

## MATH 116: FINAL EXAM

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Answer the questions in the spaces provided on the question sheets and turn them in at the end of the class period. Unless otherwise stated, all supporting work is required. You may *not* use any calculators.

Name: \_\_\_\_\_

**1** (10 Points). *Find the period, frequency, and amplitude of  $y = 3\sin(4x) - 1$ , then graph one period.*

**2** (10 Points). *Graph the function  $f(x) = -3x^2 - 6x + 15$ . Label the  $x$ -intercepts,  $y$ -intercept, and the vertex.*

**3** (10 Points). *Let  $f(x) = 2x^2$  and  $g(x) = x - 1$ .*

*(a) Compute  $(f \circ g)(x)$ .*

*(b) Compute  $(g \circ f)(x)$ .*

**4** (10 Points). *Find all the solutions (real and complex) to the equation*

$$x^4 - x = 0.$$

**5** (10 Points). *Show that*

$$\sin^2\left(\frac{1}{2}\arccos(x)\right) = \frac{1-x}{2}.$$

**6** (10 Points). Consider the polynomial  $p(x) = x^3 - 6x^2 + 11x - 6$ . Observe that

$$p(1) = 1 - 6 + 11 - 6 = 12 - 12 = 0.$$

Use this information to factor  $p(x)$  completely.

**7** (10 Points). Recall that  $\sin(\theta \pm \phi) = \sin(\theta) \cos(\phi) \pm \sin(\phi) \cos(\theta)$ . Use this identity to show that

$$\sin\left(\frac{\pi}{6}\right) = \cos\left(\frac{\pi}{3}\right).$$

**8** (10 Points). *Simplify*

$$\frac{x^2 - 3}{x - \sqrt{3}}$$

*by rationalizing the denominator.*

**9** (10 Points). *Determine whether  $f(x) = \log_2(x + 1)$  is invertible. If it is, then compute the inverse. Otherwise, explain why it does not have an inverse.*

**10** (10 Points). *Solve the following equations for  $x$ .*

(a)

$$\log_5(x+1) - \log_5(x-1) = 2$$

(b)

$$5^{-4x} = 25^2 \cdot 5^{x^2}$$