

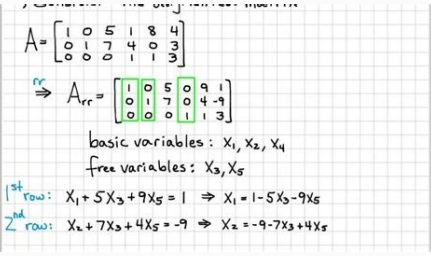
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**The Fundamental Theorem of Algebra**

**Theorem:** If  $f(x)$  is a polynomial of degree  $n$  where  $n > 0$ , then the equation  $f(x) = 0$  has at least one solution in the set of complex numbers.

**Corollary:** If  $f(x)$  is a polynomial of degree  $n$  where  $n > 0$ , then the equation  $f(x) = 0$  has exactly  $n$  solutions provided each solution repeated twice is counted as 2 solutions, each solution repeated three times is counted as 3 solutions, and so on.



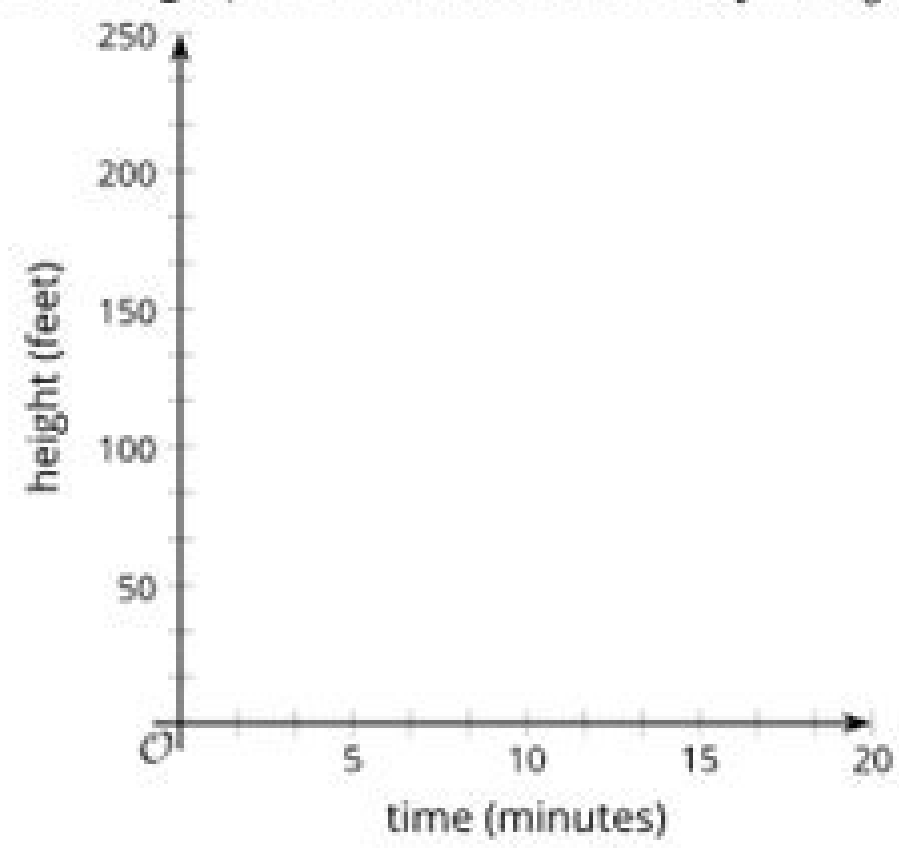
A pattern of dots grows exponentially. The table shows the number of dots at each step of the pattern.

step number	0	1	2	3
number of dots	1	5	25	125

- Write an equation to represent the relationship between the step number,  $n$ , and the number of dots,  $y$ .
- At one step, there are 9,765,625 dots in the pattern. At what step number will that happen? Explain how you know.

The height of a hot air balloon, in feet,  $m$  minutes after takeoff is modeled by the function  $f(m) = 16m$ .

- How many minutes does it take for the balloon to reach 200 feet?
- Another balloon takes off 5 minutes later and rises at the same speed. Write an equation for the function  $g$ , where  $g(t)$  is the height, in feet, of this balloon in terms of  $m$ . Explain your reasoning.
- Sketch graphs of the two functions  $f$  and  $g$ .



How To Simultaneous Equations  
Straight line and Curve.

Example 1  $x+y=2$  ⊙      Answer:  
 $x^2+y^2=10$  ⊙

$x+y=2$   
 when  $x=-1$ ,  $-1+y=2$   
 $y=3$   
 when  $x=3$ ,  $3+y=2$   
 $y=-1$

