Answer all questions below. Every question is worth the one point unless otherwise indicated. You may use the available space for work, but must write ALL answers on the answer sheet. No cell phones, calculators, notes, or music players are allowed during the exam. Keep your eyes on your own work. These rules will be strictly enforced, and anyone found violating them will be asked to leave the exam immediately.

Name: _____ UID: _____

Tip: If you're stuck on a question, don't panic. Move on and come back to it later.

Section I: In questions 1 through 8, decide whether the statement is true or false. Write the entire word "true" or the entire word "false" on your answer sheet.

1. The polynomial $x^2 + 4$ has two roots.

2. $(-1, 3] \subseteq [1, 4)$

3. $\sqrt{2} \notin \mathbb{R}$

4. $\mathbb{Q} \subseteq \mathbb{N}$

5. The graph drawn below is the graph of a function:
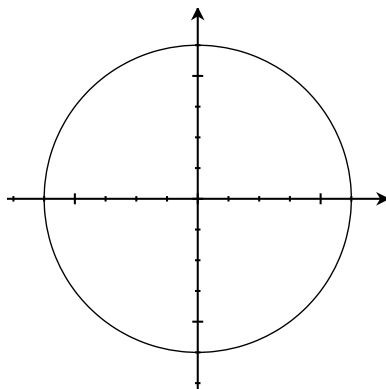
6. The function whose graph is drawn below has an inverse:
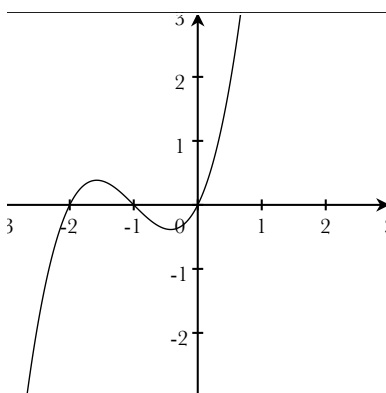
7. Is it true that $x = 1, y = 1, z = -2$ is a solution to the following system of equations?

$$\begin{cases} 2x + y - z = 5 \\ -x - y + z = -4 \\ x + y + z = 0 \end{cases}$$

8. $(x + y)^2 = x^2 + y^2$

9. Is the sequence $2, -4, 6, -8, \ldots$ arithmetic, geometric, or neither?

10. Is the sequence $3, 6, 9, 12, \ldots$ arithmetic, geometric, or neither?

Section II: Answer the following questions. You do not need to simplify your answers unless otherwise indicated.

11. Find the sum of the first 51 terms of the arithmetic sequence $1, 4, 7, 10, \ldots$

12. Find the sum: $\displaystyle\sum_{i=1}^{3}(i^2 + i)$

13. The Titanic is sinking. There are 150 passengers remaining on the boat, and only one lifeboat left. If the lifeboat can hold 10 people, how many different ways are there to choose which people to put in the lifeboat?

14. Write out $(x - y)^5$ so that your answer doesn't include any numbers that look like $\binom{n}{k}$.

15. What is the implied domain of $f(x) = \sqrt[4]{4 - 2x}$?

16. (2 points) Find the inverse of $g(x) = \sqrt[3]{2x - 8} + 1$.

17. You owe \$7000 on your credit card. If your bank charges you 12% interest every year, how much will you owe after 5 years of making no payments?

18. Solve for x: $3 \log_{10}(5x) = 15$.

19. Completely factor the polynomial $x^2 + 3x + 1$.

20. Find the quotient: $\dfrac{x^3 + 2x - 3}{x^2 + 2}$

Section III: Linear Algebra

21. Solve the system of equations:
$$\begin{cases} x - 3y = 2 \\ -2x + y = 1 \end{cases}$$

22. (2 points) Find the inverse of $\begin{pmatrix} 4 & 5 \\ 2 & 3 \end{pmatrix}$.

23. Compute the determinant of the matrix $\begin{pmatrix} -1 & 4 \\ 0 & -1 \end{pmatrix}$.

24. Compute the product: $\begin{pmatrix} 4 & -1 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} -1 & 3 \\ -1 & 4 \end{pmatrix}$

25. Given that
$$
\begin{pmatrix} 2 & 0 & -1 \\ -1 & 0 & 1 \\ 1 & 1 & -1 \end{pmatrix}^{-1} = \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 2 & 0 \end{pmatrix},
$$

solve the system of equations:
$$
\begin{cases} 2x - z = 1 \\ -x + z = 3 \\ x + y - z = 0 \end{cases}
$$

Section IV

Below is the graph of a function. Use it to answer questions 26-30.
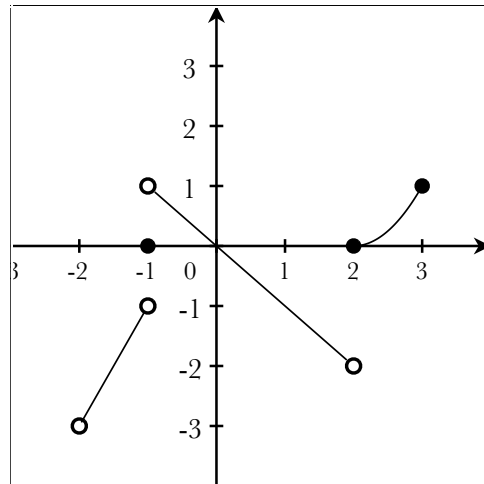
26. What is $f(-1)$?

