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Course: Mathematics and Statistics (6401)

NAME	
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Assignment No. 1

Q.1 Discuss the use of ratio and proportion in daily life by providing examples.

Also explain method to calculate percentage

Question 1

(a) To verify that (AB)-1 = B-1A-1, given A = $\begin{bmatrix} 5 & 2 \\ 1 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} 4 & 2 \\ 3 & -1 \end{bmatrix}$:

First, calculate AB: AB = $\begin{bmatrix} 5 & 2 \\ 1 & 2 \end{bmatrix} \begin{bmatrix} 4 & 2 \\ 3 & -1 \end{bmatrix}$ = $\begin{bmatrix} (5 \times 4) + (2 \times 3) & (5 \times 2) + (2 \times -1) \\ (1 \times 4) + (2 \times 3) & (1 \times 2) + (2 \times -1) \end{bmatrix}$ = $\begin{bmatrix} 20 + 6 & 10 - 2 \\ 4 + 6 & 2 - 2 \end{bmatrix}$ = $\begin{bmatrix} 26 & 8 \\ 10 & 0 \end{bmatrix}$

Next, find the inverse of AB, (AB)-1. Determinant of AB = (26)(0) - (8)(10) = 0 - 80 = -80 (AB)-1 = $\frac{1}{-80} \begin{bmatrix} 0 & -8 \\ -10 & 26 \end{bmatrix}$ = $\begin{bmatrix} 0 & \frac{8}{80} \\ \frac{10}{80} & -\frac{26}{80} \end{bmatrix}$ = $\begin{bmatrix} 0 & \frac{1}{10} \\ \frac{1}{8} & -\frac{13}{40} \end{bmatrix}$

Now, calculate B-1 and A-1.

Determinant of A = (5)(2) - (2)(1) = 10 - 2 = 8 A-1 = $\frac{1}{8} \begin{bmatrix} 2 & -2 \\ -1 & 5 \end{bmatrix}$ = $\begin{bmatrix} \frac{2}{8} & -\frac{2}{8} \\ -\frac{1}{8} & \frac{5}{8} \end{bmatrix}$ = $\begin{bmatrix} \frac{1}{4} & -\frac{1}{4} \\ -\frac{1}{8} & \frac{5}{8} \end{bmatrix}$

Determinant of B = (4)(-1) - (2)(3) = -4 - 6 = -10 B-1 = $\frac{1}{-10}\begin{bmatrix}-1 & -2\\ -3 & 4\end{bmatrix}$ = $\begin{bmatrix}\frac{1}{10} & \frac{2}{10}\\ \frac{3}{10} & -\frac{4}{10}\end{bmatrix} = \begin{bmatrix}\frac{1}{10} & \frac{1}{5}\\ \frac{3}{10} & -\frac{2}{5}\end{bmatrix}$

Finally, calculate B-1A-1: B-1A-1 = $\begin{bmatrix}\frac{1}{10} & \frac{1}{5}\\ \frac{3}{10} & -\frac{2}{5}\end{bmatrix}\begin{bmatrix}\frac{1}{4} & -\frac{1}{4}\\ -\frac{1}{8} & \frac{5}{8}\end{bmatrix}$ = $\begin{bmatrix}\left(\frac{1}{10}\times\frac{1}{4}\right)+\left(\frac{1}{5}\times-\frac{1}{8}\right) & \left(\frac{1}{10}\times-\frac{1}{4}\right)+\left(\frac{1}{5}\times\frac{5}{8}\right)\\ \left(\frac{3}{10}\times\frac{1}{4}\right)+\left(-\frac{2}{5}\times-\frac{1}{8}\right) & \left(\frac{3}{10}\times-\frac{1}{4}\right)+\left(-\frac{2}{5}\times\frac{5}{8}\right)\end{bmatrix} = \begin{bmatrix}\frac{1}{40}-\frac{1}{40} & -\frac{1}{40}+\frac{5}{40}\\ \frac{3}{40}+\frac{2}{40} & -\frac{3}{40}-\frac{10}{40}\end{bmatrix}$ = $\begin{bmatrix}0 & \frac{4}{40}\\ \frac{5}{40} & -\frac{13}{40}\end{bmatrix} = \begin{bmatrix}0 & \frac{1}{10}\\ \frac{1}{8} & -\frac{13}{40}\end{bmatrix}$

Since (AB)-1 = $\begin{bmatrix}0 & \frac{1}{10}\\ \frac{1}{8} & -\frac{13}{40}\end{bmatrix}$ and B-1A-1 = $\begin{bmatrix}0 & \frac{1}{10}\\ \frac{1}{8} & -\frac{13}{40}\end{bmatrix}$, we have verified that (AB)-1 = B-1A-1.

