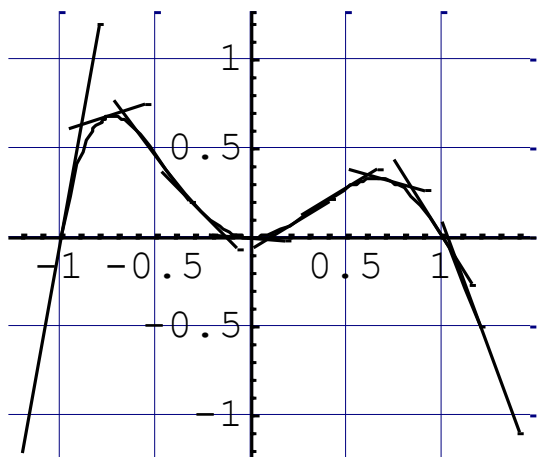
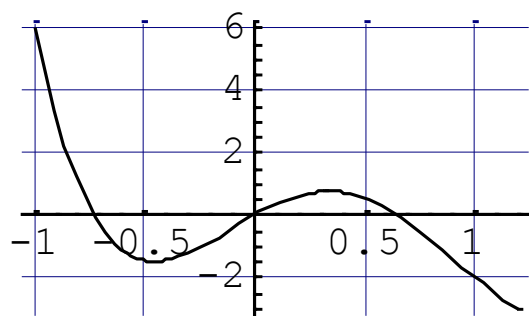


## 6. Concept and graphical meaning of derivative



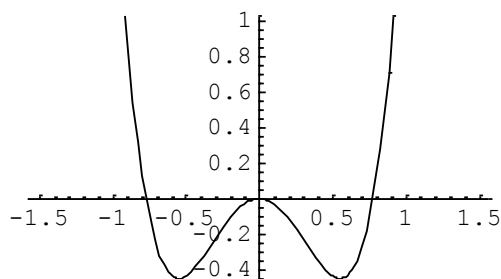
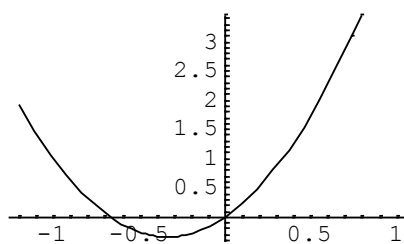
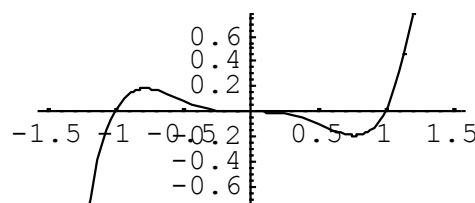
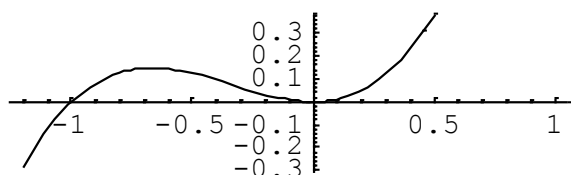
$f(x)$

