MATH 111 Sample 03 Exam 2

For each problem, show your work in the space provided.
Write your Final Answer (and the letter answer) on the Answer Sheet provided.
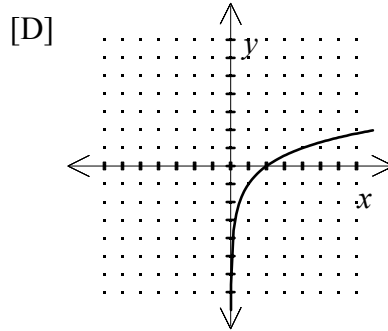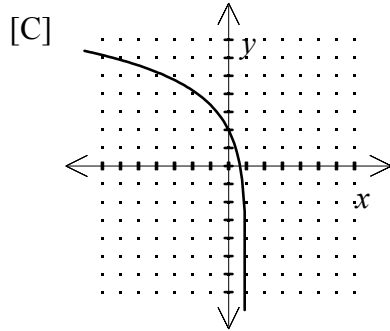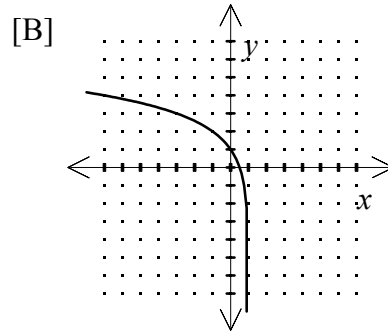
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1. Write as the logarithm of a single expression: $\log_c 4x + 3(\log_c x - \log_c y)$

   [A] $\log_c \dfrac{4x^4}{y^3}$ [B] none of these   [C] $\log_c \dfrac{12x^2}{y}$ [D] $\log_c \dfrac{7x}{3y}$

2. Graph: $y = \log_2 x - 1$

   [A]

   [B]

   [C]

   [D]

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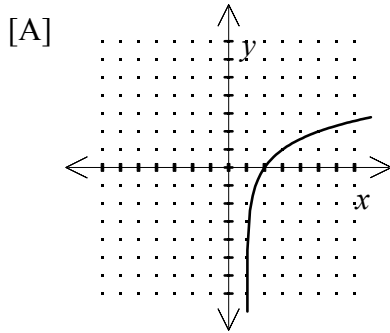**Write your Final Answer (and the letter answer) on the Answer Sheet provided.**

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3. Evaluate ln 42 correct to three decimal places and write the result in exponential form.

   [A] $42^{3.738} = e$ [B] $e^{3.738} = 42$ [C] $e^{3.737} = 42$ [D] $10^{3.737} = 42$

4. Write the equation $4^{3/2} = 8$ in logarithmic form.

   [A] $2\log_3 8 = 4$ [B] $\log_8 4 = \dfrac{2}{3}$ [C] $\log_4 8 = \dfrac{3}{2}$ [D] $\log_{3/2} 8 = 4$

5. Evaluate: $\log_4\left(\dfrac{1}{16}\right)$ [A] -3 [B] -2 [C] 3 [D] 2

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Solve:

6. $x^2 + y^2 = 16$
    $x + y = 4$

    [A] $\{(0, 0), (4, -4)\}$ [B] $\{(0, -4), (-4, 0)\}$

    [C] $\{(0, 4), (4, 0)\}$ [D] $\{(4, -4), (-4, -4)\}$

7. $2z^{2/3} + 3z^{1/3} - 2 = 0$

8. $x^2 + 4x - 5 > 0$

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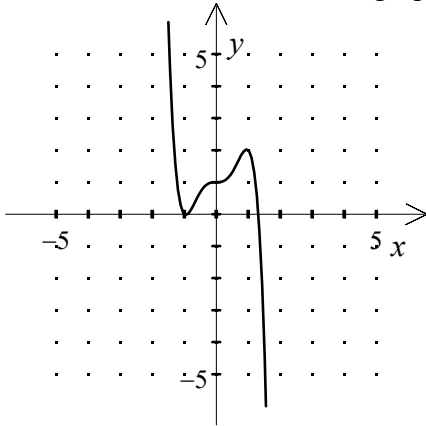
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Solve:

