Exam 2
Form A

Name: _____

Section and/or TA: _____

Do not remove this answer page — you will return the whole exam. You will be allowed two hours to complete this test. No books or notes may be used. You may use a graphing calculator during the exam, but NO calculator with a Computer Algebra System (CAS) or a QWERTY keyboard is permitted. Absolutely no cell phone use during the exam is allowed.

The exam consists of 10 multiple choice questions and 10 free response questions. Record your answers to the multiple choice questions on this page by filling in the circle corresponding to the correct answer.

Show all work to receive full credit on the free response problems. The wise student will show work for the multiple choice problems as well.

Multiple Choice Questions

1 (A) (B) (C) (D) (E)   6 (A) (B) (C) (D) (E)

2 (A) (B) (C) (D) (E)   7 (A) (B) (C) (D) (E)

3 (A) (B) (C) (D) (E)   8 (A) (B) (C) (D) (E)

4 (A) (B) (C) (D) (E)   9 (A) (B) (C) (D) (E)

5 (A) (B) (C) (D) (E)   10 (A) (B) (C) (D) (E)

SCORE

Multiple Choice	11	12	13	14	15	16	17	18	19	20	Total Score
50	5	5	5	5	5	5	5	5	5	5	100

THIS PAGE SHOULD BE BLANK

Multiple Choice Questions

1. The graph of $y = x^2$ is shifted up 9 and to the left 1. Write the resulting function.
   - A. $y = (x - 1)^2 - 9$
   - B. $y = (x - 9)^2 - 1$
   - C. $y = (x + 9)^2 + 1$
   - D. $y = (x + 1)^2 + 9$
   - E. None of these

2. Determine whether the number -7 is a zero of $f(x) = x^3 + 4x^2 - 49x - 196$. If it is, find the other real zeros.
   - A. -7 is not a zero of $f(x)$.
   - B. -7 is a zero and the other are -4 and 7.
   - C. -7 is a zero and the other are 4 and -7.
   - D. -7 is a zero and the other are -4 and -7.
   - E. -7 is a zero and there are no other real zeros.

3. For the rational function $f(x) = \dfrac{-4x^2 + 18x + 16}{x^2 + 8x + 7}$, find all vertical and horizontal asymptotes.

    A. vertical asymptotes $x = 1$ and $x = -7$, horizontal asymptote $y = -4$.

    B. vertical asymptotes $x = -1$ and $x = -7$, horizontal asymptote $y = -1/4$.

    C. no vertical asymptotes, horizontal asymptote $y = -4$.

    D. vertical asymptotes $x = 1$ and $x = 7$, horizontal asymptote $y = -1/4$.

    E. vertical asymptotes $x = -1$ and $x = -7$, horizontal asymptote $y = -4$.

4. The quadratic function $f(x) = 0.0042x^2 - 0.42x + 36.05$ models the median, or average, age, y, at which U.S. men were first married x years after 1900. In which year was this average age at a minimum? (Round to the nearest year.) What was the average age at first marriage for that year? (Round to the nearest tenth.)

    A. 1926, 50 years old

    B. 1936, 46.6 years old

    C. 1950, 25.6 years old

    D. 1950, 46.6 years old

    E. 1951, 36 years old

5. Solve the following inequality:

$$\frac{x^2(x-11)(x+1)}{(x-4)(x+9)} \geq 0$$

    A. $(-\infty,-9)$ or $[-1,4)$ or $[11,\infty)$

    B. $(-9,-1]$ or $(4,11]$

    C. $(-\infty,-9)$ or $[11,\infty)$

    D. $(-\infty,-9)$ or $[-1,0)$ or $(0,4)$ or $[11,\infty)$

    E. $[-1,0)$ or $(0,4)$

6. Economists use what is called a Leffer curve to predict the government revenue for tax rates from 0% to 100%. Economists agree that the end points of the curve generate 0 revenue, but disagree on the tax rate that produces the maximum revenue. Suppose an economist produces this rational function $R(x) = 10x(100 - x)/(15 + x)$, where R is revenue in millions at a tax rate of x percent. What tax rate produces the maximum revenue? What is the maximum revenue?

    A. 9.7%; $467 million

    B. 26.5%; $469 million

    C. 28.1%; $470 million

    D. 31.4%; $464 million

    E. 46.9%; $265 million

7. Which of the following are both factors of $p(x) = x^4 - 10x^3 + 29x^2 - 8x - 48$?

     A. $x - \dfrac{1}{3}, \ x - \dfrac{1}{4}$

     B. $x - 3, \ x - 4$

     C. $x + 3, \ x + 4$

     D. $x - 3, \ x + 4$

     E. $x + \dfrac{1}{3}, \ x - \dfrac{1}{4}$

8. Find a polynomial of degree 3 that has zeros of 2, -5, and 6, and where the coefficient of x^2 is 9.

     A. $-3x^3 + 9x^2 - 84x - 180$

     B. $-3x^3 + 9x^2 + 84x - 180$

     C. $-3x^3 + 9x^2 + 84x + 180$

     D. $3x^3 + 9x^2 + 84x - 180$

     E. $3x^3 - 9x^2 - 84x - 180$

9. Evaluate the expression $(4 + 9i)(11 - 10i)$ and write the result in the form $a + bi$.

       A. $44 + 99i$

       B. $-59 - 134i$

       C. $59 + 134i$

       D. $134 - 59i$

       E. $134 + 59i$

10. Find the inverse function of $f(x) = \dfrac{x - 7}{x - 8}$.

       A. $f^{-1}(x) = \dfrac{8 - x}{x - 7}$

       B. $f^{-1}(x) = \dfrac{-7x - 8}{x - 1}$

       C. $f^{-1}(x) = \dfrac{7 - 8x}{1 + x}$

       D. $f^{-1}(x) = \dfrac{8x - 7}{x - 1}$

       E. $f^{-1}(x) = \dfrac{8x - 7}{1 - x}$

Free Response Questions

11. The average temperature in Denver, CO, in the spring time is given by the function $T(x) = -0.65x^2 + 14.5x - 26.8$, where T is the temperature in degrees Fahrenheit and x is the time of day in military time and is restricted to $6 < x < 18$ (sunrise to sunset). What is the temperature at 11 A.M.? What is the temperature at 4 P.M.?