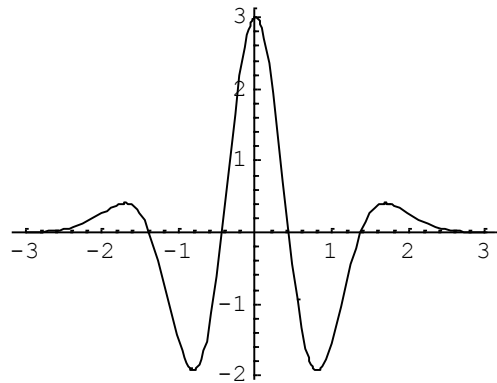
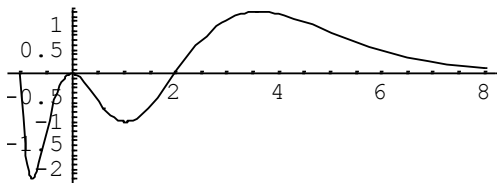
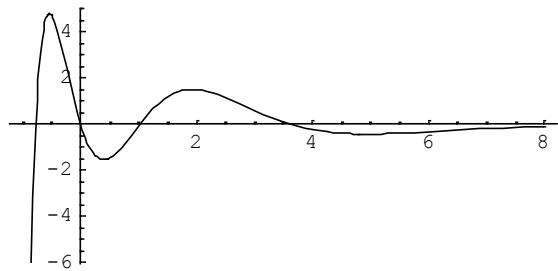
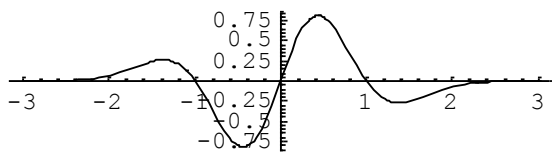
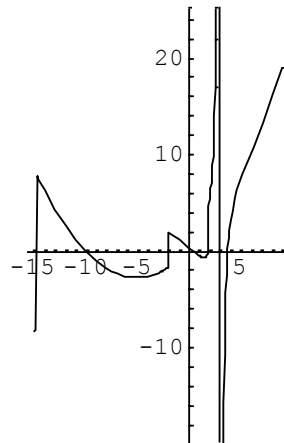
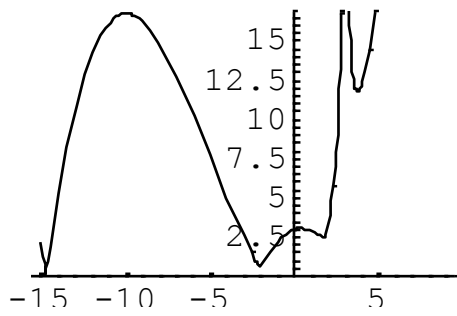
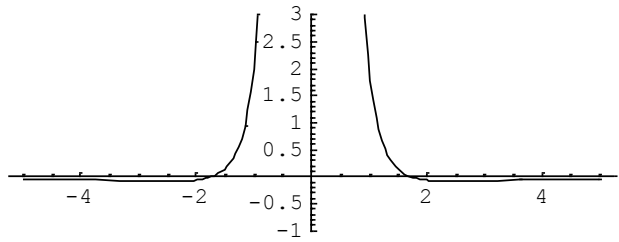
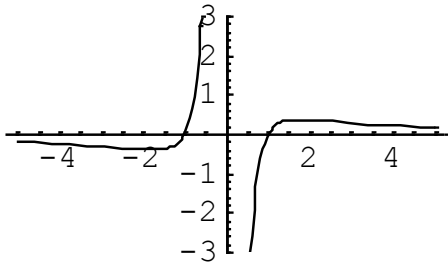
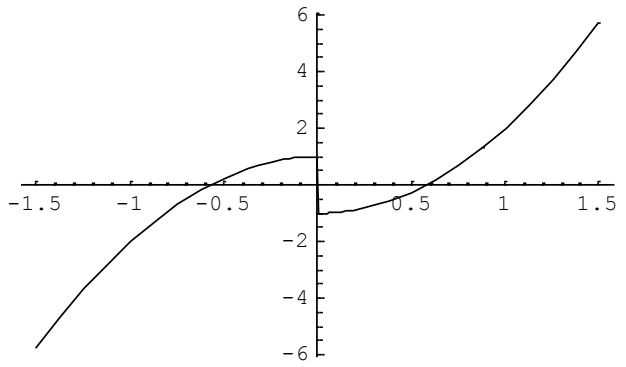
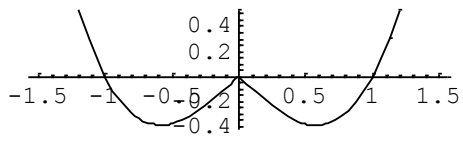


