

# Homefun 12

## Algebra Time!

MATH 150  
15 points

**Directions:** Work in groups of 2 to 4 in class and then finish outside of class as necessary. Each group should submit **ONE** solution page for the group. (Be sure everyone's name is on it!)

This worksheet has no particular context. It's just an opportunity to practice some skills.

1. Convince your group members that  $\sqrt{x^2 + 4}$  and  $x + 2$  are different functions. What about  $\sqrt{x^2 + y^2}$  and  $x + y$ ?
2. Convince your group members that  $\frac{x^2 + 5}{3x}$  and  $\frac{x + 5}{3}$  are different.
3. Pondering Polynomials: suppose  $p(x)$  is a polynomial of degree  $n$ .
  - (a) How many roots could  $p(x)$  have?
  - (b) How many local extrema could  $p(x)$  have?
  - (c) We say that  $x = a$  is a **repeated root** of  $p(x)$  if  $(x - a)^2$  is a factor of  $p(x)$ . Construct a polynomial with a repeated root at  $x = 1$  and a non-repeated root at  $x = 4$ .
4. Construct a polynomial with degree 3 and  $f(0) = 2$ ,  $f'(0) = 3$ ,  $f''(0) = -4$ ,  $f'''(0) = 12$ .
5. Perform polynomial long division to find the quotient and remainder:  $\frac{5x^4 - 3x + 2}{x + 1}$ .
6. Find  $\lim_{x \rightarrow \infty} (3x^{3/2} - 2x^{5/3})$ .
7. Find the zeros (roots), removable discontinuities (holes), and horizontal and vertical asymptotes of each rational function. Also determine any slant asymptotes (where the degree of the numerator is one more than the degree of the denominator).
  - (a)  $f(x) = \frac{2x^2 + x - 3}{x + 1}$
  - (b)  $f(x) = \frac{(x + 3)(x - 2)^2}{(x - 2)(x + 1)}$