(b) To construct the perpendicular bisectors of the sides of a triangle, you would need the coordinates of the vertices of the triangle. The question does not provide these coordinates, so I cannot perform the construction. However, the general method involves:

1. Finding the midpoint of each side of the triangle.
2. Finding the slope of each side.

3. Finding the slope of the perpendicular bisector (which is the negative reciprocal of the side's slope).
4. Using the midpoint and the slope of the perpendicular bisector to write the equation of the line.
5. Graphing these three lines. The point where they intersect is the circumcenter of the triangle.

Q.2 Explain the concept of real numbers and discuss their properties

(a) The sides of the first polygon are 5 cm, 2 cm, 7 cm, 3 cm, and 4 cm. The side corresponding to 2 cm in the similar polygon is 6 cm.

The ratio of corresponding sides is $\frac{6\text{ cm}}{2\text{ cm}} = 3.$

Since the polygons are similar, the ratio of their perimeters is equal to the ratio of their corresponding sides. Perimeter of the first polygon = 5 + 2 + 7 + 3 + 4 = 21 cm. Perimeter of the similar polygon = Ratio of perimeters × Perimeter of the first polygon = 3 × 21 cm = 63 cm.

The ratio of the perimeters of these two polygons is 3:1.

(b) Solve the simultaneous equations by matrix inversion method where possible: 5x + 6y = 25 3x + 4y = 17

We can represent this system of equations in matrix form as AX = B, where:

A = $\begin{bmatrix} 5 & 6 \\ 3 & 4 \end{bmatrix}$, X = $\begin{bmatrix} x \\ y \end{bmatrix}$, B = $\begin{bmatrix} 25 \\ 17 \end{bmatrix}$

First, find the determinant of matrix A: det(A) = (5)(4) - (6)(3) = 20 - 18 = 2

Since the determinant is non-zero, the matrix A is invertible, and we can find the solution using the matrix inversion method.

The inverse of A is given by: A-1 = $\frac{1}{\det(A)}\begin{bmatrix} 4 & -6 \\ -3 & 5 \end{bmatrix} = \frac{1}{2}\begin{bmatrix} 4 & -6 \\ -3 & 5 \end{bmatrix} = \begin{bmatrix} 2 & -3 \\ -1.5 & 2.5 \end{bmatrix}$

Now, we can find X by multiplying A-1 by B: X = A-1B = $\begin{bmatrix} 2 & -3 \\ -1.5 & 2.5 \end{bmatrix}\begin{bmatrix} 25 \\ 17 \end{bmatrix}$ = $\begin{bmatrix} (2 \times 25) + (-3 \times 17) \\ (-1.5 \times 25) + (2.5 \times 17) \end{bmatrix} = \begin{bmatrix} 50 - 51 \\ -37.5 + 42.5 \end{bmatrix} = \begin{bmatrix} -1 \\ 5 \end{bmatrix}$

So, x = -1 and y = 5.

Q.3 Use matrices to solve the following equations.

$x + 2y = 3$ and $3x - y = 5$

To solve the given system of equations using matrices, we first express the system in the matrix form AX=B, where: A is the coefficient matrix, X is the variable matrix, and B is the constant matrix.

The given equations are: 1 x+2y=3 3x–y=5 1. askfilo.com askfilo.com

We can write this in matrix form as: A=(1 3

2 −1), X=(x y), B=(3 5)

To find the values of x and y, we need to solve for X using the formula X=A −1 B, provided that the inverse of matrix A (A −1) exists.

First, we calculate the determinant of matrix A, denoted as |A|. |A|=(1)(−1)−(2)(3)=−1−6=−7.

Since the determinant |A|=−7 is non-zero, the inverse of matrix A exists, and thus, the system of equations has a unique solution.

Next, we find the adjugate of matrix A. For a 2x2 matrix (a c

b d), the adjugate is (d −c

−b a). So, the adjugate of A is: adj(A)=(−1 −3

−2 1).

