

# U. of Utah Algebra Knowledge for Engineering Majors Self-Test

1. Simplify the expression

$$\frac{27^{\frac{2}{3}}2^{-3}}{16^{-\frac{3}{2}}}.$$

2. Determine all the intervals of  $x$  values that satisfy the inequality  $3 < |4 - x^2|$ .

3. Given  $f(x) = \sqrt{10 - 5x} = y$ , find the real-valued domain, range, and inverse function.

4. Solve the equation for  $x$ :  $4 = 2^{2x}e^{-x/2}$ . Use base-2 log in your calculation.

5. Divide the complex numbers  $\frac{2-i}{1+3i}$

6. Convert the polar-form complex number to Cartesian form:  $z = 2e^{-i\frac{\pi}{6}}$

7. The polynomial  $2x^3 + 3x^2 - 8x + 3$  has a root at  $x = 1$ . Use polynomial division to find the other two roots.

8. Simplify the following difference of rational expressions into a single simplified rational expression:

$$\frac{2x - 2}{x - 1} - \frac{x + 4}{x + 3}.$$

9. Simplify  $\tan(x)\sec(x)$  into an expression containing sine-functions and no other trigonometric functions present.
10. Simplify  $(\sin(x) + \cos(x))^2$  into an expression containing sine-functions and no other trigonometric functions present.

## Self-Test Answers

Score 70% correct and above: recommended to take calculus. Otherwise, take algebra.

- 72.
- $(-\infty, -\sqrt{7}) \cup (-1, 1) \cup (\sqrt{7}, \infty)$ .
- Domain:  $x \leq 2$ , range:  $[0, \infty)$ , inverse  $f^{-1}(y) = 2 - \frac{1}{5}y^2 = x$ .
- $x = \frac{2}{2 - \frac{1}{2} \log_2(e)}$ .
- $-\frac{1}{10} - \frac{7}{10}i$ .
- $\sqrt{3} - i$ .
- $x = 1/2, x = -3$ .
- $\frac{x+2}{x+3}$ .
- $\frac{\sin(x)}{1 - \sin^2(x)}$ .
- $\sin(2x) + 1$ .