

Functions

PSU Math Relays 2019

- There are 33 problems
 - For each problem, place your answer in the appropriate blank of the answer sheet provided.
 - All functions on the test are real-valued functions.
 - Simplify each answer as much as possible. Rationalize fractions. Give numerical answers in fractional form, if applicable. Do not use decimal approximations.
 - Use interval notation and use $+\infty$ and $-\infty$ for positive and negative infinity.
 - No calculators are allowed on the exam.
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1. State the domain of $f(x) = x^4 + 7$ using interval notation.
2. State the range of $f(x) = x^4 + 7$ using interval notation.
3. Find the difference quotient, $\frac{f(x+h)-f(x)}{h}$, for the function $f(x) = 3x^2 - 5x + 17$.
4. Find the composition $f \circ g$ if $f(x) = 5x^3 - 4x + 12$ and $g(x) = x - 2$.
5. Find the inverse equation of the function $h(x) = \frac{5x-1}{x+2}$.
6. Find the zeros of $f(x) = 6x^2 - x - 12$.
7. Find the zeros of $f(x) = x^3 + 3x^2 - 4x - 12$.
8. Identify the horizontal asymptote for $g(x) = \frac{3x^2-16}{7x^2-15x-42}$.
9. For what positive value of x is $9^{x^2-7} = 3^{x-4}$.
10. What is the smallest possible value for the function $f(x) = 2x^6 + 12x^3 + 10$?
11. Find the product of all the real roots of $0 = 2x^3 + 3x^2 - 18x + 8$.
12. If $e^x = 3$, find e^{3x+1} .
13. Evaluate $f^{-1}(f(2019))$.

Recall that $a^x = y$ exactly when $\log_a(y) = x$.

14. Find $\log_7(49)$.
15. Find $\log_2(0.125)$.
16. Find $\log_2(.5) \log_3(81)$.
17. Find $2^{\log_{16}(32)}$.

For problems 18-25 below, use the functions

- $f(x) = \frac{1}{5x-9}$
- $g(x) = \sqrt{3-2x}$
- $h(x) = -x^3$
- $k(x) = 3^{x-2}$

Evaluate and simplify your answers. If the answer does not exist, write “DNE”.

18. $f(2) =$
19. $h(-1) =$
20. $k(0) =$
21. $g(5) =$
22. $(h/k)(-1) =$
23. $(f \circ g)(-2) =$
24. $(gk)(3) =$
25. $(f \circ k)(1) - (h \circ g)(2) =$

For problems 26-30 state whether the following functions are odd, even, both, or neither.

26. $y = 2 \cos x$
27. $y = 0$
28. $y = 5x^3 - 12x^2 + 3x - 12$
29. $y = 35x^6 + 7x^2 + 3$
30. $y = 12x^5 + 5x^3 - 5$

For problems 31-33, use the parabolic function $h(x) = x^2 + bx + 5$, where b is a real constant.

31. If the axis of symmetry of the graph $y = h(x)$ is $x = 2$, what is b ?
32. If the parabola passes through the point $(1, 1)$, what is b ?
33. If the average rate of change for $h(x)$ on the interval $[-1, 2]$ is 3, what is b ?