

1. 10 pts. Prove the function

$$f(x) = \frac{x + 2}{1 - 4x}$$

is one-to-one using the definition of one-to-oneness. Do not graph the function.

2. 10 pts. Prove the function $g(x) = 6x^4 - 5$ is not one-to-one using the definition of one-to-oneness. Do not graph the function.

3. 10 pts. each Refer to the function f in Problem (1).

- (a) Find the inverse of f .
(b) Give the domain and range of both f and f^{-1} .

4. 10 pts. each Simplify and write the answer in the form $a + bi$.

(a) $(3 + \sqrt{-16}) + (2 + \sqrt{-25})$

(b) $\frac{i}{2 + i}$

5. 10 pts. each Solve each quadratic equation by the indicated method.

- (a) $18x + 9x^2 = 0$ by factoring.
(b) $x^2 + 6x + 13 = 0$ by completing the square.

6. 10 pts. each Solve each equation.

(a) $\frac{1}{x - 6} - \frac{1}{x} = \frac{6}{x^2 - 6x}$.

(b) $\sqrt[3]{2x + 1} = -4$.

(c) $\sqrt{7x + 4} = x + 2$

7. For the quadratic function

$$f(x) = -x^2 - 8x + 5,$$

determine the following.

- (a) 10 pts. The vertex of the parabola, and the axis of symmetry.
(b) 5 pts. Determine whether there is a maximum or minimum value for $f(x)$, and find that value.
(c) 5 pts. Graph f .

8. 10 pts. each Solve each absolute value equation or inequality.

(a) $|2x - 1| - 5 = -3$

(b) $|x + 5| < 8$

(c) $|6 - 4x| \geq 8$

9. 10 pts. Use synthetic division to perform the division: $(x^5 + x^3 - x) \div (x + 2)$.

10. Consider the polynomial function

$$f(x) = x^4 - 7x^3 + 9x^2 + 27x - 54.$$

(a) 10 pts. Factor $f(x)$ into linear factors using synthetic division and appropriate theorems.

(b) 5 pts. Find all solutions to the equation $f(x) = 0$.

11. 10 pts. Find a polynomial function of lowest degree with rational coefficients that has $2 - i$ and -1 as some of its zeros.