

Student Name: _____



MATHEMATICAL METHODS 2020

Unit 3

Key Topic Test 7 – Transformations Technology Free

Recommended writing time: 45 minutes

Total number of marks available: 30 marks

QUESTION BOOK

* The recommended writing time is a guide to the time students should take to complete this test. Teachers may wish to alter this time and can do so at their own discretion.

Conditions and restrictions

- Students are permitted to bring into the room for this test: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the room for this test: blank sheets of paper and/or white out liquid/tape.
- No calculator is permitted in this test.

Materials supplied

- Question and answer book of 8 pages.

Instructions

- Print your name in the space provided on the top of the front page.
- All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic communication devices into the room for this test.

Instructions

Answer all questions in the spaces provided.

In all questions where a numerical answer is required, an exact value must be given, unless otherwise specified.

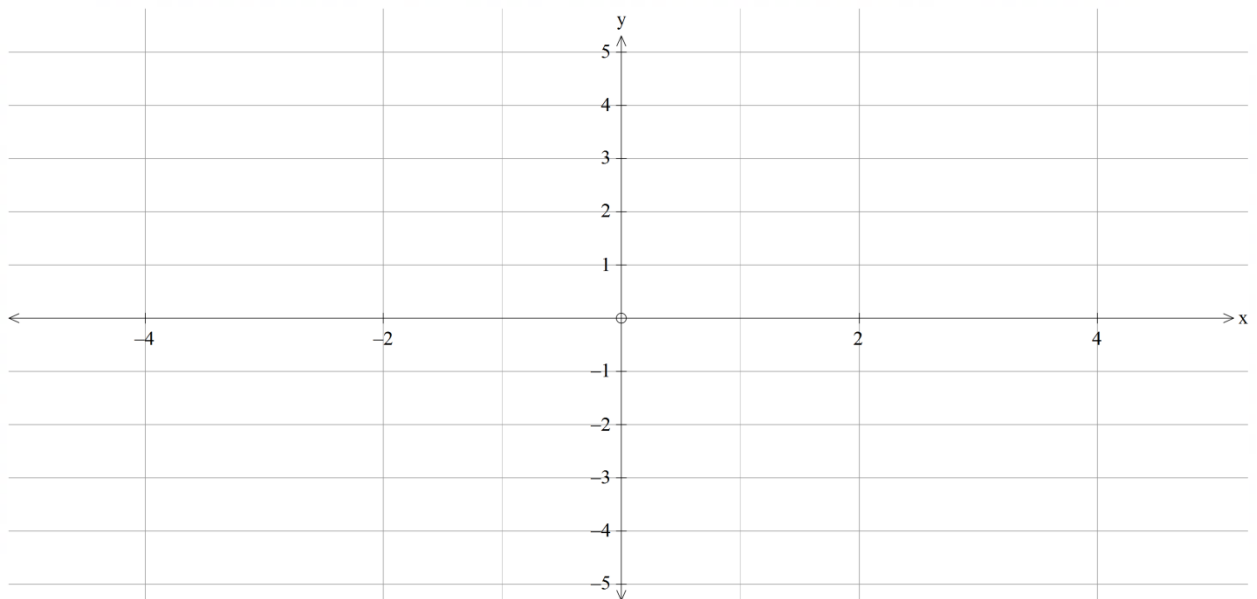
In questions where more than one mark is available, appropriate working must be shown.

Unless otherwise indicated, the diagrams in this book are not drawn to scale.

