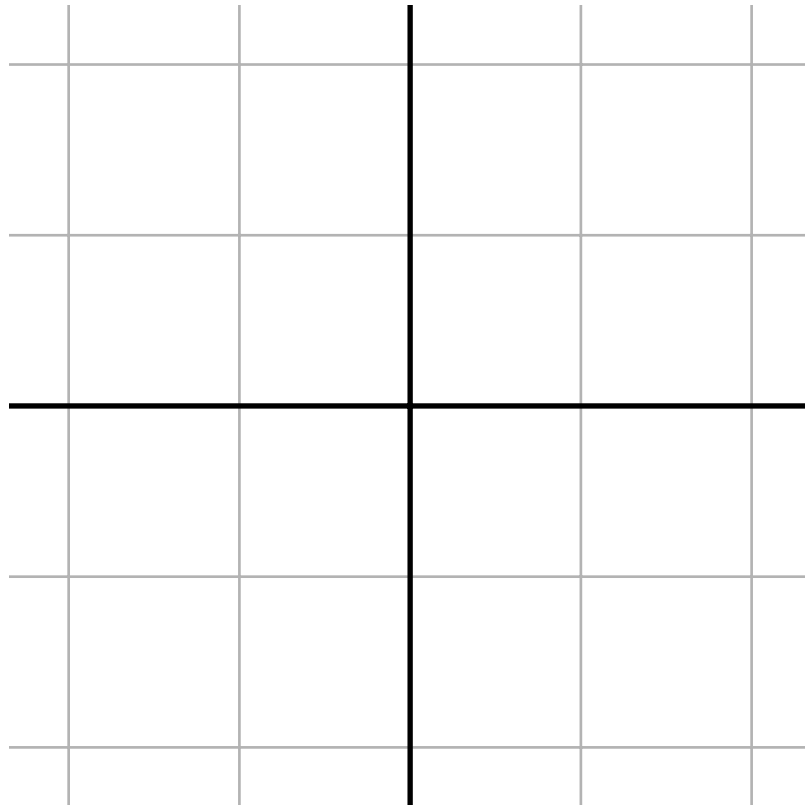


[10] 1. Let

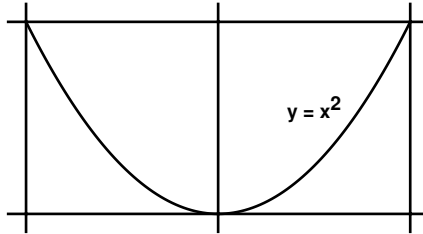
$$M = \begin{bmatrix} 1 & -1 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix} .$$

If M is considered as the matrix of a projective transformation, what quadrilateral does it take the unit square with corners at $(0, 0)$ and $(1, 1)$ to? Draw the figure below (1×1 grid), and indicate exact coordinates.



- [10] 2. A certain affine function $Ax + By + C$ is equal to -4 at $(0, 0)$ and 7 at $(1, 2)$. At what point on the line segment between these two points is it equal to 0 ?

- [10] 3. Write a complete PostScript program that produces the following picture:



Points will be given for the simplicity and readability of your code. Put in only what is necessary.

- [10] 4. What does the following fragment of PostScript code draw? Assume units in inches, origin centred. Show it below. Include calculations so I can see what you've done.

```
3 {  
  newpath  
  -1 -1 moveto  
  2 0 rlineto  
  0 2 rlineto  
  -1 1 lineto  
  closepath  
  stroke  
  45 rotate  
  0.5 dup scale  
} repeat
```

Indicate features of the drawing carefully.

- [10] 5. On the next few pages, draw a sequence of diagrams, with as little text as possible, explaining how to construct a regular pentagon inside a given circle with ruler and compass. Explain as you do this why the construction works.

**The University of British Columbia
Midterm Examination
October 24, 2003
Mathematics 308
Section 101
Instructor: Bill Casselman**

Duration: 50 minutes

- Be sure that you have 7 pages in addition to this one.
- Put your name below and on the **back** of the other pages.
- In all questions, **you must show work** — i.e. display intermediate results — to get full credit.
- Partial credit will be given only for well defined steps in a problem. Algebraic and arithmetical mistakes will be treated no differently from conceptual errors.
- You may use a calculator and drawing tools.
- Be neat! I will not attempt to decipher messy calculations.
- *All work you wish to be graded must be placed on these sheets. Work books should be used for scrap work only, and must not be handed in. I will simply throw away any other papers I receive.*

First Name _____ Last Name _____

Signature _____ Student Number _____

Rules governing examinations

- Each candidate should be prepared to produce upon request his library/AMS card.
- No candidate shall be permitted to enter the examination room after the expiration of one half hour, or to leave during the first half hour of the examination.
- Candidates are not permitted to ask questions of the invigilators, except in cases of supposed errors or ambiguities in examination questions.
- **CAUTION** - Candidates guilty of any of the following or similar practices shall be immediately dismissed from the examination and shall be liable to disciplinary action.
 - (a) Making use of any books, papers, or memoranda, other than those authorized by the examiners.
 - (b) Speaking or communicating with other candidates.
 - (c) Purposely exposing written papers to the view of other candidates.
- Smoking is not permitted during examinations.

1.	2.	3.	4.	5.	Total
10	10	10	10	10	50