

MATH 120
SPRING 2024
EXAM 3

NAME:

1. 10 pts. Find the exact distance and midpoint between the points $(-2, 5)$ and $(8, -1)$.
2. 15 pts. Complete the square and write the equation $x^2 + 10x + y^2 - 4y - 20 = 0$ in the standard form (or center-radius form) for a circle. What is the center and radius of the circle?
3. 15 pts. Find the vertex of the parabola given by $f(x) = x^2 - 2x - 15$. In interval notation, what is the domain and range of the function?
4. 15 pts. You have 80 meters of fencing to enclose a rectangular region. Find the dimensions of the rectangle that maximize the enclosed area. What is the maximum area?
5. 10 pts. Divide using long division: $(x^4 + 2x^3 - 9x - 16) \div (x^2 - 2x + 1)$.
6. 10 pts. Find a 3rd-degree polynomial function f having real coefficients, zeros -3 and $2 + i$, and such that $f(1) = 10$.
7. 15 pts. Consider the equation

$$x^4 - 3x^3 - 20x^2 - 24x - 8 = 0.$$

List all the possible rational roots. Use synthetic division to test the possible rational roots and find actual roots. Then find *all* solutions to the equation, real or complex.

8. 20 pts. Use the 7-step procedure used in homework to sketch a graph of the rational function

$$R(x) = \frac{x^3 + 1}{x^2 + 2x}.$$

The steps are: (1) Domain; (2) Symmetry; (3) Intercepts; (4) Vertical asymptotes and holes; (5) Horizontal/slant asymptote; (6) Plot additional points as necessary; (7) Graph.

9. 10 pts. each Solve each inequality, showing use of test values and the Intermediate Value Theorem. Put answers in interval notation.
 - (a) $x^3 + x^2 + 4x + 4 > 0$
 - (b) $\frac{x - 2}{x + 2} \leq 2$