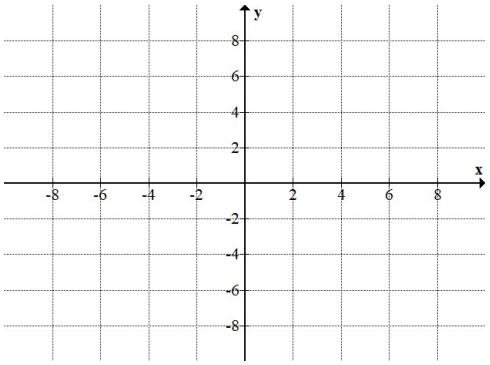
NAME: _____ .

MATH 113:	TEST 3

No phones. You are allowed a calculator and a sheet of notes front and back. At least 150pts to earn here. Thanks!

Problem 1: (10pts) Factor $f(x) = x^2 - 12x + 38$ over $\mathbb{R}$ if possible, find the vertex of the parabola $y = f(x)$, and graph $y = f(x)$ carefully in the plot provided:

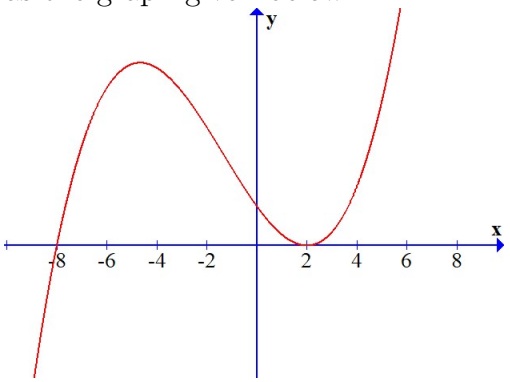


Problem 2: (15pts) Solve $\dfrac{1}{x^2 + 2x - 3} > 0$ and write your answer using interval notation.

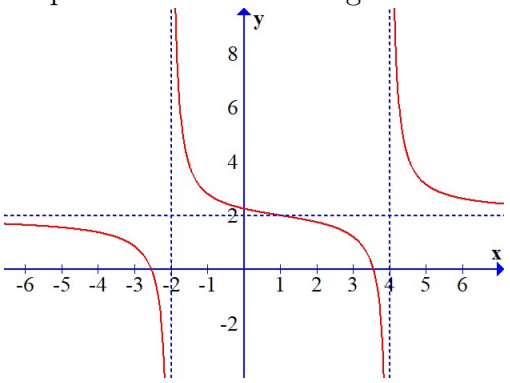
Problem 3: (15pts) Solve $\dfrac{x+4}{x-3} \leq 1$. Write the answer in interval notation.

Problem 4: (15pts) Suppose a polynomial $P(x)$ has a graph which crosses the x-axis at $x = -4$ and bounces off the x-axis at $x = 5$. Find formula of $P(x)$ given that the y-intercept is -200.

Problem 5: (15pts) Find $P(x)$ which could have a graph which shares the same shape and x-intercepts as the graph given below:



Problem 6: (10pts) Find a rational function $f(x)$ which could have a graph which shares the same shape as well as matching horizontal and vertical asymptotes of the graph given below:



Problem 7: (15pts) Let $P(x) = x^4 + 2x^3 - 5x^2 - 6x$. Show that 2 is a zero of $P(x)$ and factor $P(x)$ completely over $\mathbb{R}$.

Problem 8: (15pts) Factor $f(x) = x^4 - 2x^3 + x^2 + 18x - 90$ completely over $\mathbb{R}$. Hint: $f(1+3i) = 0$.

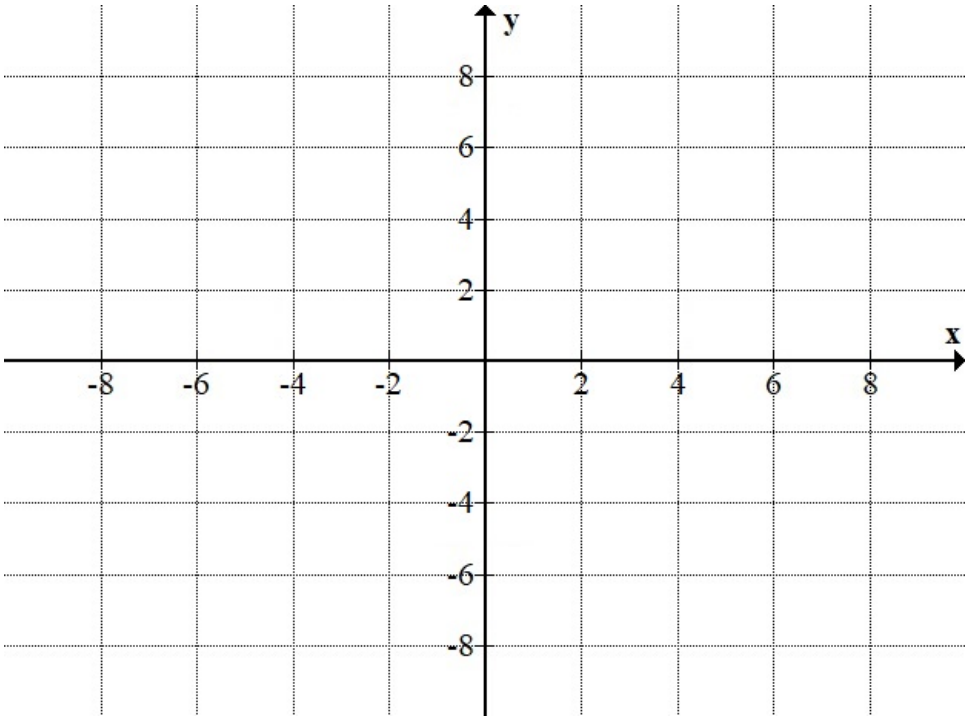
Problem 9: (15pts) It is known that $P(x) = x^3 - 7x^2 + 7x + 15$ has real zeros which are integers. Factor $P(x)$ completely. *Hint: use the Rational Roots Theorem*

Problem 10: (20pts) Factor the following polynomials completely over the complex numbers.

(a.) $x^4 - 6x^3 + 11x^2$

(b.) $x^4 - 8x^2 - 7$

Problem 11: (10pts) Consider the rational function $f(x) = \dfrac{2x^2}{16x - x^3}$. Find all vertical or horizontal asymptotes, as well as any holes in the graph. Graph the function carefully with each feature clearly labeled.



Problem 12: (5pts) Write the range of function in the previous problem in interval notation.