

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

Name: _____
Show all your work!

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

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

2. (5pts) $\frac{3 + 2i}{-2 - i} =$

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

$i^{111} =$

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

$x^2 - 14x = 15$

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

$|3x + 2| \leq 4$

6. (6pts) Let $P(x)$ be a polynomial of degree 5.

a) Draw a graph of P that has the maximal number of turning points.

b) Explain why a P with 4 x -intercepts and 2 turning points is not possible.

7. (12pts) The quadratic function $f(x) = -x^2 - 3x + 18$ 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) $\frac{2}{x} = \frac{x+1}{x-4} + \frac{2x-28}{x^2-4x}$

9. (8pts) $x + \sqrt{5x-26} = 4$

10. (14pts) The polynomial $f(x) = (x + 2)(x - 3)^2(1 - x)$ 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!).

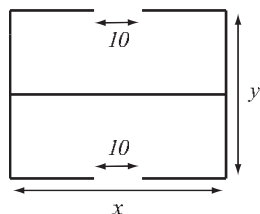
d) Find all the turning points (i.e., local maxima and minima) with accuracy 6 decimal points.

11. (12pts) The combined area of two squares is 84 cm^2 . If the larger square has sides 2 cm longer than the smaller square, what are the lengths of the sides of the two squares?

12. (14pts) Jeffrey is designing a combo gas station / fast food restaurant building with 10-foot wide entrances on either side. His budget allows for 350 feet of total wall length. Jeffrey's goal is to maximize the total area of the building.

a) Express the total area of the building 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 building that has the biggest possible total area, and what is the biggest possible total area?



Bonus. (10pts) Find the equation of the parabola that goes through the points $(-2, 21)$, $(0, 7)$ and $(2, 9)$. *Hint: you are looking for an equation of form $y = ax^2 + bx + c$ with unknown a , b and c . Use the three listed points to get equations for a , b and c and solve them.*