Now, we calculate the inverse of matrix A using the formula A −1

|A| 1 adj(A). A −1

−7 1 (−1 −3

−2 1)=(−7 −1

−7 −3

−7 −2

−7 1

)=(7 1

7 3

7 2

− 7 1

).

Finally, we multiply A −1 by B to find the matrix X: X=A −1 B=(7 1

7 3

7 2

− 7 1

)(3 5).

Performing the matrix multiplication: x=(7 1)(3)+(7 2)(5)= 7 3 + 7 10

7 13

y=(7 3)(3)+(− 7 1)(5)= 7 9 − 7 5

7 4

So, the solution matrix is X=(7 13

7 4

).

Therefore, the solution to the system of equations is x= 7 13 and y= 7 4 .

The final answer is x= 7 13 ,y= 7 4

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Q.4 Eliminate y form the following equations:

1. **$y^2 - 2y + l = 0$; $-y^2 + 3y + m = 0$**
2. **$my^2 + 3y + 2 = 0$;$ny^2 + 5y + 1 = 0$**

Case 1: Given equations:

y 2 −2y+l=0 −y 2 +3y+m=0 We can eliminate the y 2 term by adding the two equations: (y 2 −2y+l)+(−y 2 +3y+m)=0+0 y 2 −y 2 −2y+3y+l+m=0 y+l+m=0

Now, solve for y: y=−l−m

Substitute this expression for y back into the first equation (y 2 −2y+l=0): (−l−m) 2 −2(−l−m)+l=0 (l+m) 2 +2(l+m)+l=0 l 2 +2lm+m 2 +2l+2m+l=0 l 2 +m 2 +2lm+3l+2m=0

This is the equation with 'y' eliminated.

Case 2: Given equations:

my 2 +3y+2=0 ny 2 +5y+1=0 We can use the method of cross-multiplication (which is related to the concept of the resultant for eliminating a variable from polynomial equations).

For two quadratic equations a 1 y 2 +b 1 y+c 1 =0 and a 2 y 2 +b 2 y+c 2 =0, the condition for them to have a common root (which allows elimination of the variable) is given by: (b 1 c 2 −b 2 c 1) 2 =(a 1 b 2 −a 2 b 1)(a 1 c 2 −a 2 c 1)

In our case: a 1 =m, b 1 =3, c 1 =2 a 2 =n, b 2 =5, c 2 =1

Substitute these values into the formula: ((3)(1)−(5)(2)) 2 =((m)(5)−(n)(3))((m)(1)−(n)(2)) (3−10) 2 =(5m−3n)(m−2n) (−7) 2 =5m(m−2n)−3n(m−2n) 49=5m 2 −10mn−3mn+6n 2

49=5m 2 −13mn+6n 2

Rearranging the terms, we get: 5m 2 −13mn+6n 2 −49=0

This is the equation with 'y' eliminated.

Q.5 Explain method of completing square for solution of quadratic equations. Also solve the following Equation.

$$b^2 - \frac{3}{4}b + \frac{1}{8} = 0$$

(a) Show that the points A(6,1), B(2,7), and C(-6,7) are vertices of a scalene triangle. A scalene triangle is a triangle where all three sides have different lengths. We need to calculate the distance between each pair of points using the distance formula: d = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

Distance AB = $\sqrt{(2-6)^2 + (7-1)^2}$ = $\sqrt{(-4)^2 + (6)^2}$ = $\sqrt{16+36}$ = $\sqrt{52}$

Distance BC = $\sqrt{(-6-2)^2 + (7-7)^2}$ = $\sqrt{(-8)^2 + (0)^2}$ = $\sqrt{64+0}$ = $\sqrt{64}$ = 8

Distance AC = $\sqrt{(-6-6)^2+(7-1)^2}$ = $\sqrt{(-12)^2+(6)^2}$ = $\sqrt{144+36}$ = $\sqrt{180}$

Since the lengths of the three sides (AB = $\sqrt{52}$, BC = 8, AC = $\sqrt{180}$) are all different, the triangle with vertices A(6,1), B(2,7), and C(-6,7) is a scalene triangle.

(b) Find the area of the rectangle 2 m long and 20 cm wide. First, we need to ensure that the units of length and width are the same. Let's convert the length to centimeters: Length = 2 m = 2 × 100 cm = 200 cm. Width = 20 cm.