9. $\sqrt{k + 25} + 5 = k$

10. Which function matches the graph?

[A] $f(x) = -2x^4 - 3x^2 - 1$ [B] $f(x) = -2x^4 + 3x^2 + 1$

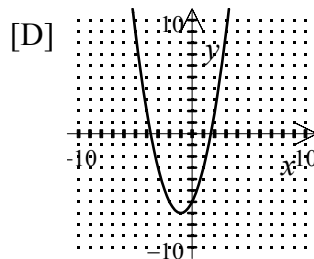[C] $f(x) = -2x^5 + 3x^3 + 1$ [D] $f(x) = -x^5 + 3x^2 - x$

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11. Graph: $f(x) = x^2 + 2x - 6$

[A]

[B]

[C]

[D]

12. Use Descartes' Rule of Signs to determine how many positive and how many negative real zeros the polynomial functions may have. Do not attempt to find the zeros.
$$f(x) = x^6 - 2x^5 + 4x^4 - 5x^3 + 2x^2 - x + 3$$

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13. Use synthetic division to determine what pair of integers provide both a lower and an upper bound for the zeros of $f(x) = x^5 - 5x^4 - 13x^3 + 65x^2 + 36x - 182$.

14. Which of the following equations represents the graph below?

[A] $\dfrac{y^2}{25} - \dfrac{x^2}{9} = 1$ [B] $25x^2 - 9y^2 = 225$

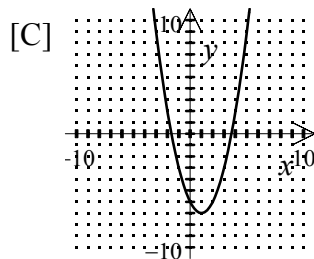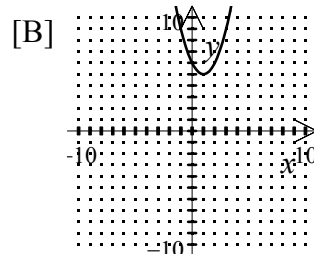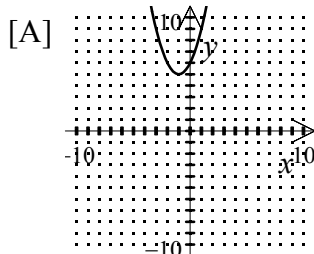[C] $\dfrac{x^2}{25} - \dfrac{y^2}{9} = 1$ [D] $25y^2 - 9x^2 = 225$

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15. Find an equation for the hyperbola with vertices (3, 0) and (−3, 0) and asymptote $y = \dfrac{2}{3}x$.

   [A] $9x^2 - 4y^2 = 36$ [B] $4x^2 + 9y^2 = 36$ [C] $4x^2 - 9y^2 = 36$ [D] $4x^2 - 4y^2 = 36$

16. Use matrices to solve the following system.
$$-3x + 3z = -12$$
$$x - y + 5z = 0$$
$$4x + 2y - z = 9$$

17. If $A = \begin{bmatrix} -3 & -4 & -1 \\ -7 & -5 & 1 \\ -8 & 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} -9 & 7 & -7 \\ -6 & 1 & 5 \\ 9 & -3 & 6 \end{bmatrix}$, find $A - B$.
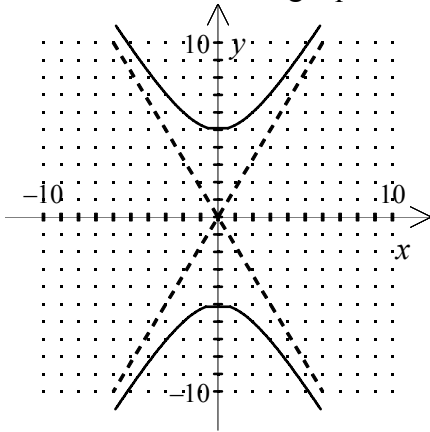
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18. If $A = \begin{bmatrix} -6 & 1 \\ -4 & 9 \end{bmatrix}$ and $B = \begin{bmatrix} -3 & -8 \\ -7 & -4 \end{bmatrix}$, find $-3A + 4B$.

[A] $\begin{bmatrix} 6 & -35 \\ -16 & -43 \end{bmatrix}$ [B] $\begin{bmatrix} -3 & 4 \\ 3 & 16 \end{bmatrix}$ [C] $\begin{bmatrix} 30 & 9 \\ 40 & 1 \end{bmatrix}$ [D] $\begin{bmatrix} -9 & -2 \\ -11 & 2 \end{bmatrix}$

19. If $A = \begin{bmatrix} 3 & -1 & 5 \\ 4 & -5 & 4 \\ -2 & -3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 5 & -4 \\ 1 & -4 & -1 \\ -3 & 2 & -3 \end{bmatrix}$, find AB.

