

SIT190 - Knight- Weeks 2–4 - OnTrack Assessment

Task 1: Matrices - Inverses Trimester1,2024

Find the inverse of each of the following matrices if they exist. If they do not exist, explain why.

1. $\begin{bmatrix} 8 & -16 \\ -2 & 4 \end{bmatrix}$

2. $\begin{bmatrix} 5 & 2 \\ 7 & 4 \end{bmatrix}$

Task 2: Simultaneous equations

Sakae and Pritika each bought the same pens and the same notebooks, but in different quantities. Sakae bought 4 pens and 2 notepads and paid \$13. Pritika bought 8 pens and 1 notebook and paid \$8.

What was the cost per pen and the cost per notebook?

1. Express this problem as a pair of linear equations.
2. Solve this pair of simultaneous equations using matrices. Show all working including the working used to find the inverse of the matrix.
Explain why you find the matrix method easier or harder than using elimination or substitution methods (1-2 sentences).

Task 3: Quadratics

For the quadratic function $y = -x^2 - 3x - 9$:

- Find the x -intercepts and y -intercept
- Find the stationary point by completing the square (show all working).
- State whether they are a local maximum or local minimum (Hint: use the sign of the x^2 coefficient)
- Sketch the graph clearly identifying all the above elements.

Task 4: Cubics

Find the x -intercepts and y -intercepts of the cubic $y = (x - 3)(x^2 - 14)$.

Submission

In order to complete this task, you must submit the following:

Task 1 Matrices - Inverses

- 1.1-1.2** For each matrix, give the inverse if it exists (showing all working), otherwise an explanation (1-2 sentences) on why no inverse exists.

Task 2 Matrices - Solving simultaneous equations

- Identify the variables in this problem and state them in the form 'Let x be the ...' and 'Let y be the ...'.
- Express the problem in the form of two linear equations.
- Solve this problem using the matrix method including the following steps:
 - Formulate the problem as a matrix problem.
 - Find the inverse showing all working.
 - Solve the equation showing each step of the working.
 - Explanation of why you prefer this method or otherwise (1-2 sentences).

- Task 3**
- Give the intercepts, stationary points and the type of stationary points showing all working.
 - State the type of stationary point and give an explanation why it is this type.
 - A hand drawn sketch of the graph showing all the above elements and a labelled x axis and y axis and origin.

- Task 4** The x -intercepts and y -intercept of the cubic showing all working.



Useful Resources

- Watch, Read and Think Section 3.3, Examples 1 and 2.
- Watch, Read and Think Section 4
- Video: Sketching Quadratics
- Treasure Chest: Sketching quadratics; Sketching quadratics with a negative coefficient
- Watch, Read and Think Section 4.5 has some examples of finding the intercepts of cubic polynomials

1 Further Thoughts



Ancient civilisations such as the Egyptians ($\approx 1500\text{BCE}$) recorded the lengths of the shadow of a vertical stick (gnomon) in tables that related the shadow length to the time of day. A shadow is long early in the morning, shortens at noon and then becomes longer in the afternoon. Gnomons enabled them to tell the time of day and of the year. Later in history, people were able to estimate the circumference of the earth and distance to the moon using shadows and trigonometry.

Isler, M. (1991). The Gnomon in Egyptian Antiquity. *Journal of the American Research Center in Egypt*, 28, 155-185. doi:10.2307/40000578)

Note: Further Thoughts is **not** part of the Distinction On-Track task.