# MATH 251 (PHILLIPS): WRITTEN HOMEWORK 2.

This homework sheet is due in class on Wednesday 15 January 2025 (week 2), in class. Write answers on a separate piece of paper, well organized and well labelled, with each solution starting on the left margin of the page.

All the requirements in the sheet on general instructions for homework apply. In particular, show your work (unlike WeBWorK), give exact answers (not decimal approximations), and **use correct notation.** (See the course web pages on notation.) Some of the grade will be based on correctness of notation in the work shown.

10 points per problem, total 50 points.

1. A version of Midterm Zero administered to a class of fire breathing monsters on the planet Yuggxth contained the following problem:

Determine the exact value of the **slope** of the line in the graph below.
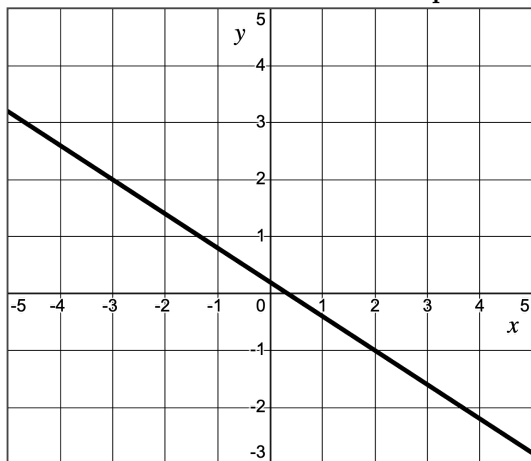
Some of the papers turned in were too badly burned to be read, but among those that could be read, the answers listed below were found. Keeping in mind that the scales on the two axes are the same, four of these answers are obviously wrong, that is, can be seen to be wrong without calculating anything. For each of those four, explain why that answer is obviously wrong. Also, determine whether any of them is correct, stating, for each, "correct" or "wrong" as appropriate.

(a) $\frac{3}{5}$.

(b) -17.

(c) $-\frac{1}{20}$.

(d) $-\frac{3}{5}$.

(e) $y = -\frac{3}{5}x + \frac{1}{5}$.

(f) $-\frac{4}{5}$.

2. Find the derivative of the function $g(t) = 4t^3 - at^2 + \pi^2$. ($a$ is a *constant*.)

Comtinued on back or on next page.

Date: 11 January 2025 .

3. This problem is about using correct notation. Accordingly, almost all the credit is for correctness of notation.

Consider the problem of finding the exact value of $\lim\limits_{x\to 3} \dfrac{x\cos(x) + x - 3\cos(x) - 3}{x\cos(x) + 2x - 3\cos(x) - 6}$. The method is to factor the numerator and denominator, and cancel the common factor. The factors of the numerator are $x - 3$ and $\cos(x) + 1$, and the factors of the denominator are $x - 3$ and $\cos(x) + 2$.

Write out the calculation in full, in correct notation which exhibits correctly the steps of the calculation. Start at $\lim\limits_{x\to 3} \dfrac{x\cos(x) + x - 3\cos(x) - 3}{x\cos(x) + 2x - 3\cos(x) - 6}$. Show at least the following steps:

   (1) After factoring but before cancellation.
   (2) After cancellation but before substituting $x = 3$.
   (3) After substituting $x = 3$ but before possible simplification.
   (4) The simplified final result, if the result in the previous step can be simplified. (Don't use a decimal approximation to $\cos(3)$, and don't give a decimal approximation to the final answer.)

4. This problem is about using correct notation. Accordingly, almost all the credit is for correctness of notation.

Consider the problem of finding the exact value of $\lim\limits_{x\to -1} \dfrac{x^7 + x^6 + 5x + 5}{x + 1}$. The method is to factor the numerator and cancel one of the factors. The factors of the numerator are $x + 1$ and $x^6 + 5$.

Write out the calculation in full, in correct notation which exhibits correctly the steps of the calculation. Start at $\lim\limits_{x\to -1} \dfrac{x^7 + x^6 + 5x + 5}{x + 1}$. Show at least the following steps:

   (1) After factoring but before cancellation.
   (2) After cancellation but before substituting $x = -1$.
   (3) After substituting $x = -1$ but before possible simplification.
   (4) The simplified final result, if the result in the previous step can be simplified.

5. For the function $y = q(x)$ graphed below, answer the following questions.
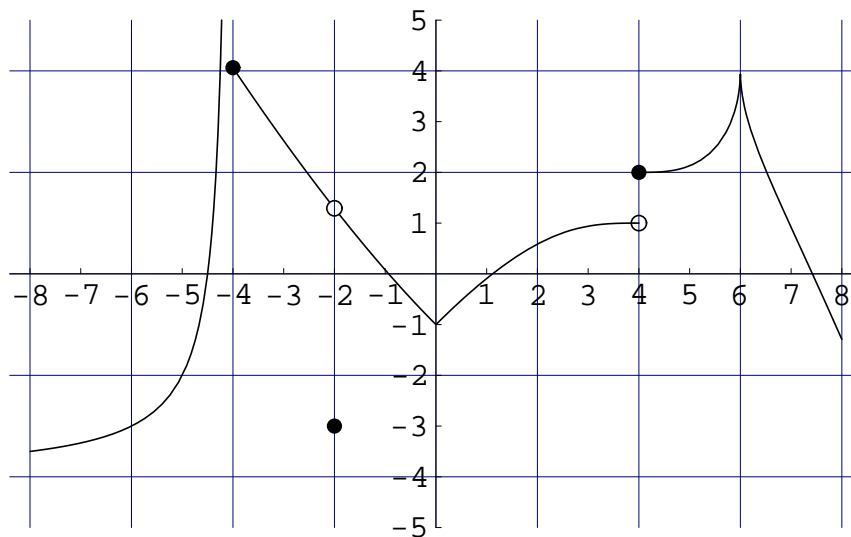
   (a) List all numbers a in $(-8, 8)$ such that q is not continuous at a. Give reasons.

   (b) Find the largest interval containing -3 on which q is continuous.