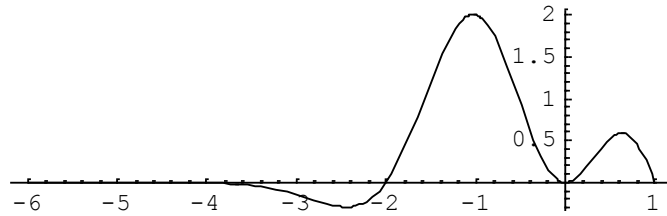
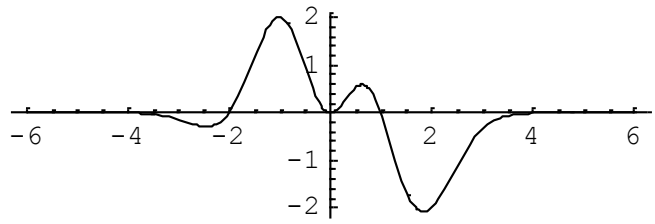
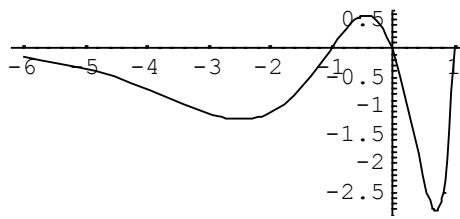
$f'(x)$

### PROBLEM 1

Plot the derivative of the following functions!

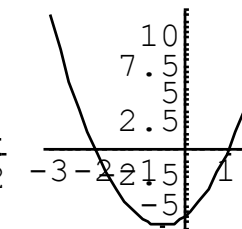
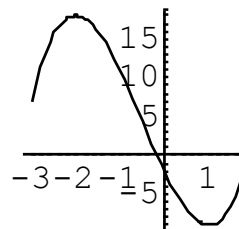
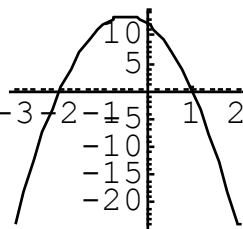
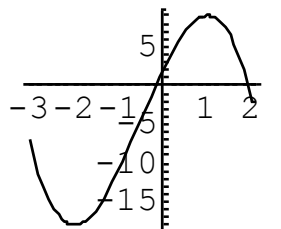
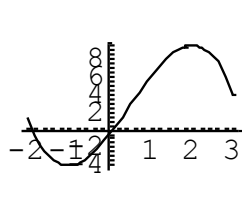
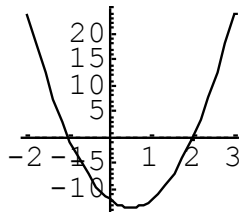
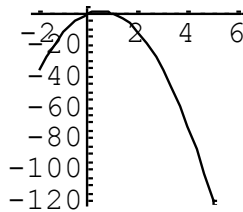
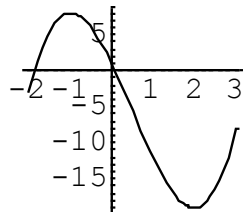
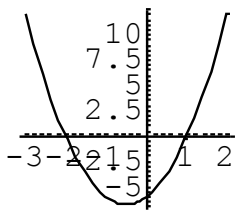
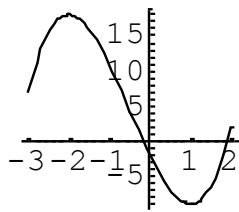
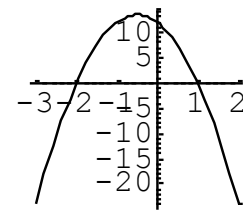
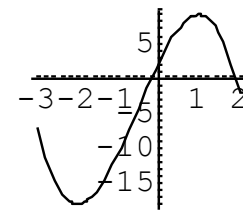
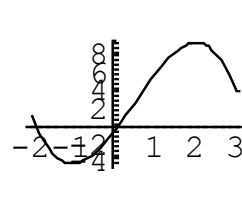
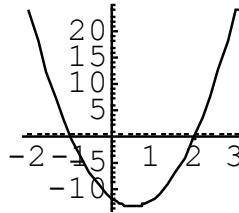
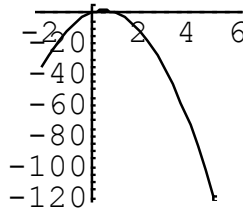
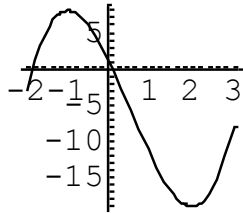