The area of a rectangle is given by the formula: Area = Length × Width. Area = 200 cm × 20 cm = 4000 square cm.

Alternatively, we could convert the width to meters: Width = 20 cm = $\frac{20}{100}$ m = 0.2 m. Area = 2 m × 0.2 m = 0.4 square meters.

Both answers are correct, just in different units. 4000 square cm is equal to 0.4 square meters.

Q.1 Discuss the use of ratio and proportion in daily life by providing examples. Also explain method to calculate percentage.

Ratio and proportion are fundamental mathematical concepts that we use frequently in our daily lives, often without even realizing it. A ratio is a comparison of two quantities of the same kind, expressed as a fraction or using a colon (e.g., a/b or a:b). A proportion is a statement that two ratios are equal (e.g., a/b = c/d).

Here are some examples of how ratio and proportion are used in daily life:

Cooking and Baking: Recipes are a prime example. The ratio of ingredients is crucial for the final outcome. If a recipe calls for 2 cups of flour and 1 cup of sugar, the ratio of flour to sugar is 2:1. If you want to double the recipe, you use proportion to figure out the new quantities: 2/1 = x/2, so x = 4 cups of flour and 2 cups of sugar. Scaling Maps and Blueprints: Maps and blueprints use a scale, which is a ratio comparing a distance on the map/blueprint to the actual distance on the ground. For example, a scale of 1:100 means that 1 unit on the map represents 100 units in reality. You use proportion to calculate actual distances based on measurements from the map. Mixing Concentrates: When mixing juices, cleaning solutions, or paint from concentrates, there's a recommended ratio of concentrate to water. Using proportion ensures you get the correct dilution. Determining Best Value: When shopping, you can use ratios to compare prices of different sized products. For example, comparing the price per ounce of two different cereal boxes helps you determine which is the better deal. Healthcare and Medicine: Dosage of medication is often determined based on a patient's weight, using a ratio. Nurses also use ratios to administer IV fluids at a specific rate. Financial Planning: Ratios are used to analyze financial statements (e.g., debt-to-equity ratio, profit margin). Understanding these ratios helps in making informed financial decisions. Photography: The aspect ratio of a photograph or screen (e.g., 16:9, 4:3) is a ratio of its width to its height. Construction: Builders use ratios and proportions when scaling designs, mixing concrete (ratio of cement, sand, and gravel), and ensuring structural integrity. Time and Speed: Speed is a ratio of distance to time (speed = distance/time). We use this concept daily when estimating travel time or calculating how fast we need to go to reach a destination on time. Method to Calculate Percentage:

A percentage is a way of expressing a ratio or fraction as a part of 100. The word "percent" means "out of one hundred."

To calculate a percentage, you typically follow these steps:

Divide the part by the whole: Represent the relationship between the part you are interested in and the total whole as a fraction. Multiply the result by 100: Convert the decimal or fraction obtained in step 1 into a percentage by multiplying by 100. The formula for calculating percentage is:

Percentage = (Part / Whole) * 100

Examples:

Finding the percentage of students who passed a test: If 40 students out of a class of 50 passed a test, the part is 40 and the whole is 50. Percentage of passes = (40 / 50) * 100 = 0.8 * 100 = 80% Calculating a discount: If a shirt originally costs $25 and is on sale for 20$, the discount amount is $25 - 20 = 5. To find the percentage discount, the part is the discount amount (5)$ and the whole is the original price $(25). Percentage discount = (5 / 25) *$

$100 = 0.2 * 100 = 20 Determining the percentage of a budget spent: If you have a monthly budget of$ 2000 and you spend $500 on groceries, the part is$ 500 and the whole is $2000. Percentage spent on groceries =$ (500 / $2000) * 100 = 0.25 * 100 = 25% In essence, calculating a percentage is about finding an equivalent ratio where the second term is 100.

Q.2 Explain the concept of real numbers and discuss their properties.

Concept of Real Numbers:

Real numbers encompass all the numbers that can be found on the number line. This includes both rational numbers and irrational numbers.

