

I. Write TRUE if the statement is always true. Otherwise, write FALSE.

1. If $1 + 2i$ is a root of a polynomial $p(x)$, then $x^2 - 2x + 5$ is a factor of p .
2. The function $f(x) = |x| + x^2 + 4$ is an even function.
3. $e^{\ln x} = x$ for any $x \in \mathbb{R}$.
4. Let f, g, h be functions. Then $(f \circ (g \circ h))(x) = ((g \circ h) \circ f)(x)$.
5. $\frac{\log 2 + 1}{\log 3}, \frac{\log 6 + 1}{\log 3}, \frac{\log 18 + 1}{\log 3}$ form an arithmetic sequence.

II. Do as indicated.

1. Find k such that the remainder when $x + 2$ is divided by $(1 - k^2)x^3 - 4kx + 9$ is -1 .
2. Find all values of k such that $k^2 - 6, k + 3$ and $2 - k$ form an arithmetic sequence.
3. If $3^x = 5$, find the numerical value of $\left(\frac{1}{9}\right)^{2x+1}$.
4. The first two terms of a geometric progression differ by $\frac{9}{4}$. If the first term is $-\frac{3}{4}$, find the sum of the first 6 terms.

III. Solve the following word problem.

During each turn, a knight moves two steps to the right and one step up. The knight starts somewhere on the Cartesian plane. After 32 turns, the knight finds itself 25 units away from the origin. If its initial y -value was -8 , what are its possible initial x -values?

IV. Let $f(x) = \begin{cases} \sqrt{-1-x} & , \text{ if } x \leq -1 \\ \frac{2x^2 - x^3}{x} & , \text{ if } x \in (-1, 2). \\ |x - 3| & , \text{ if } x \geq 2 \end{cases}$.

1. Sketch the graph of f .
2. Find the range of f .

V. Let $g(x) = \frac{1}{x^2 - 4}$ and $h(x) = \sqrt{|x| - 1}$.

1. Find $g \circ h$.
2. Find the domain of $g \circ h$.

VI. Let $m(x) = \frac{2^{x+1} + 2}{2^x - 1}$.

1. Find m^{-1} .
2. Find the domain of m .
3. Find the range of m .

VII. Find all possible complex values of x which satisfy

$$\ln \sqrt{x} = \sqrt{\ln x}.$$