This set of Signals & Systems Multiple Choice Questions & Answers (MCQs) focuses on "Basics of Linear Algebra". 1. Find the values of  $x, y, z$  and  $w$  from the below condition.  $\begin{pmatrix} x & z \\ y & w \end{pmatrix} = \begin{pmatrix} 2 & 10 \\ 3 & 2x+y \end{pmatrix} + \begin{pmatrix} z & 5 \\ 7 & w \end{pmatrix}$  a)  $x=1, y=3, z=4, w=0$  b)  $x=2, y=3, z=0, w=1$  c)  $x=1, y=2, z=3, w=1$  d)  $x=1, y=2, z=4, w=1$  View AnswerAnswer: d Explanation:  $5z=10+5 \Rightarrow 5z=15 \Rightarrow z=3$   $5x=2+y \Rightarrow 5x=5 \Rightarrow x=1$   $5y=3+w \Rightarrow 5y=10 \Rightarrow y=2$   $5w=2+2+w \Rightarrow 4w=4 \Rightarrow w=1$ . 2. The matrix A is represented as  $\begin{pmatrix} 1 & 4 \\ -2 & 9 \end{pmatrix}$  &  $\begin{pmatrix} 3 & -8 \end{pmatrix}$ . The transpose of the matrix of this matrix is  $3 \times 2$  matrix. The values of matrix are not changed but, the elements are interchanged, as row elements of a given matrix to the column elements of the transpose matrix and vice versa but the polarities of the elements remains same. 3. Find the inverse of the matrix  $A = \begin{pmatrix} 8 & 5 & 2 \\ 4 & 6 & 3 \\ 7 & 4 & 2 \end{pmatrix}$ . a)  $\frac{1}{13} \begin{pmatrix} 93 & 68 & 80 \\ 68 & 61 & 58 \\ 80 & 58 & 69 \end{pmatrix}$  b)  $\frac{1}{14} \begin{pmatrix} 93 & 68 & 80 \\ 68 & 61 & 58 \\ 80 & 58 & 69 \end{pmatrix}$  c)  $\frac{1}{13} \begin{pmatrix} 93 & 68 & 80 \\ 68 & 61 & 58 \\ 80 & 58 & 69 \end{pmatrix}$  d)  $\frac{1}{13} \begin{pmatrix} 93 & 68 & 80 \\ 68 & 61 & 58 \\ 80 & 58 & 69 \end{pmatrix}$  View AnswerAnswer: d Explanation: The inverse of matrix  $A = \frac{1}{\det(A)} \text{adj}(A)$ ,  $\det(A) = 1(4 \cdot 2 - 3 \cdot 7) - 2(2 \cdot 14 - 3 \cdot 28) + 3(2 \cdot 28 - 4 \cdot 14) = 1(-10) - 2(-28 + 84) + 3(-28 + 56) = -10 - 2(56) + 3(28) = -10 - 112 + 84 = -38$ . 4. Given the equations are  $4x+2y+z=8, x+y+z=3, 3x+y+3z=9$ . Find the values of  $x, y$  and  $z$ . a)  $5/3, 0, 2/3$  b)  $1, 2, 3$  c)  $4/3, 1/3, 5/3$  d)  $2, 3, 4$  View AnswerAnswer: a Explanation: The matrix from the equations is represented as  $M = \begin{pmatrix} 4 & 2 & 1 \\ 1 & 1 & 1 \\ 3 & 1 & 3 \end{pmatrix}$  The another matrix is  $X = \begin{pmatrix} 8 \\ 3 \\ 9 \end{pmatrix}$ . Then  $|M| = 6$  For  $x = \frac{1}{6} \begin{vmatrix} 8 & 2 & 1 \\ 3 & 1 & 3 \\ 1 & 1 & 9 \end{vmatrix} = \frac{1}{6} (8(9-3) - 2(27-3) + 1(27-3)) = \frac{1}{6} (8(6) - 2(24) + 1(24)) = \frac{1}{6} (48 - 48 + 24) = \frac{24}{6} = 4$ . Similarly,  $y = 0, z = 2/3$ . 5. Find the adjacent A as  $A = \begin{pmatrix} 1 & 7 & -3 \\ 5 & 4 & -2 \\ 6 & 8 & -6 \end{pmatrix}$ . a)  $\begin{pmatrix} 1 & 1 & 1 \\ 2 & 3 & 4 \\ 3 & 4 & 4 \end{pmatrix}$  b)  $\begin{pmatrix} 31 & 39 & 80 \\ 39 & 45 & 74 \\ 80 & 74 & 136 \end{pmatrix}$  c)  $\begin{pmatrix} 1 & 5 & 6 \\ 7 & 4 & 8 \\ -3 & -2 & -6 \end{pmatrix}$  d)  $\begin{pmatrix} 35 & 34 & 32 \\ 56 & 67 & 48 \\ 98 & 74 & 52 \end{pmatrix}$  View AnswerAnswer: b Explanation: The adjacency of A is given by  $AA^T = \begin{pmatrix} 1 & 5 & 6 \\ 7 & 4 & 8 \\ -3 & -2 & -6 \end{pmatrix}$ .  $AA^T = \begin{pmatrix} 31 & 39 & 80 \\ 39 & 45 & 74 \\ 80 & 74 & 136 \end{pmatrix}$ . 6. Find the rank of the matrix  $A = \begin{pmatrix} 1 & 3 & 5 \\ 4 & 6 & 7 \\ 1 & 2 & 2 \end{pmatrix}$ . a) 3 b) 2 c) 1 d) 0 View AnswerAnswer: a Explanation: To find out the rank of the matrix first find the  $|A|$ . If the value of  $|A| = 0$  then the matrix is said to be reduced. But, as the determinant of A has some finite value then, the rank of the matrix is 3. 7. The rank of the matrix  $(m \times n)$  where  $m$

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