27. What is the domain of f?

28. What is the range of f?

29. What are the x-intercepts of the graph?

30. What are the y-intercepts of the graph?

For each of the following functions, decide which graph matches each function, and write the corresponding capital letter on you answer sheet.

31. $id(x)$

32. x^6

33. x^{11}

34. 15

35. $\frac{1}{x^3}$

36. $\frac{1}{x^5}$

37. $\log_e(x)$

38. $\log_{0.5}(x)$

39. 2^x

40. $\left(\frac{1}{2}\right)^x$

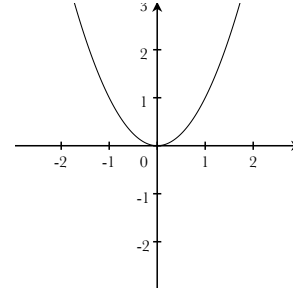41. $\sqrt[5]{x}$

42. $\sqrt[4]{x}$
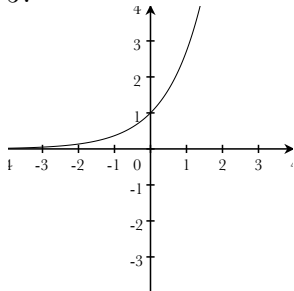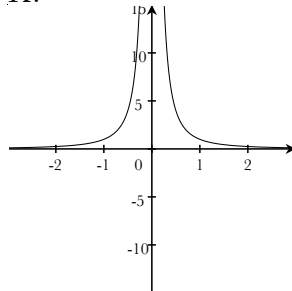
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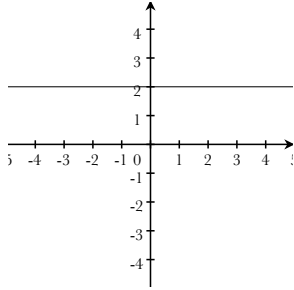
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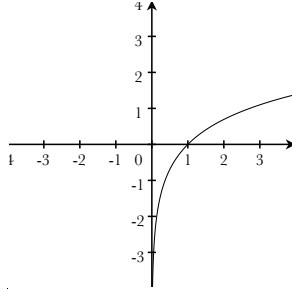
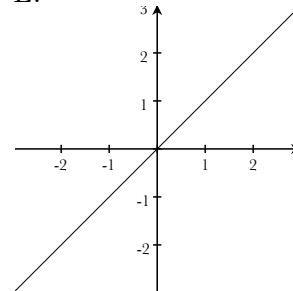C.
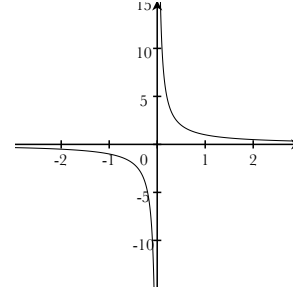
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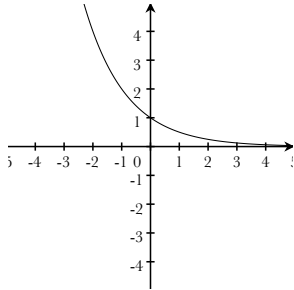
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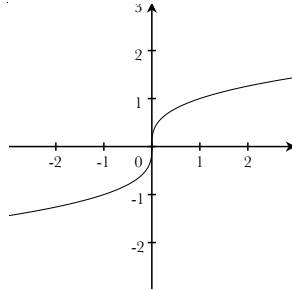
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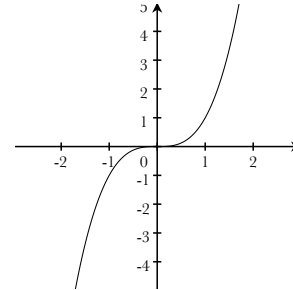
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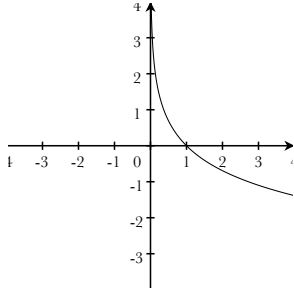
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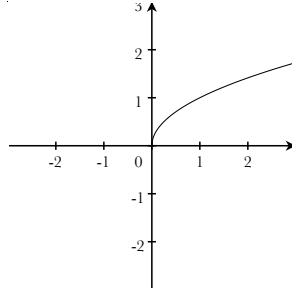
I.

J.

K.

L.

Graph the following functions and label the intercepts and asymptotes as indicated.

43. Graph $g(x) = 2x + 2$ and label the x- and y-intercepts.

44. Graph $h(x) = \frac{1}{x^3} + 1$ and label the x- and y-intercepts, and horizontal asymptote.

45. Graph $q(x) = -\log_2 x + 4$ and label the x- and y- intercepts.

46. Graph $f(x) = 2^{-x}$ and label the y-intercept.

47. (2 points) Graph $f(x) = \begin{cases} 3 & \text{if } x \in (-\infty, -1] \\ -2 & \text{if } x \in (-1, 3) \\ 1 & \text{if } x \in [3, \infty) \end{cases}$, and label the y-intercept.

48. (4 points) Graph $r(x) = \dfrac{-2(x^2 + 2x + 2)(x + 1)(x + 3)}{4(x - 3)}$, and label any x- or y-intercepts and vertical asymptotes.

49. (3 points) Graph $p(x) = -3(x - 1)(x - 2)(x^2 + x + 1)$ and label all x- and y-intercepts.