

**College Algebra — Exam 3**  
**MAT 140C, Fall 2024 — D. Ivanšić**

**Name:** \_\_\_\_\_

*Show all your work!*

Simplify, so that the answer is in form  $a + bi$ .

1. (4pts)  $3i(4 - 5i) + 2i(-1 + 4i) =$

2. (6pts)  $\frac{3 + i}{1 - 2i} =$

3. (4pts) Simplify and justify your answer.

$i^{86} =$

4. (6pts) Solve the equation by completing the square.

$x^2 - 10x = -5$

5. (6pts) Solve the inequality. Write the solution in interval form.

$|2x - 7| > 3$

6. (6pts) Let  $P(x)$  be a polynomial of degree 4.

a) Draw a graph of  $P$  that has the maximal number of  $x$ -intercepts.

b) Explain why the graph of  $P$  has to have at least one turning point.

**7.** (12pts) The quadratic function  $f(x) = x^2 - 4x + 5$  is given. Do the following without using the calculator.

a) Find the  $x$ - and  $y$ -intercepts of its graph, if any.

b) Find the vertex of the graph.

c) Sketch the graph of the function.

Solve the equations:

**8.** (8pts)  $\frac{x}{x+1} + \frac{16}{x^2 - 6x - 7} = \frac{2}{x-7}$

**9.** (8pts)  $x + \sqrt{22 - x} = 2$

**10.** (14pts) The polynomial  $f(x) = (x + 3)(x - 1)^2(x - 4)^2$  is given.

a) What is the end behavior of the polynomial?

b) List all the zeros and their multiplicities. Find the  $y$ -intercept.

c) Use the graphing calculator along with a) and b) to accurately sketch the graph of  $f$  (yes, on paper!).

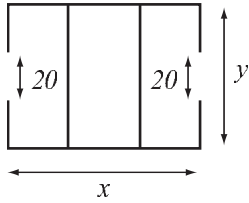
d) Find all the turning points (i.e., local maxima and minima) with accuracy 6 decimal points.

**11.** (12pts) In a right triangle, the longer side is twice the length of the shorter side, and the hypotenuse is 4 centimeters longer than the shorter side. What is the length of the shorter side in this right triangle?

**12.** (14pts) A logistics company is building a warehouse whose floorplan is below. It has two entrances of width 20 feet. It has budgeted enough money to build 600 feet of walls, and its goal is to maximize the total area of the warehouse.

a) Express the total area of the warehouse as a function of the length of one of the sides. What is the domain of this function?

b) Graph the function in order to find the maximum (no need for the graphing calculator — you should already know what the graph looks like). What are the dimensions of the warehouse that has the biggest possible total area, and what is the biggest possible total area?



**Bonus.** (10pts) Find all solutions to the equation.

$$|x^2 - 10x + 23| = 2$$