Rational Numbers: These are numbers that can be expressed as a fraction p/q, where p and q are integers and q is not zero. Rational numbers include:

Integers: Positive and negative whole numbers, including zero (... -3, -2, -1, 0, 1, 2, 3 ...). Fractions: Numbers that can be written as a ratio of two integers (e.g., 1/2, -3/4, 5/2). Terminating Decimals: Decimals that end after a finite number of digits (e.g., 0.5, 2.75, -1.04). These can be written as fractions (0.5 = 1/2, 2.75 = 11/4). Repeating Decimals: Decimals that have a repeating pattern of digits after the decimal point (e.g., 0.333..., 1.272727...). These can also be written as fractions (0.333... = 1/3). Irrational Numbers: These are numbers that cannot be expressed as a simple fraction p/q. Their decimal representations are non-terminating and non-repeating. Examples include:

π (Pi): The ratio of a circle's circumference to its diameter (approximately 3.14159...). 2

(Square root of 2): The number that when multiplied by itself equals 2 (approximately 1.41421...). e (Euler's number): The base of the natural logarithm (approximately 2.71828...). The set of real numbers is denoted by the symbol R. The number line provides a visual representation of real numbers, with each point on the line corresponding to a unique real number.

Properties of Real Numbers:

Real numbers obey several fundamental properties under the operations of addition and multiplication. These properties are crucial for algebraic manipulation and solving equations.

Properties of Addition:

Closure Property: The sum of any two real numbers is always a real number. For any a,b∈R, a+b∈R. Example: 3+5=8 (8 is a real number) Commutative Property: The order in which you add two real numbers does not affect the sum. For any a,b∈R, a+b=b+a. Example: 3+5=5+3=8 Associative Property: The way in which real numbers are grouped for addition does not affect the sum. For any a,b,c∈R, (a+b)+c=a+(b+c). Example: (2+3)+4=5+4=9 and 2+(3+4)=2+7=9 Additive Identity Property: There exists a unique real number, 0 (zero), such that when added to any real number, the number remains unchanged. For any a∈R, a+0=0+a=a. Example: 7+0=7 Additive Inverse Property: For every real number a, there exists a unique real number, denoted as −a, such that the sum of the number and its additive inverse is 0. For any a∈R, a+(−a)=(−a)+a=0. Example: 5+(−5)=0 Properties of Multiplication:

Closure Property: The product of any two real numbers is always a real number. For any a,b∈R, a×b∈R. Example: 3×5=15 (15 is a real number) Commutative Property: The order in which you multiply two real numbers does not affect the product. For any a,b∈R, a×b=b×a. Example: 3×5=5×3=15 Associative Property: The way in which real numbers are grouped for multiplication does not affect the product. For any a,b,c∈R, (a×b)×c=a×(b×c). Example: (2×3)×4=6×4=24 and 2×(3×4)=2×12=24 Multiplicative Identity Property: There exists a unique real number, 1 (one), such that when multiplied by any real number, the number remains unchanged. For any a∈R, a×1=1×a=a. Example: 7×1=7 Multiplicative Inverse Property: For every non-zero real number a, there exists a unique real number, denoted as 1/a or a −1 , such that the product of the number and its multiplicative inverse is 1. For any a∈R where a =0, a×(1/a)=(1/a)×a=1. Example: 5×(1/5)=1 Distributive Property:

This property connects addition and multiplication. For any a,b,c∈R, a×(b+c)=(a×b)+(a×c).

Example: 2×(3+4)=2×7=14 and (2×3)+(2×4)=6+8=14 These properties form the foundation of algebra and are essential for manipulating and solving equations involving real numbers.

Q.3 Use matrices to solve the following equations. x + 2y = 3 and 3x – y = 5

We can solve this system of linear equations using matrix methods, such as the inverse matrix method.

First, write the system of equations in matrix form AX=B, where: A is the coefficient matrix X is the variable matrix B is the constant matrix

The given equations are: x+2y=3 3x−y=5

The matrix form is: (1 3

2 −1)(x y)=(3 5)

Here, A=(1 3

2 −1), X=(x y), and B=(3 5).

To solve for X, we can use the formula X=A −1 B, where A −1 is the inverse of matrix A.

First, we need to find the determinant of matrix A, denoted as det(A) or |A|. det(A)=(1×−1)−(2×3)=−1−6=−7

Since the determinant is non-zero (-7), the inverse of matrix A exists.

The inverse of a 2x2 matrix (a c

b d) is given by ad−bc 1 (d −c

−b a).