12. Evaluate the expression and write the result in the form $a + bi$.

$$\frac{(1 + 4i)(3 - i)}{2 + i}.$$

13. Given that -1 is a zero of the polynomial $f(x) = x^3 + 10x^2 + 29x + 20$, determine all other zeros and write the polynomial in terms of a product of linear factors.

14. For the rational function $f(x) = \dfrac{9x^3 + 6x^2 + 2x - 6}{3x^2 + 4x + 2}$, find the equation of the slant asymptote.

15. A rare species of insect was discovered in the rain forest of Costa Rica. Environmentalists transplant the insect into a protected area. The population of the insect t months after being transplanted is

$$P(t) = 45 \left(\frac{1 + 0.6t}{3 + 0.02t} \right).$$

(I) What was the population when $t = 0$?

(II) What will the population be after 10 years?

(III) What is the end behavior of this population?

16. Find the intercepts and asymptotes of

$$R(x) = \frac{3x(x + 2)}{(x - 1)(x - 6)}.$$

(I) The x-intercept(s) are

(II) The y-intercept is

(III) The vertical asymptote(s) are

(IV) The horizontal asymptote(s) are

17. Find the formula for a quadratic function with vertex $(1,4)$ and y-intercept $(0,3)$.

18. Given that $f(x) = 1 + x$ and $g(x) = x^2 - x$, find
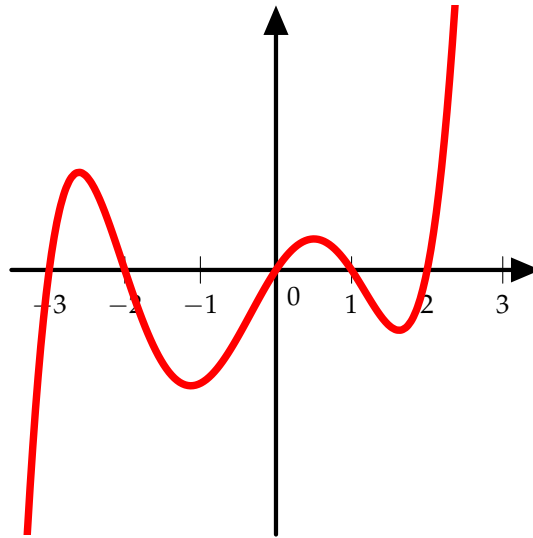
   (I) $(f \circ g)(x)$

   (II) $(g \circ f)(x)$
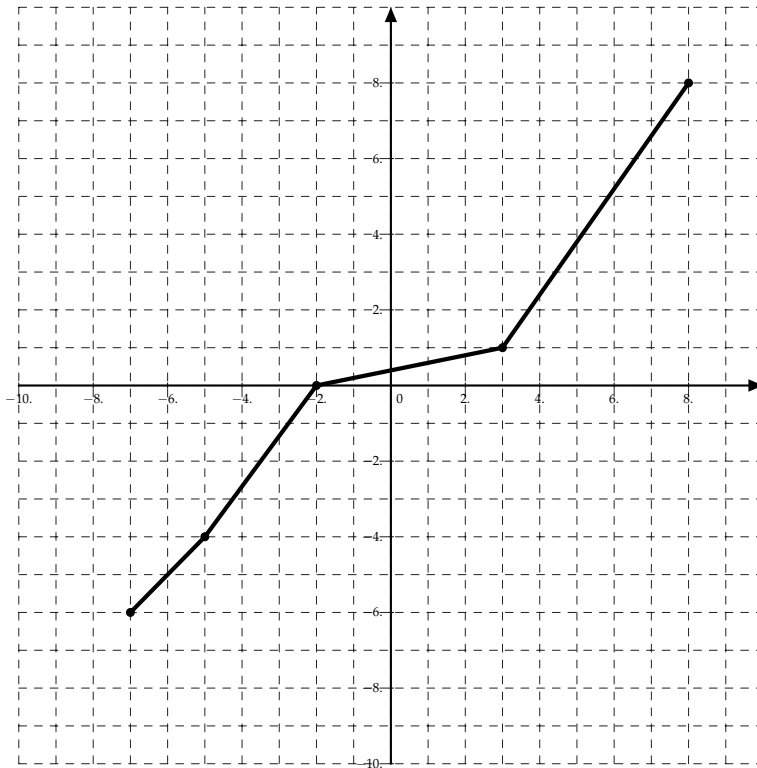
   (III) $(f \circ f)(x)$

   (IV) $(g \circ g)(x)$

   (V) $g(f(2) + 5)$

19. The graph is of a polynomial function $f(x)$ of degree 5 whose leading coefficient is 1. The graph is not drawn to scale. Find the polynomial.

20. The graph of a function f is given. Sketch the graph of the inverse function of f. (Graph segments with closed endpoints only.)

END OF TEST