

Note: Unless otherwise specified, the domain of a function f is assumed to be the set of all real numbers x for which $f(x)$ is a real number.

Part 1: Multiple Choice

Solve each of the following problems, using available space for scratchwork. After examining the form of the choices, decide which is the best of the choices given. Do not spend too much time on any one problem.

1. The domain of $f(x) = \frac{x-1}{x^2+1}$ is

- (A) all $x \neq 1$
- (B) all $x \neq 1, -1$
- (C) all $x \neq -1$
- (D) $x \geq 1$
- (E) all reals

Answer

2. The graph of $y = \sqrt[3]{x^2+1}$ is symmetric with respect to which of the following?

- I. The x-axis
- II. The y-axis
- III. The origin

- (A) I only
- (B) II only
- (C) III only
- (D) II and III only
- (E) I, II, and III

Answer

3. The expression $x^{-\frac{2}{5}}$ is equivalent to

(A) $-\sqrt[2]{x^5}$

(B) $-\sqrt[5]{x^2}$

(C) $\frac{1}{\sqrt[2]{x^5}}$

(D) $\frac{1}{\sqrt[5]{x^2}}$

(E) $x^{\frac{5}{2}}$

Answer

4. If $f(x) = x^3 - x + 3$ and if c is the only real number such that $f(c) = 0$, then c is between

(A) -2 and -1

(B) -1 and 0

(C) 0 and 1

(D) 1 and 2

(E) 2 and 3

Answer

5. If $\log_b(3^b) = \frac{b}{2}$, then $b =$

(A) $\frac{1}{9}$

(B) $\frac{1}{3}$

(C) $\frac{1}{2}$

(D) 3

(E) 9

Answer

6. If f is a function such that $f(0) = 1$, $f(1) = 2$, and $f(n) = \frac{f(n-2)}{f(n-1)}$ for all integers $n \geq 0$, what is the value of $f(4)$?

- (A) $\frac{1}{8}$
(B) $\frac{2}{3}$
(C) 1
(D) 2
(E) It cannot be determined from the information given.

Answer

7. The function $f(x) = 2x^3 + x - 5$ has exactly one real zero. It is between

- (A) -2 and -1
(B) -1 and 0
(C) 0 and 1
(D) 1 and 2
(E) 2 and 3

Answer

8. $\frac{\ln(x^3 e^x)}{x} =$
- (A) $\frac{3(\ln x + e^x)}{x}$
(B) $\frac{3 \ln x + x}{x}$
(C) $\ln(x^3 e^x - x)$
(D) $\frac{3 \ln x}{x}$
(E) $\ln x^2 + 1$

Answer

9. Which of the following functions is not odd?

(A) $f(x) = \sin x$

(B) $f(x) = \sin 2x$

(C) $f(x) = x^3 + 1$

(D) $f(x) = \frac{x}{x^2 + 1}$

(E) $f(x) = \sqrt[3]{2x}$

Answer

10. The expression $\frac{\frac{a}{b} - 1}{\frac{a}{b} + 1}$ is equivalent to

(A) $\frac{a+b}{a-b}$

(B) $\frac{a-b}{a+b}$

(C) $\frac{1}{a-b}$

(D) $\frac{1}{a+b}$

(E) -1

Answer

11. Which of the following is the equation of the line that passes through the point (a, b) and is parallel to the x -axis?

(A) $x = a$

(B) $x = b$

(C) $y = a$

(D) $y = b$

(E) $x = \frac{-b}{2a}$

Answer

12. If the graph of a function f is symmetric about the y -axis and contains the point $(-2, 1)$, which point is also on f ?
- (A) $(-2, -1)$
 - (B) $(1, -2)$
 - (C) $(0, 0)$
 - (D) $(1, 2)$
 - (E) $(2, 1)$

Answer

13. If $f(x) = x - 1$ and $g(x) = x^2 + 1$, then $f(g(x)) = g(f(x))$ when $x =$
- (A) $-\frac{1}{2}$
 - (B) $\frac{1}{2}$
 - (C) -1
 - (D) 1
 - (E) 0

Answer

Part 2: Free-Response

SHOW ALL YOUR WORK WHERE POSSIBLE. Indicate clearly the methods you use because you will be graded on the correctness of your methods as well as on the accuracy of your final answers. If you choose to use decimal approximations, your answers should be correct to three decimal places.

14. Complete the chart with exact values only. These values must be memorized for AP Calculus.

	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π	$\frac{\pi}{6}$	$\frac{\pi}{3}$	$\frac{\pi}{4}$
sin x								
cos x								
tan x								

15. Consider $g(x) = \begin{cases} 1 - x & x \leq -2 \\ x^2 - 1 & -2 < x < 2 \\ 4 & 2 \leq x \end{cases}$

This is called a piecewise function. If you have never seen something like this before, consider it a challenge. Perhaps you might need to do a little research on the internet. Your knowledge of domain and range and graphing functions is of utmost importance.

- a. Find $g(-3)$, $g(0)$, $g(1)$ and $g(3)$
- b. Sketch the graph of $g(x)$.

16. Sketch the graph of $f(x) = \frac{4x + 8}{2x + 2}$. Identify any intercepts and vertical and/or horizontal asymptotes.

17. a. Sketch the graph of the function $y = -x^2 - 2x + 3$.
b. Identify the intercepts and any maximum or minimum points.

18. Factor each polynomial:

a. $16 - 25a^2$

b. $2x^2 - 7x + 3$

c. $3x^2 - 12x$

d. $x^2 + 5x - 6$

19. The standard equation for converting Celsius (C) temperature to Fahrenheit (F) temperature is a linear equation. If we plot Fahrenheit temperature against Celsius temperature in the coordinate plane, the points lie in a line. The line passes through the point (0, 32) because $F = 32$ when $C = 0$. It also passes through the point (100, 212) because $F = 212$ when $C = 100$. Use this information to write an equation for the line.

20. a. If $f(x) = x + 1$ and $g(x) = x^2$, find $(f \circ g)(3)$.

b. If $f(x) = x - 3$ and $g(x) = x^3$, then find $f(g(3))$

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21. Write the equation of a circle whose center is at (3, 4) and has a radius of 5. Sketch the circle.

22. Name the type of graph for each equation. Sketch the graph. If a graph has an intercept or a vertex, be sure that it is clearly marked in your sketch.

a. $(x - 2)^2 + y^2 = 4$

b. $x + y = 4$

c. $4x^2 + y = 4$

d. $y = |x + 4| - 2$

e. $y = \sqrt{x - 4}$

f. $y = e^x$

g. $y = \ln x$