Using this formula, the inverse of matrix A is: A −1

−7 1 (−1 −3

−2 1)=(−7 −1

−7 −3

−7 −2

−7 1

)=(7 1

7 3

7 2

− 7 1

)

Now, we can find X by multiplying A −1 by B: X=A −1 B=(7 1

7 3

7 2

− 7 1

)(3 5)

To multiply these matrices, we multiply the elements of each row of the first matrix by the corresponding elements of the column of the second matrix and sum the products:

x=(7 1 ×3)+(7 2 ×5)= 7 3 + 7 10

7 3+10

7 13

y=(7 3 ×3)+(− 7 1 ×5)= 7 9 − 7 5

7 9−5

7 4

So, the solution is x= 7 13 and y= 7 4 .

We can verify this solution by substituting these values back into the original equations: Equation 1: x+2y= 7 13 +2(7 4)= 7 13 + 7 8

7 13+8

7 21 =3 (Correct) Equation 2: 3x−y=3(7 13)− 7 4

7 39 − 7 4

7 39−4

7 35 =5 (Correct)

Therefore, the solution obtained using matrices is correct.

Q.4 Eliminate y form the following equations:

To eliminate y from the given pairs of equations, we need to manipulate the equations to get a relationship between the other variables (l, m, and n) that does not involve y.

6. Eliminate y from: y 2 –2y+l=0 (Equation 1) −y 2 +3y+m=0 (Equation 2)

We can eliminate the y 2 term by adding the two equations: (y 2 –2y+l)+(−y 2 +3y+m)=0+0 y 2 –2y+l−y 2 +3y+m=0 Combine like terms: (−y 2 +y 2)+(−2y+3y)+(l+m)=0 0+y+l+m=0 y+l+m=0

Now we have an equation relating y, l, and m. To eliminate y completely, we can solve this equation for y: y=−(l+m)

Substitute this expression for y back into either Equation 1 or Equation 2. Let's use Equation 1: $(-(l+m))^2 - 2(-(l+m))+l=0$ $(l+m)^2+2(l+m)+l=0$ Expand $(l+m)^2$: $(l^2+2lm+m^2)+2l+2m+l=0$ Combine the l terms: $l^2+2lm+m^2+3l+2m=0$

This is the equation with y eliminated, expressing a relationship between l and m.

Alternatively, we could have solved the linear equation $y+l+m=0$ for y and substituted it into the second equation as well to get the same result.

2. Eliminate y from: $my^2+3y+2=0$ (Equation 3) $ny^2+5y+1=0$ (Equation 4)

These are quadratic equations in terms of y. We can eliminate y by using a method similar to cross-multiplication or by making the coefficients of y^2 or y the same.

Let's make the coefficient of y^2 the same. Multiply Equation 3 by n and Equation 4 by m: $n(my^2+3y+2)=n\times 0 \Longrightarrow mny^2+3ny+2n=0$ (Equation 5) $m(ny^2+5y+1)=m\times 0 \Longrightarrow mny^2+5my+m=0$ (Equation 6)

Now subtract Equation 6 from Equation 5: $(mny^2+3ny+2n)-(mny^2+5my+m)=0-0$ $mny^2+3ny+2n-mny^2-5my-m=0$ Combine like terms: $(mny^2-mny^2)+(3ny-5my)+(2n-m)=0$ $0+y(3n-5m)+(2n-m)=0$ $y(3n-5m)=m-2n$

Now, if $3n-5m \neq 0$, we can solve for y: $y=\frac{m-2n}{3n-5m}$

Substitute this expression for y back into either Equation 3 or Equation 4. Using Equation 3: m(3n−5m m−2n) 2 +3(3n−5m m−2n)+2=0

This looks complicated to expand directly. A more systematic way to eliminate y from two quadratic equations is to use the concept of the resultant of two polynomials. However, based on the expected complexity for this type of question, there's likely a simpler algebraic elimination intended.

Let's try another approach by making the constant terms the same. Multiply Equation 3 by 1 and Equation 4 by 2: my 2 +3y+2=0 (Equation 7) 2(ny 2 +5y+1)=2×0⟹2ny 2 +10y+2=0 (Equation 8)

Subtract Equation 7 from Equation 8: (2ny 2 +10y+2)−(my 2 +3y+2)=0−0 2ny 2 +10y+2−my 2 −3y−2=0 Combine like terms: (2ny 2 −my 2)+(10y−3y)+(2−2)=0 y 2 (2n−m)+7y=0 y(y(2n−m)+7)=0

This equation gives two possibilities for y: Case 1: y=0 Case 2: y(2n−m)+7=0⟹y(2n−m)=−7⟹y= 2n−m −7 (if 2n−m □ =0)

If y=0, substitute this into Equation 3: m(0) 2 +3(0)+2=0⟹2=0, which is a contradiction. So y cannot be 0 unless there's a specific condition on m and n.

