Write all your working out and answers neatly by hand on your own notepaper. 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 2.8 The derivative as a function

(1) For $g(x) = 3x + 8$ use the limit definition of the derivative to find the function $g'(x)$.

(2) This is the graph of the function $h(x)$.
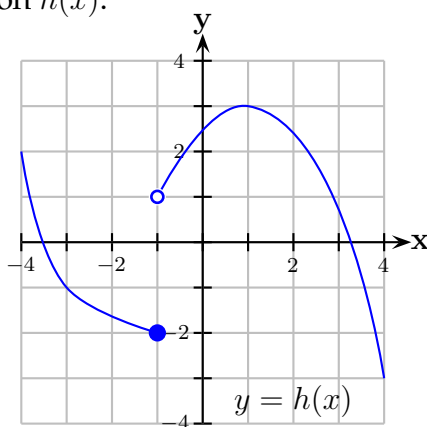
Estimate each of these from the graph:

(a) $h(0)$ and $h'(0)$

(b) $h(1)$ and $h'(1)$

(c) $h'(3)$ and $h'(-1)$

(3) Draw an example of the graph of a function $f(x)$ that is continuous everywhere but not differentiable at $x = 2$. Explain your answer.

(4) (a) Let $f(x) = x^2$ and use the limit definition of the derivative to find $f'(x)$.

(b) Sketch $f(x)$ and $f'(x)$ on the same graph and explain what the graph of $f'(x)$ tells us.

(5) Let $f(x) = \dfrac{1}{x + 2}$

(a) Use the limit definition of derivative to find $f'(x)$

(b) What are the domains of $f(x)$ and $f'(x)$ here?

Section 3.1 Derivatives of polynomials and exponentials

For the following questions use the differentiation formulas

$$\frac{d}{dx}c = 0, \quad \frac{d}{dx}x^n = nx^{n-1}, \quad \frac{d}{dx}e^x = e^x,$$

and the sum, difference, and constant multiple rules.

(6) Differentiate: $f(x) = 3x^4 - \frac{2}{3}x^3 + \sqrt{5}x + 16$

(7) Differentiate: $g(x) = x^{2/3} - \dfrac{1}{x^2} + 4\sqrt{x}$

(8) Differentiate: **(a)** $f(x) = 13e^x - 12$ **(b)** $h(t) = t^6 + \sqrt{3} + t + e^6$
(Hint: don't let part (b) trick you!)

(9) Suppose $y = 4t^2x + tx^5$ and find: **(a)** $\dfrac{dy}{dx}$ **(b)** $\dfrac{dy}{dt}$

(10) Let $y = x + \dfrac{2}{x}$

    (a) Find the equation of the tangent line to this curve at the point $(2, 3)$.

    (b) Find the equation of the normal line to this curve at $(2, 3)$. (The normal line is perpendicular to the tangent line.)

(11) Let $s(t) = t^3 - 9t^2 + t$ give the position of an object in meters after t seconds.

    (a) Find its velocity $v(t)$.

    (b) Find its acceleration $a(t)$.
    (Remember $v(t) = s'(t)$ and $a(t) = v'(t) = s''(t)$.)

    (c) How fast is the object moving after 10 seconds?

    (d) When does the object have zero acceleration?

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 text-book (answers at the back of the book).

- Ask me about it after class.

- Come to my office hours: Mon 11:30 - 12:30, Wed 11:30 - 12:30 in CP 317.

- Go to the Math Tutorial Lab in-person in CP 303 or online.