

Mth 31, Homework 3 on sections 2.7, 2.8

Due by Wed, Sept 25.

Try these 11 questions. Write all your working out and answers by hand on your own notepaper and hand them to me next week. Please use lots of space and as many pages as you want, so I can include corrections or comments. You do not need to write the questions, but it is very important that you show clearly any work you had to do to get your answers. Each question is worth 3 points.

Section 2.7 Derivatives and rates of change

- (1) The derivative of a function $f(x)$ at $x = a$ can be defined as

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$$

as we saw in class.

Let $f(x) = 9x + 10$ and use this limit definition to calculate $f'(5)$.

(No points for any of these questions if you use derivative shortcuts – we'll get to those soon.)

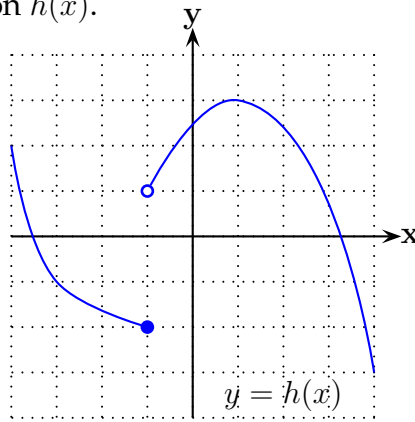
- (2) Let $g(x) = x^2 - 4x$.
- (a) Find $g'(1)$ using the limit definition of the derivative.
 - (b) What is the slope of the tangent line to the graph of g at the point $(1, -3)$?
 - (c) Give the equation of this tangent line.
- (3) For the curve $y = \frac{x-3}{x+2}$ use the limit definition to find its derivative at $x = -1$. Then find the equation of the tangent line at the point $(-1, -4)$.
- (4) The position of a rocket at time t , in seconds, is given by $s(t) = 2t^2 + 6$ measured in meters. Use the limit definition of derivative to find the rocket's velocity at $t = 10$.
(Hint: we want $s'(10)$ and state your answer with the correct units.)
- (5) Use the limit definition to compute $f'(3)$ for $f(x) = \sqrt{2x+10}$.
- (6) Sketch a graph of $g(x)$ if you know that:

$$g(-2) = 3, \quad g'(-2) = -1, \quad g'(0) = 0, \quad g'(2) = 1, \quad g'(4) = 0$$

Section 2.8 The derivative as a function

- (7) For $g(x) = x^2 - 4x$ as in question (2), now use the limit definition of the derivative to find the new function $g'(x)$.

(8) This is the graph of the function $h(x)$.



Estimate:

- (a) $h(0)$
 - (b) $h'(0)$
 - (c) $h(1)$
 - (d) $h'(1)$
 - (e) $h'(3)$
 - (f) $h'(-1)$
- (9) Draw an example of the graph of a function $f(x)$ that is continuous everywhere but not differentiable at $x = 2$. Explain your answer.
- (10) (a) Compute $(x + h)^3$ by multiplying out $(x + h)(x + h)(x + h)$ and simplifying.
(Did you get $x^3 + 3x^2h + 3xh^2 + h^3$?)
- (b) Use part (a) and the limit definition of derivative to find $\frac{d}{dx}x^3$
- (11) Let $f(x) = \frac{1}{2 + x}$
- (a) Use the limit definition of derivative to find $f'(x)$
 - (b) What are the domains of $f(x)$ and $f'(x)$ here?

If you get stuck on a question or aren't sure if you understand it:

- Go over the relevant class notes and section in the textbook.
- Check if you get the right answer for a similar odd-numbered question in the textbook (answers at the back of the book).
- Ask me about it after class.
- Come to my office hours: Mon 12:00 - 1:00, Wed 12:00 - 1:00 in CP 317.
- Go to the Math Tutorial Lab in-person in CP 303 or online.