

- Make sure you attend the exercise class that you have been assigned to!
 - The instructor will present the starred problem in class.
 - You should then work on the other problems on your own.
 - The instructor and helper will be available for questions.
 - Solutions will be available online after the exercise class took place.
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(*)1. **Definition of derivative.** [(a), (b) 2008 exam questions]

- (a) State the definition of the derivative of the function $f(x)$ with respect to the variable x .
- (b) Differentiate from first principles $f(x) = \sqrt{x}$ by using the definition involving $h \rightarrow 0$.
- (c) Does any tangent to the curve $y = \sqrt{x}$ cross the x -axis at $x = -1$? If so, find an equation for the line and the point of tangency. If not, why not?

2. **Tangent line via derivatives.** [2008 exam question]

Find equations of all lines having slope -2 that are tangent to the curve

$$y = \frac{18}{x+9}.$$

3. **Implicit differentiation.** [2008 exam question]

If

$$x^3 + y^3 = 56,$$

find the values of dy/dx and d^2y/dx^2 at the point $(-2, 4)$.

4. **Differentiation rules** [2008 exam question]

Find the derivative $q'(t)$ of

$$q = \tan \frac{t}{\sqrt{t+2}}.$$

Extra: Suppose that a function f satisfies the following conditions for all real values of x and y :

- i. $f(x+y) = f(x)f(y)$.
- ii. $f(x) = 1 + xg(x)$, where $\lim_{x \rightarrow 0} g(x) = 1$.

Show that the derivative $f'(x)$ exists at every value of x and that $f'(x) = f(x)$.