

1. Suppose $f(x) = \ln x$. Which of the following statement(s) is/are true about $f(x)$?

- I. $f^{-1}(x) = e^x$
 II. $f(x)$ has a domain of $[0, \infty)$.
 III. $f(f^{-1}(-2)) = f^{-1}(f(-2))$

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

2. Suppose $f(x) = \sqrt{x+5} - 7$. Compute the domain of $f^{-1}(x)$.

- A. $[-7, \infty)$
 B. $[-5, \infty)$
 C. $[0, \infty)$
 D. $[5, \infty)$
 E. $[7, \infty)$

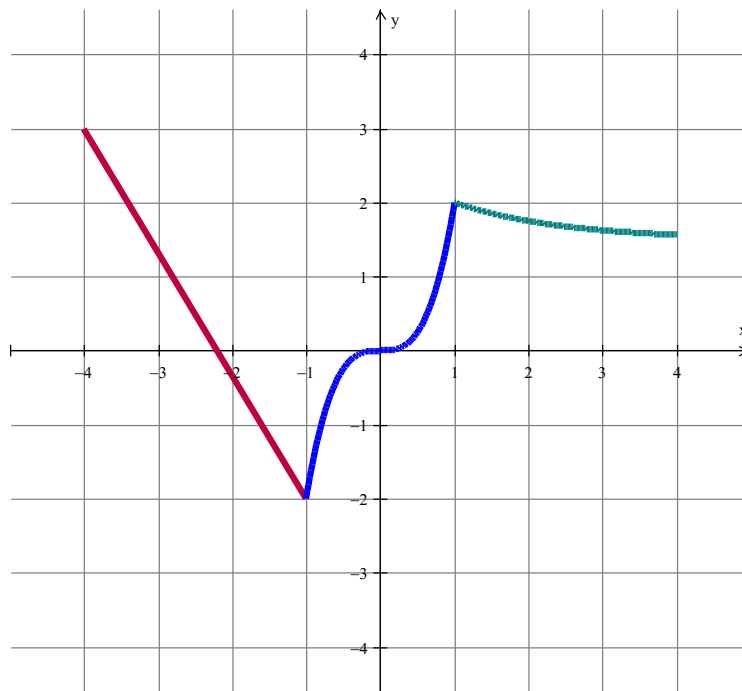
3. Which of the following functions have two horizontal asymptotes?

- I. $f(x) = \frac{|x|}{x}$
 II. $g(x) = \frac{1}{1+e^{-x}}$
 III. $h(x) = \frac{3x-4}{x^2-4}$

- A. $f(x)$ only
 B. $g(x)$ only
 C. $h(x)$ only
 D. $f(x)$ & $g(x)$ only
 E. None of the Above

4. Suppose $f(x) = \frac{ax+b}{x+d}$, where a, b, d are integers. If $f(0) = 4$, f has a vertical asymptote at $x = -2$, and $f\left(-\frac{3}{8}\right) = 0$, compute $a+b+d$.

- A. 11
 B. 12
 C. 13
 D. 14
 E. 15



For questions 5-9, refer to the graph above that represents a function, $f(x)$. The domain of $f(x)$ is $[-4, 4]$ and the range of $f(x)$ is $[-2, 3]$. Additionally, suppose $g(x) = x$.

5. Calculate $f(g(1))$.

A. -2 B. -1 C. 0 D. 1 E. 2
6. For how many values of x does $f(x) = 2g(x)$?

A. 0 B. 1 C. 2 D. 3 E. 4
7. For how many values of x does $f(x) = 1$?

A. 0 B. 1 C. 2 D. 3 E. 4
8. For how many values of x in $(-4, 4)$ is $f(x)$ continuous, but not differentiable?

A. 0 B. 1 C. 2 D. 3 E. 4
9. Amongst the values listed, for what value of x does $f(x) - g(x)$ have the smallest value?

A. 0 B. 1 C. 2 D. 3 E. 4

For questions #10-#12, consider the series $\sum_{n=1}^{\infty} 3\left(\frac{1}{2}\right)^{n-1}$.

10. What is the first term of the series?

- A. 1/2 B. 1 C. 3/2 D. 3 E. 6

11. What is the common ratio of the series?

- A. 1/2 B. 1 C. 3/2 D. 3 E. 6

12. Does the series converge or diverge? If it converges, gives it sum.

- A. 1/2 B. diverges C. 3/2 D. 3 E. 6

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For questions #13-#16, consider the polar equation $r = 2 \cos(3\theta)$.