[A] $\begin{bmatrix} -22 & 29 & -26 \\ -25 & 48 & -23 \\ -2 & 4 & 8 \end{bmatrix}$ [B] $\begin{bmatrix} -6 & -5 & -20 \\ 4 & 20 & -4 \\ 6 & -6 & -3 \end{bmatrix}$

[C] $\begin{bmatrix} -6 & 20 & 8 \\ -1 & 20 & 3 \\ -15 & 8 & -3 \end{bmatrix}$ [D] $\begin{bmatrix} 22 & -11 & 6 \\ -11 & 22 & -12 \\ 5 & 2 & -10 \end{bmatrix}$

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20. The odds against Pat winning the election are 6:7. With these odds, what is the probability that Pat will win the election?

[A] $\dfrac{7}{13}$ [B] $\dfrac{6}{13}$ [C] $\dfrac{6}{7}$ [D] $\dfrac{7}{6}$

21. Let $P(n)$ represent the statement:

$-1 + 5 + 11 + \cdots + (6n - 7) = 3n^2 - 4n$

Use the Principle of Mathematical Induction to show that $P(n)$ is true for all integers n, $n \geq 1$.

22. Two urns each contain black balls and red balls. Urn I contains three black balls and two red balls and Urn II contains five black balls and two red balls. A ball is drawn from each urn. What is the probability that both balls are black?

[A] $\dfrac{2}{19}$ [B] $\dfrac{8}{37}$ [C] $\dfrac{1}{9}$ [D] $\dfrac{3}{7}$

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23. Account numbers for Western Oil Company consist of eight digits. If the first digit cannot be a 0, how many account numbers are possible?

   [A] 90,000,000   [B] 80,000,000   [C] 10,000,000   [D] 800,000,000

24. Two cards are drawn in succession from a standard deck of 52 cards. Find the probability that two jacks are drawn.

   [A] $\dfrac{1}{663}$ [B] $\dfrac{1}{2652}$ [C] $\dfrac{4}{663}$ [D] $\dfrac{1}{221}$

25. Six balls numbered from 1 to 6 are placed in an urn. One ball is selected at random. Find the probability that it is NOT number 5.

   [A] $\dfrac{1}{6}$ [B] $\dfrac{1}{2}$ [C] $\dfrac{2}{3}$ [D] $\dfrac{5}{6}$

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_____

[1] _____

[2] _____

[3] _____

[4] _____

[5] _____

[6] _____

[7] _____

[8] _____

[9] _____

[10] _____

[11] _____

[12] _____

[13] _____

[14] _____

[15] _____

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[16] _____

[17] _____

[18] _____

[19] _____

[20] _____

[21] _____

[22] _____

[23] _____

[24] _____

[25] _____

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[1] [A]_____

[2] [D]_____

[3] [B]_____

[4] [C]_____

[5] [B]_____

[6] [C]_____

[7] $\left\{\dfrac{1}{8}, -8\right\}$ _____

[8] $x < -5$ or $x > 1$ _____

[9] 11 _____

[10] [C]_____

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_____
_____

[11] [D]_____

_____

[12] 6, 4, 2, or no positive real zeros; no negative real zeros

_____

[13] –4, 7_____

_____

[14] [A]_____

_____

[15] [C]_____

_____

[16] {(3, –2, –1)}_____

_____

[17] $\begin{bmatrix} 6 & -11 & 6 \\ -1 & -6 & -4 \\ -17 & 6 & -2 \end{bmatrix}$_____

_____

[18] [A]_____

_____

[19] [A]_____

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[20] [A]____

(I) $n = 1$: $6 \cdot 1 - 7 = -1$ and $3 \cdot 1^2 - 4 \cdot 1 = -1$

(II) If $-1 + 5 + 11 + \cdots + (6k - 7) = 3k^2 - 4k$,

then $-1 + 5 + 11 + \cdots + (6k - 7) + 6(k + 1) - 7 = 3k^2 - 4k + 6(k + 1) - 7$

$= 3k^2 + 2k - 1$

$= 3k^2 + 6k + 3 - 4k - 4$

$= 3(k^2 + 2k + 1) - 4k - 4$

[21] $= 3(k + 1)^2 - 4(k + 1)$

[22] [D]____

[23] [A]____

[24] [D]____

[25] [D]____