## PROBLEM 2

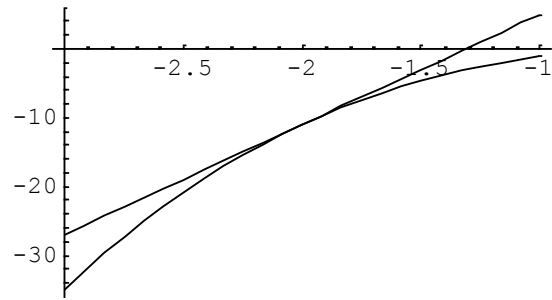
The first figure shows the graph of  $f$ . Choose the derivative from the others.



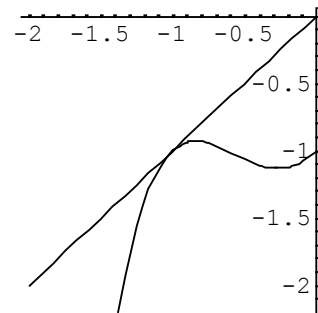
### PROBLEM 3

What is the equation of the tangent line at the given place. Sketch the graph of it.

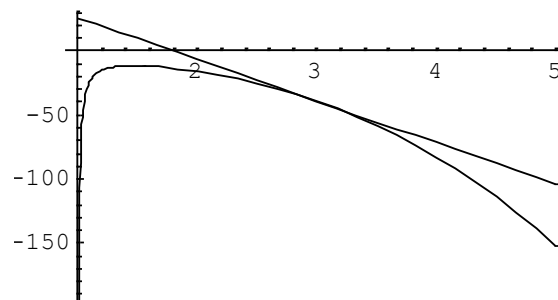
$$f(x) := x^3 - x^2 + 1; x_0 = -2;$$



$$f(x) := -x^4 + 2x^2 + x - 1; x_0 = -1;$$



$$f(x) := \frac{-x^4 + x^2 - 2x}{x - 1}; x_0 = 3;$$



### PROBLEM 4

What is the angle between the graphs of the following functions at their intersection.

$$f(x) := 0.5x^2; g(x) := 4 - 0.5x^2;$$

$$f(x) := x^2 + 4; g(x) := (x + 2)^2;$$

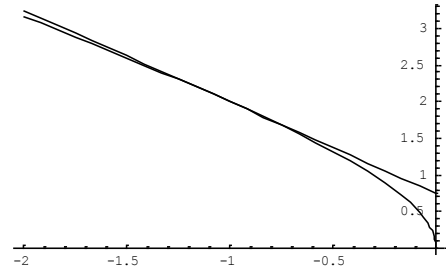
$$f(x) := x^2 + 4; g(x) := x^2 + 4x;$$

$$f(x) := \sqrt{|x|}; g(x) := \frac{x^3}{8};$$

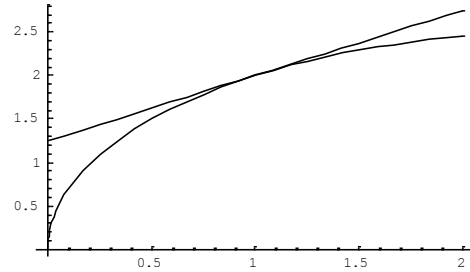
### PROBLEM 5

Approximate the value of the following functions at  $x_1$  with the value of the tangent line at  $x_0$ . Plot their graphs.

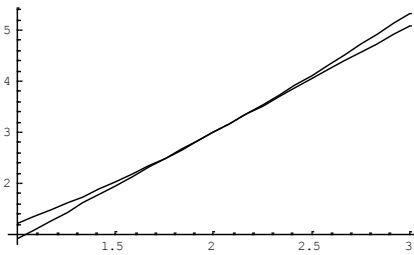
$$f(x) := \sqrt{x^2 - 3x}; x_0 = -1; x_1 = -0.97;$$