13. What term best describes the shape of the graph?

- A. Limacon B. Rose Curve C. Hyperbolic Tangent
D. Circle E. Elliptical Crescent

14. For how many values of θ does $r = 1$ in the interval $[0, 2\pi]$?

- A. 1 B. 2 C. 4 D. 6 E. 8

15. The point $\left(-\sqrt{2}, \frac{5\pi}{12}\right)$ is on the graph of r . What is this point in Cartesian (rectangular) coordinates?

- A. (-1.366, -0.366) B. (-0.366, -1.366) C. (-0.227, -1.227)
D. (-1.227, -0.227) E. None of the Above

16. What value of θ produces the same value of r as $\theta = \frac{\pi}{6}$?

- A. 0 B. $\frac{\pi}{4}$ C. $\frac{\pi}{3}$ D. $\frac{\pi}{2}$ E. $\frac{2\pi}{3}$

For questions 17-20, consider the parametric equations: $x(t) = t^2 - 4$, $y(t) = \sin(\pi t)$.

17. What point corresponds to the parameter value $t = 5$?

- A. $(5, 5\pi)$ B. $(21, 1)$ C. $(21, -1)$
D. $(21, 0)$ E. None of the Above

18. Calculate $\frac{dy}{dx}$ at $t = 5$.

- A. $-\frac{\pi}{10}$ B. $-\frac{1}{10}$ C. 0 D. $\frac{1}{10}$ E. $\frac{\pi}{10}$

19. If $x(t) = -3$, which of the following are possible values, which of the following are possible values of $y(t)$?

- A. -1 B. 0 C. 1
D. Both A & C E. None of the above

20. How many y-intercepts does this graph have if $-\pi \leq t \leq \pi$?

- A. 1 B. 3 C. 5 D. 6 E. 7

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For questions 21-24, suppose $f(x) = e^{-x}$ & $g(x) = \log_3(3x)$.

21. Solve $g(x) = 4$.

- A. $4/3$ B. 3 C. 9 D. 27 E. 81

22. Compute $g(f(0))$.

- A. -1 B. 0 C. 1 D. 2 E. Undefined

23. Compute the domain of $f(g(x))$.

- A. $(-\infty, \infty)$ B. $(-\infty, 0)$ C. $(0, \infty)$ D. $(-\infty, 0]$ E. $[0, \infty)$

24. Solve $f(x) = \frac{1}{\sqrt[11]{e^4}}$.

- A. $-11/4$ B. $-4/11$ C. 0 D. $4/11$ E. $11/4$

For questions 25-28, suppose $f(x) = x^3 - 8x^2 + 25x - 26$.

25. Describe the end behavior of $f(x)$.

- A. $\lim_{x \rightarrow -\infty} f(x) = -\infty, \lim_{x \rightarrow \infty} f(x) = -\infty$ B. $\lim_{x \rightarrow -\infty} f(x) = \infty, \lim_{x \rightarrow \infty} f(x) = -\infty$
C. $\lim_{x \rightarrow -\infty} f(x) = -\infty, \lim_{x \rightarrow \infty} f(x) = \infty$ D. $\lim_{x \rightarrow -\infty} f(x) = \infty, \lim_{x \rightarrow \infty} f(x) = \infty$
E. None of the above are true.

26. Which of the following is not a potential root for $f(x)$?

- A. 26 B. -13 C. -2 D. 1 E. 1/2

27. Find the two non-real zeros of $f(x)$.

- A. $2 \pm 3i$ B. $3 \pm 2i$ C. $1 \pm 4i$ D. $4 \pm i$ E. $5 \pm i$

28. Which term best describes $f(x)$?

- A. Linear Binomial B. Quadratic Monomial C. Quadratic Polynomial
D. Cubic Trinomial E. Cubic Polynomial
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For questions 29-32, suppose $f(x) = \frac{x^3 - 1}{x^2 - 5x + 4}$.

29. At $x = 4$, $f(x)$ has a(n) _____.

- A. Vertical Asymptote B. Removable Discontinuity C. Jump Discontinuity
D. x -intercept E. Oscillating Discontinuity

30. At $x = 1$, $f(x)$ has a(n) _____.

- A. Vertical Asymptote B. Removable Discontinuity C. Jump Discontinuity
D. x -intercept E. Oscillating Discontinuity

31. How many x -intercepts does $f(x)$ have?

- A. 0 B. 1 C. 2 D. 3 E. 4

32. Compute $\lim_{x \rightarrow 1} f(x)$.

- A. -1 B. -1/4 C. 0 D. 1/4 E. 1