

MATH 20C
WINTER 2020
SECTION D00 (MANNERS)

HOMEWORK – WEEK 7

Due by 2359 (11:59 PM) on Sunday February 23. Hand in via Gradescope.

For problem 0, credit is awarded for any honest response, not for the amount of work undertaken.

For problems 1, 2 and 3, you *must* give a fully written-out solution showing all your working and justification. Stating the correct answer, by itself, will earn no credit.

0. Do the following textbook problems. *Do not turn them in*, but provide a list here of those for which you wrote down solutions.

§3.1: 1, 3, 7(b), 9

§3.3: 1, 7, 9, 17, 19

(1 points)

1. A function $f(x, t)$ obeys the *one-dimensional wave equation*¹ if

$$\frac{\partial^2 f}{\partial x^2}(x, t) = \frac{1}{c^2} \frac{\partial^2 f}{\partial t^2}(x, t)$$

holds for all x, t . Which of the following functions obey the one-dimensional wave equation?

(a) $f(x, t) = \sin(x - ct)$;

(b) $f(x, t) = \sin(x) \sin(ct)$.

2. Consider the function $f(x, y) = x^2 + y^2 - (x^2 + y^2)^2$.

(a) Find all the critical points of f .

(b) Identify any of these critical points where the second derivative test is conclusive, and classify them as maxima / minima / saddle points.

(c) By means of suitable sketches / level set plots / etc. of the graph $z = f(x, y)$, describe in words or pictures the behavior of f at the remaining critical points.

(6 points)

3. Consider the function

$$f(x, y) = 1 + xy - 2x + y.$$

(a) Find and classify all the critical points of f .

(b) Find the absolute maximum and minimum values of f over the triangular region D with vertices $(-2, 1)$, $(-2, 5)$ and $(2, 1)$. Give all points where these maximum and minimum values occur.

¹This is a sort of physics

(6 points)