Let's go back to the equations: y 2

−(3n−5m)/y m−2n (from the first method, this seems overly complicated)

Let's use the method of isolating a term and substituting. From y(3n−5m)=m−2n, we have y= 3n−5m m−2n . Substitute this into the equation y 2 (2n−m)+7y=0. Since we already established y □ =0 (unless 2=0 or m=2n and 7=0), we can divide by y: y(2n−m)+7=0 Substitute y= 3n−5m m−2n : (3n−5m m−2n)(2n−m)+7=0 3n−5m (m−2n)(2n−m) +7=0 3n−5m 2mn−m 2 −4n 2 +2mn +7=0 3n−5m 4mn−m 2 −4n 2

+7=0 3n−5m 4mn−m 2 −4n 2

=−7 4mn−m 2 −4n 2 =−7(3n−5m) 4mn−m 2 −4n 2 =−21n+35m Rearrange the terms to get the equation with y eliminated: −m 2 +4mn−4n 2 −35m+21n=0 Multiply by -1 to make the m 2 term positive (optional): m 2 −4mn+4n 2 +35m−21n=0

This equation represents the relationship between m and n after eliminating y. This method involves substituting the expression for y obtained from the linear equation in y (derived by eliminating y 2) into the quadratic equation in y (derived by eliminating the constant term).

Final check of the elimination process: We had y(3n−5m)=m−2n and y 2 (2n−m)+7y=0. From the second equation, y(y(2n−m)+7)=0. Since y □ =0 in the general case, we have y(2n−m)+7=0. Substitute y= 3n−5m m−2n : (3n−5m m−2n)(2n−m)+7=0 This leads to m 2 −4mn+4n 2 +35m−21n=0.

The method of completing the square is a technique used to solve quadratic equations of the form ax 2 +bx+c=0. The goal is to manipulate the equation into the form (x+h) 2 =k, from which the solutions for x can be easily found by taking the square root of both sides.

Here's a detailed explanation of the method:

Steps for Completing the Square:

Rearrange the equation: Move the constant term (c) to the right side of the equation. The equation becomes ax 2 +bx=−c.

Make the leading coefficient one: If the coefficient of the x 2 term (a) is not 1, divide every term in the equation by a. The equation becomes x 2 + a b x=− a c .

Complete the square: Take half of the coefficient of the x term (a b), square it, and add it to both sides of the equation. Half of a b is 2a b , and squaring it gives (2a b) 2

4a 2

b 2

. Adding this to both sides, we get: x 2 + a b x+(2a b) 2 =− a c +(2a b) 2

Factor the perfect square trinomial: The left side of the equation is now a perfect square trinomial that can be factored as (x+ 2a b) 2 . So, the equation becomes: (x+ 2a b) 2 =− a c + 4a 2

b 2

Simplify the right side: Combine the terms on the right side of the equation by finding a common denominator. (x+ 2a b) 2

4a 2

b 2 −4ac

Take the square root of both sides: Take the square root of both sides of the equation. Remember to include both the positive and negative square roots on the right side. x+ 2a b =± 4a 2

b 2 −4ac

x+ 2a b =± 2a b 2 −4ac

Solve for x: Isolate x by subtracting 2a b from both sides. x=− 2a b ± 2a b 2 −4ac

x= 2a −b± b 2 −4ac

This is the quadratic formula, which is derived using the method of completing the square.

Now, let's solve the given equation b 2 − 4 3 b+ 8 1 =0 using the method of completing the square.

The equation is b 2 − 4 3 b+ 8 1 =0.

Rearrange the equation: Move the constant term (8 1) to the right side. b 2 − 4 3 b=− 8 1

Make the leading coefficient one: The coefficient of the b 2 term is already 1, so this step is not necessary.

