p.148 - p.149 - local maximum/local minimum