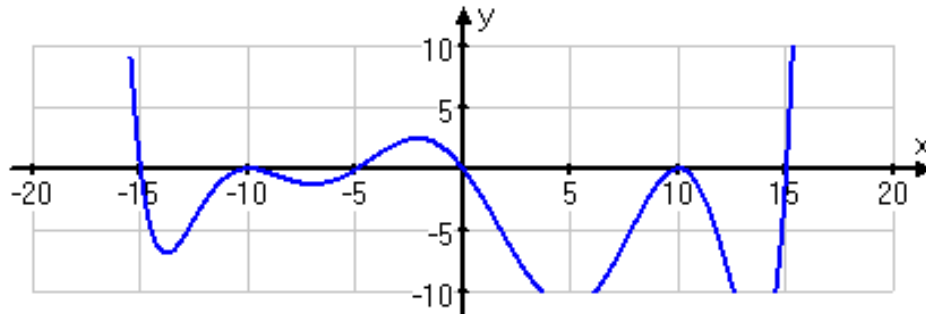
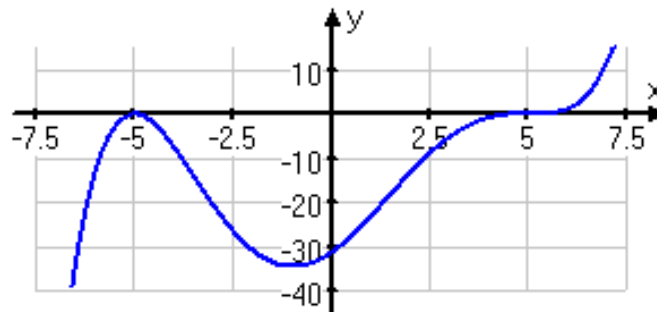


Worksheet: Finding complex roots of polynomials
 Unless otherwise specified, find **simplified, exact answers!!!!**
 Do all work on notebook paper. Calculator is permitted

1. List all possible rational x -intercepts of $y = x^4 + 2x^3 - 7x^2 - 8x + 12$, then find all complex roots. Use your calculator to narrow down your rational root possibilities. Show the synthetic division.
2. List all possible rational x -intercepts of $y = 2x^3 + 3x - 5$, then find all complex roots. Use your calculator to narrow down your rational root possibilities. Show the synthetic division.
3. Use the Rational Roots Test to find possible rational zeroes of $y = 6x^4 - 11x^3 + 8x^2 - 33x - 30$, then find the all complex roots. Use your calculator to narrow down your rational root possibilities. Show the synthetic division. You do not have to list the rational root possibilities.
4. The following is a graph of a 8th degree polynomial function, $f(x)$, with all real roots.
 - a. Write an equation of the function if the root at $x = -5$ has multiplicity one.

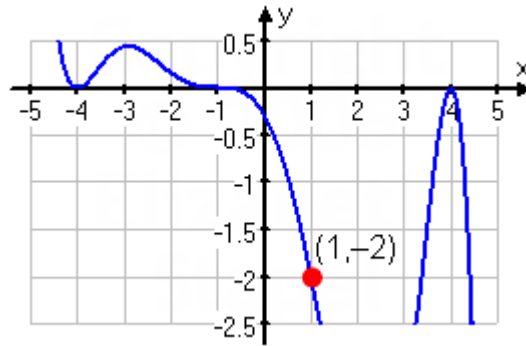


- b. If the function satisfies $f(-2) = 3$, find the particular equation of $f(x)$. Show work and use proper notation.
5. The following is a graph of a polynomial function, $f(x)$, with all real roots.
 - c. Write an equation of the function.



- d. If the function satisfies $f(0) = -30$, find the particular equation of $f(x)$. Show work and use proper notation.

6. Find the equation of the polynomial corresponding to the following graph. Show work and use proper notation.



7. Sketch a graph of the following polynomial. Show all x -intercepts.

$$y = -\frac{1}{5600}(x+5)^2(x+1)(x-4)^3(x-7)$$

8. Find all the roots of $f(x) = 15x^4 + x^3 - 52x^2 + 20x + 16$ by using synthetic division. Write your answer as a product of the linear factors. Don't forget to include your leading coefficient.
9. Given that $x = -3 + \sqrt{11}$ is a zero of $f(x) = x^4 + 6x^3 - 7x^2 - 30x + 10$, find all complex roots using synthetic division.
10. Given that $-i + 2$ is a zero of $f(x) = x^5 - 6x^4 + 11x^3 - x^2 - 14x + 5$, find all complex roots using synthetic division. List your possible rational roots also.
11. Find all the complex zeroes of the following polynomial: $f(x) = 2x^5 + 3x^4 - 30x^3 - 57x^2 - 2x + 24$. List all possible rational roots first, then use your calculator to help narrow down the search. Show your synthetic division.
12. Completely factor the following polynomial into the product of its linear factors. Use your calculator to help you find at least three rational roots, then use synthetic division. Don't forget the leading coefficient.

$$f(x) = 30x^5 - 166x^4 - 542x^3 + 2838x^2 + 1520x - 800$$

13. Find the remainder when $x^{36} + 4x^{27} + 7$ is divided by $x+1$. (Hint: use the remainder theorem and not synthetic division.) (Hint 2: Re-read the theorem in your notes before asking me.)
14. Find the quotient and remainder when $f(x) = x^3 - x^2 - 10x + 8$ is divided by $x+4$.
15. Find $P(x)$ if $P(x)$ divided by $x-1$ has a remainder of -2 and a quotient of $x^3 + x^2 - x - 1$. Write $P(x)$ in expanded form.
16. A polynomial function has the following complex roots: A polynomial $P(x)$ has the following roots: $-2, 1 + \sqrt{3}, 5i$.
- Write an equation of the function of lowest possible degree. Remember to expand any factors containing radicals or imaginary units.
 - If $P(0) = -25$, write the particular equation.

17. True or False: if False, explain why or provide a counterexample.

- a. A polynomial of the 5th degree can have only 2 real roots and 3 imaginary roots
- b. A polynomial function of degree 8 can only have as its real roots 2 (m3) and 3 (m2).
- c. A polynomial function of degree 7 must have at least one rational root.
- d. A 44th degree polynomial function can have exactly 12 relative extrema.
- e. Every even degree function is even.
- f. Every odd polynomial function is also of odd degree.
- g. An odd degree polynomial has a range of all real numbers.
- h. An even degree polynomial has a domain of all real numbers.
- i. Precalculus is awesome.

18. Determine a polynomial of lowest degree with real coefficients that has the given roots:

a. 0 (m2), $4 + 3i$

b. $7 - i\sqrt{5}$ (m2), $\sqrt{5}$ (m2)

19. Determine k so that $f(x) = x^3 - 11x^2 + kx - 6$ has $x - 3$ as a factor.

20. Find all the complex roots of $f(x) = x^8 - x^7 - 10x^6 + 12x^5 - 80x^4 + 144x^3 + 96x^2 + 320x + 768$ if $f(x)$ has roots of $2i$ (m2). Show all synthetic division and have fun!