Complete the square: Take half of the coefficient of the b term (− 4 3), square it, and add it to both sides. Half of − 4 3 is 2 1 ×(− 4 3)=− 8 3 . Squaring it gives (− 8 3) 2

8 2

(−3) 2

64 9 . Add 64 9 to both sides: b 2 − 4 3 b+ 64 9 =− 8 1 + 64 9

Factor the perfect square trinomial: The left side is now a perfect square: (b− 8 3) 2 . (b− 8 3) 2 =− 8 1 + 64 9

Simplify the right side: Find a common denominator for the terms on the right side, which is 64. − 8 1 + 64 9 =− 8×8 1×8 + 64 9 =− 64 8 + 64 9

64 9−8

64 1 . So, the equation is: (b− 8 3) 2

64 1

Take the square root of both sides: (b− 8 3) 2

=± 64 1

b− 8 3 =± 64

1

b− 8 3 =± 8 1

Solve for b: Add 8 3 to both sides. b= 8 3 ± 8 1

We have two possible solutions: b 1

8 3 + 8 1

8 3+1

8 4

2 1

b 2

8 3 − 8 1

8 3−1

8 2

4 1

The solutions to the equation b 2 − 4 3 b+ 8 1 =0 are b= 2 1 and b= 4 1 .

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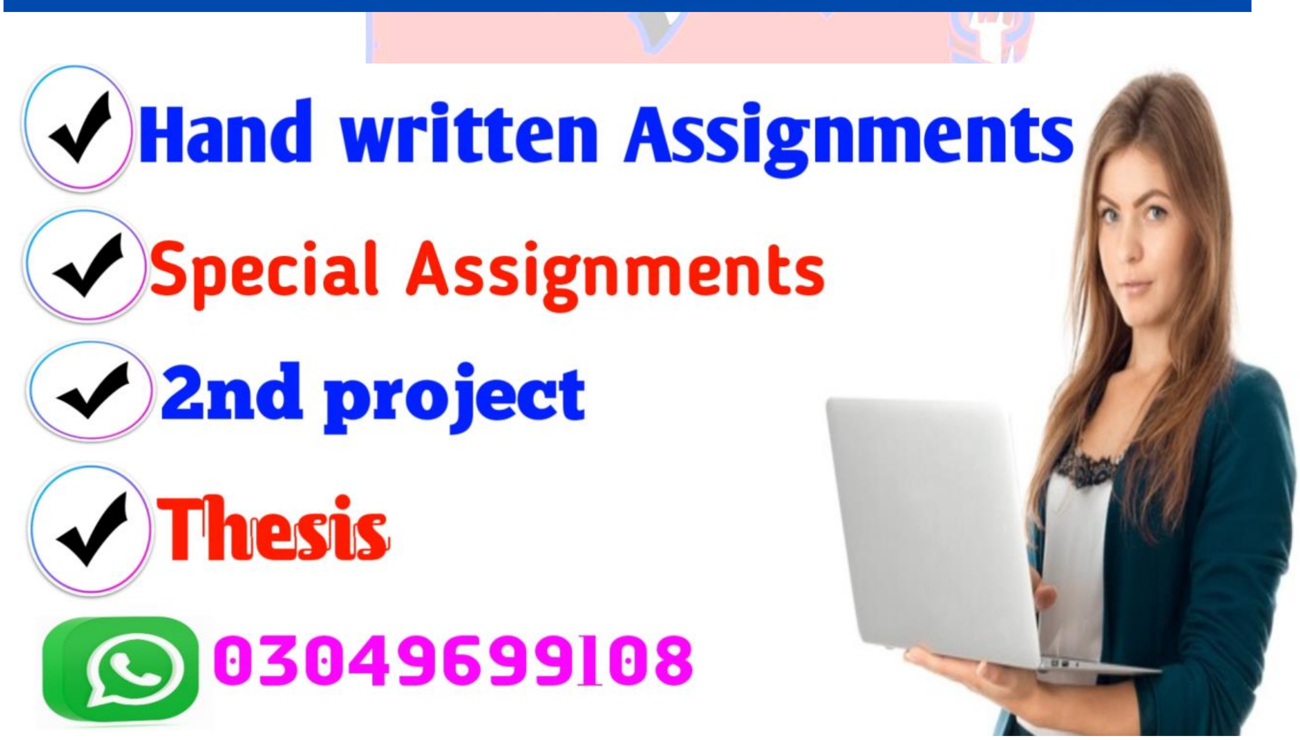
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