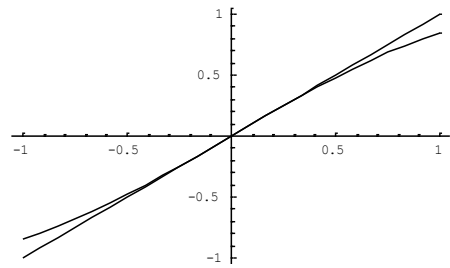
$$f(x) := \sqrt{5x - x^2}; x_0 = 1; x_1 = 0.95;$$



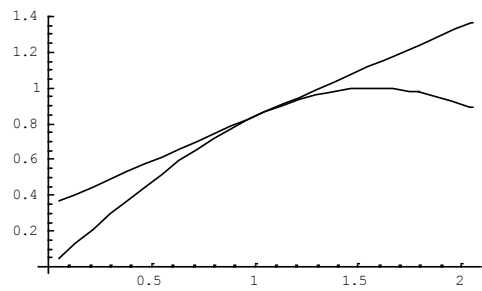
$$f(x) := \sqrt{x^3 + \frac{x}{2}}; x_0 = 2; x_1 = 2.01;$$



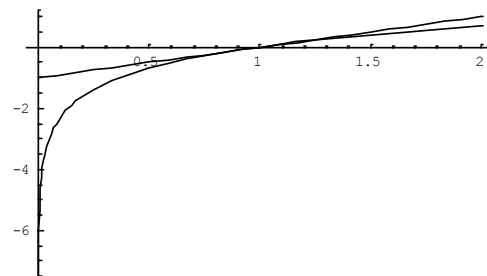
$$f(x) := \sin(x); x_0 = 0; x_1 = 0.1;$$



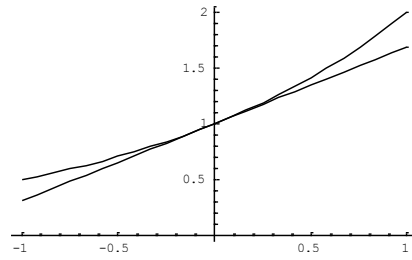
$$f(x) := \sin(x); x_0 = \frac{\pi}{3}; x_1 = \frac{\pi}{3} + 0.05;$$



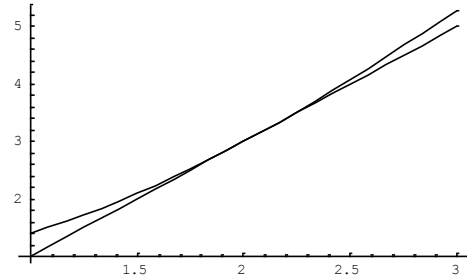
$$f(x) := \log(x); x_0 = 1; x_1 = 1.1;$$



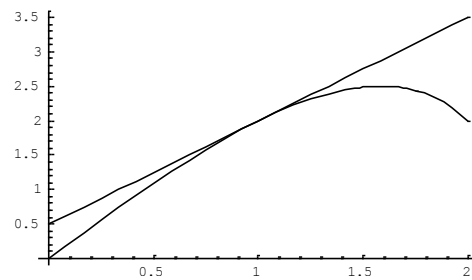
$$f(x) := 2^x; x_0 = 0; x_1 = 0.5;$$



$$f(x) := \sqrt{x^3 + 1}; x_0 = 2; x_1 = 2.1;$$



$$f(x) := \sqrt{5x^2 - x^4}; x_0 = 1; x_1 = 0.9;$$



## PROBLEM 6

Find the equation of the tangent line of  $f(x)$  at  $x_0$ ! At the problems marked with +, plot the graphs. Approximate the value of the function at  $x=x_0+0,1$  and  $x=x_0-0,1$ .

a+)  $f(x) = \sqrt{x-1}$ ,  $x_0 = 3$

b+)  $f(x) = -\frac{x^2}{2} + 3x - 4$ ,  $x_0 = 1$

c+)  $f(x) = \frac{2x+5}{x+2}$ ,  $x_0 = 0$

d+)  $f(x) = 1 - \cos 2x$ ,  $x_0 = \frac{\pi}{4}$

e)  $f(x) = \ln(x^2 + 2x - 2)$ ,  $x_0 = 1$

f)  $f(x) = 2xe^{x+1} + 1$ ,  $x_0 = -1$