

MATH 180 Workshops

Workshops are a *1.5 hour facilitated learning activity* designed to be of benefit to first year Calculus students. Previous study suggests that students grades on the final exam are improved through the workshop activity. Attendance is *mandatory* with 7.5% of the course grade based on the workshops. See the separate grading scheme for details.

Workshop Activities: During the workshops you will be

- actively thinking about and solving problems involving calculus,
- practicing doing calculations,
- interacting with peers to solve problems involving Mathematics,
- receiving feedback to help you identify and work on correcting possible weaknesses.

Learning Goals: From the activities in the workshops you will

- after reading a problem, be able to correctly state in your own words what the problem is asking and what information is given that is needed in order to solve the problem;
- after restating the problem, be able to identify which mathematical techniques and concepts are needed to find the solution;
- be able to apply those techniques and concepts and correctly perform the necessary algebraic steps to obtain a solution.

The workshops should help you to judge in advance what is a suitable solution method. And after solving a problem, you should be more able to judge if the solution makes sense.

Understand that the workshops are *not* a replacement for home study. They will assist you in identifying your areas of weakness and helping you to develop your ability to learn and analyze problems. MATH 180 has 4 credits and so you should expect to do $1/3$ more work than for a regular 3 credit course perhaps on average 8 hours work outside of class per week.

Workshop Format: The workshop format will involve having you split up into groups of 3 or 4 students. You will have a worksheet and you will go through the problems in turn on the blackboard and will get feedback from the TAs on your progress. They will also facilitate you in thinking about the problems but they are not there to give you the answer. Writing things down (on the blackboard) will be a good way to learn some strategies for doing problems, confront your weaknesses and identify areas for home study. At the end of most workshops, you will also work individually on a problem that you will hand in. This problem will be similar to one of the problems you've been working on in your group.

Role of TAs: TAs will give you feedback on your progress as you work through a problem. They will also facilitate you in thinking about the problems but they are not there to give you the answer. They may be give you hints and suggestions on how to approach a problem, or prompt you to discover for yourself the reason for your errors.

Math 180 Workshop - Problems #1, Week of September 9, 2012

Website for solutions: <http://www.math.ubc.ca/~gupta/workshops/> (solutions posted at week's end)

Basic Skills required to work through the workshop problems:

- factoring quadratic and cubic polynomials;
- manipulating (factoring, simplifying, rationalizing, etc.) expressions with ratios and square roots of polynomials;
- interpreting and manipulating expressions containing absolute values;

Learning Goals: After completing this workshop, you should be able to:

- master the basic skills listed above;
- compute the limit of a function at a point using limit laws and algebraic manipulation techniques, or determine that such limit does not exist.

If at the end of this workshop you do not feel comfortable with any of the basic skills listed above, make sure you spend extra time at home reviewing them.

1. (*Warm up*) (i) Write out factorizations of the following expressions:

(a) $x^2 - 25$ (b) $x^2 - x - 2$ (c) $x^3 - 1$

- (ii) Simplify:

(a) $\frac{x^2 - 25}{x + 5}$ (b) $\frac{x^2 - x - 2}{x - 2}$ (c) $\frac{x^2 - 1}{x^3 - 1}$

2. Evaluate the following limits. In each case, explain

(i) what the problem is asking (e.g. explain what it means to evaluate the limit of a function at a point)

(ii) what strategy you are using to solve the problem (e.g. are you using Direct Substitution? what algebraic manipulation are you using? etc.),

(iii) why you are using that particular strategy (e.g. why does Direct Substitution not apply? etc.).

(a) $\lim_{x \rightarrow -5} \frac{x^2 - 25}{x + 5}$ (b) $\lim_{x \rightarrow -1} \frac{x^2 - 25}{x + 5}$ (c) $\lim_{x \rightarrow 2} \frac{x^2 - x - 2}{x - 2}$ (d) $\lim_{x \rightarrow 1} \frac{x^2 - 1}{x^3 - 1}$

3. Evaluate the following limit:

$$\lim_{x \rightarrow -2} \frac{\frac{1}{x} + \frac{1}{2}}{x^3 + 8}$$

4. Evaluate the following limit:

$$\lim_{x \rightarrow 0} \frac{x}{|x - 1| - |x + 1|}$$

5. Evaluate the following limit:

$$\lim_{t \rightarrow 0} \left(\frac{1}{t\sqrt{1+t}} - \frac{1}{t} \right)$$

6. Show by means of example that

$$\lim_{x \rightarrow a} [f(x) + g(x)]$$

may exist even though neither

$$\lim_{x \rightarrow a} f(x)$$

nor

$$\lim_{x \rightarrow a} g(x)$$

exists.