NAME: _____ .

| MATH 113: | QUIZ 3 |
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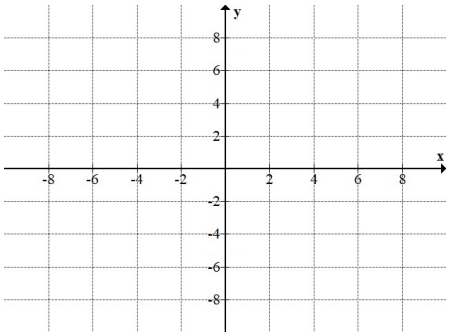
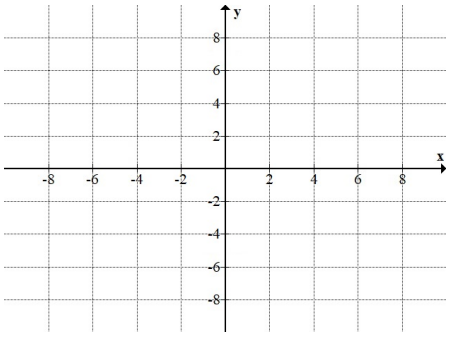
*No phones. You are allowed a calculator and a sheet of notes front and back. 45 minutes to take this Quiz. At least 25pts to earn here. Thanks!*

**Problem 1:** (4pts) Calculate the discriminant for each $f(x)$ given below and factor $f(x)$ over $\mathbb{R}$ if possible. In addition, graph $y = f(x)$ carefully in the plot provided:

**(a.)** $f(x) = x^2 - 6x + 7$

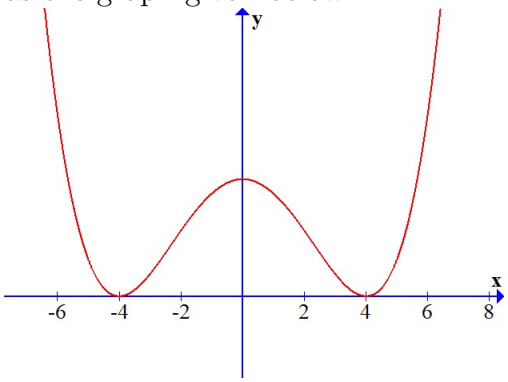



**(b.)** $f(x) = x^2 - 4x + 5$

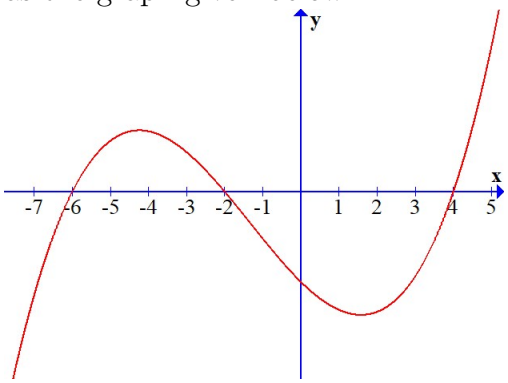



**Problem 2:** (2pts) Suppose a polynomial $P(x)$ has a graph which crosses the $x$-axis at $x = 3$ and bounces off the $x$-axis at $x = -2$. Find formula of $P(x)$ given that the $y$-intercept is 10.

**Problem 3:** (2pts) Find $P(x)$ which could have a graph which shares the same shape and $x$-intercepts as the graph given below:




**Problem 4:** (2pts) Find $P(x)$ which could have a graph which shares the same shape and $x$-intercepts as the graph given below:




**Problem 5:** (2pts) Let $P(x) = x^3 + x^2 - 4x - 4$. Show that $-1$ is a zero of $P(x)$ and find all the other zeros of $P(x)$. *Hint: factoring by grouping is a good idea here*

**Problem 6:** (3pts) Factor $f(x) = x^4 + 7x^3 + 7x^2 + 7x + 6$ completely over $\mathbb{R}$. Hint: $f(i) = 0$.

**Problem 7:** (1pts) If $R(x) = 3x^5 + 3x^3 + 4x^2 - 2$ then use the Rational Roots Theorem (aka the Rational Zeros Theorem) to list all possible rational zeros for $R(x)$.

**Problem 8:** (2pts) It is known that $P(x) = x^3 - 4x^2 - 7x + 10$ has real zeros which are integers. Factor $P(x)$ completely. *Hint: use the Rational Roots Theorem*

**Problem 9:** (2pts) Factor the following polynomials completely over the complex numbers.

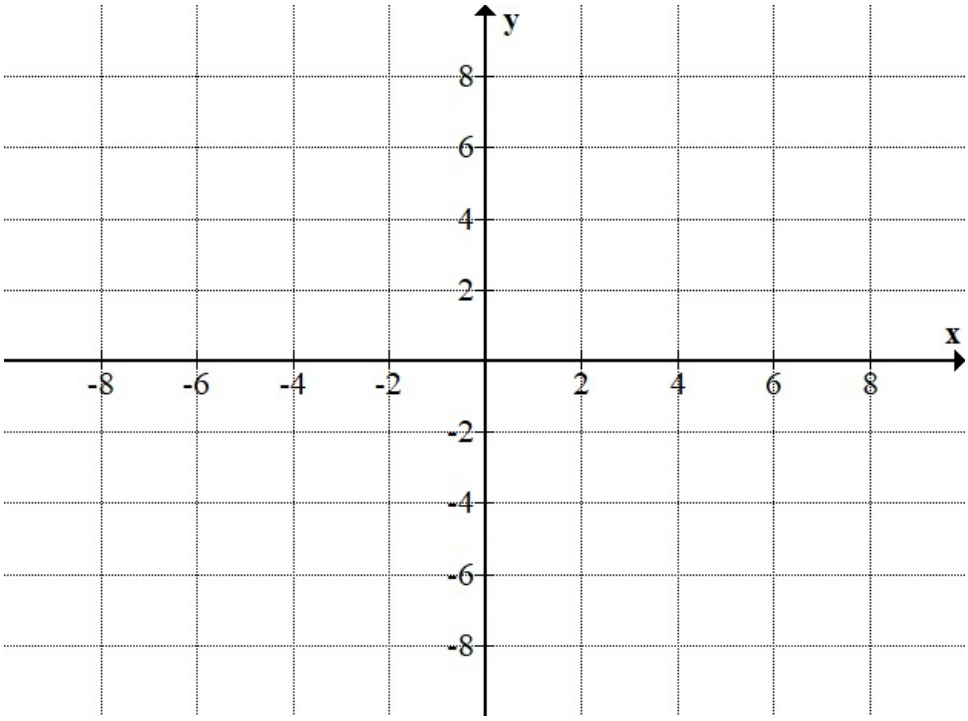
**(a.)** $x^4 - 4x^3 + 5x^2$

**(b.)** $x^4 - 5x^2 - 6$

**Problem 10:** (2pts) Solve $x^3 - 4x^2 + 3x \geq 0$. Write the answer in interval notation.

**Problem 11:** (2pts) Solve $\dfrac{x+4}{3x-8} \leq 0$. Write the answer in interval notation.

**Problem 12:** (5pts) Consider the rational function $f(x) = \dfrac{2x^2 - 8x}{x^2 + 2x - 24}$. Find all vertical or horizontal asymptotes, as well as any holes in the graph. Graph the function carefully with each feature clearly labeled.




**Problem 13:** (1pts) Write the range of function in the previous problem in interval notation.