Question 1 (8 marks)

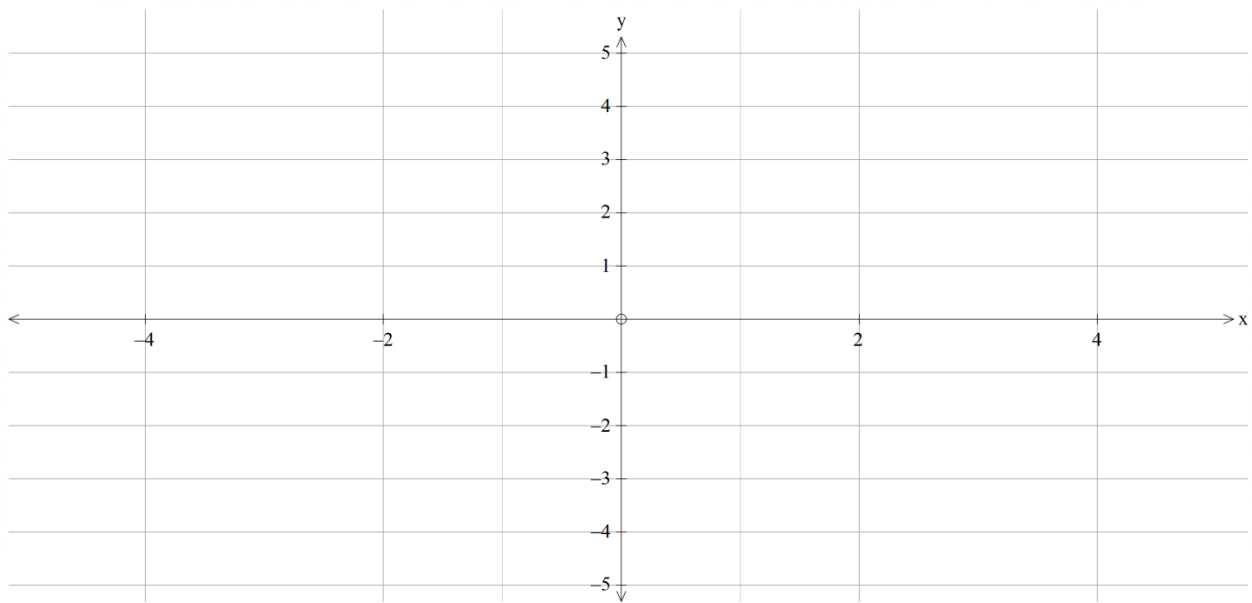
State the transformations that map the graph of $y = f(x)$ to the graph of $y = g(x)$ in each of the following and sketch the graph of $g(x)$.

a. $f(x) = \frac{1}{x}, g(x) = \frac{3}{2-x}$



2 + 2 = 4 marks

b. $f(x) = \sqrt{x}$, $g(x) = -\sqrt{2x + 4} + 1$



2 + 2 = 4 marks

Question 2 (5 marks)

The transformation $T: R^2 \rightarrow R^2$, which maps the graph of $y = \sqrt{\frac{x}{2} + 1} - 5$ onto the graph of $y = \sqrt{x}$ has rule: $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = A \begin{bmatrix} x \\ y \end{bmatrix} + B$, where A is a 2×2 matrix and B is a 2×1 matrix.

- a. The graph of $y = \sqrt{\frac{x}{2} + 1} - 5$, undergoes a dilation and two translations, in that order to map onto the graph of $y = \sqrt{x}$. List the transformations.

3 marks

- b. Find matrix A

1 mark

- c. Find matrix B

1 mark

Question 3 (6 marks)

The graph of $y = x^2 + 4x + 4$ undergoes a series of transformations in the order:

- Translation 4 units to the right
- Translation 2 units up
- Dilation factor 2 from the x-axis
- Reflection in the y-axis

- a. Find the image of the point $(-2, 0)$ after these transformations

2 marks

b. Find the pre-image of the point (0,12)

2 marks

c. Find the equation of the transformed function.

2 marks

Question 4 (3 marks)

A transformation $T: R^2 \rightarrow R^2$ is defined by $T \left(\begin{bmatrix} x \\ y \end{bmatrix} \right) = \begin{bmatrix} -1 & 0 \\ 0 & \frac{1}{2} \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} 3 \\ -2 \end{bmatrix}$

Find the image of the curve $y = \frac{1}{x}$ under this transformation.

3 marks

Question 5 (4 marks)

For the function $f(x) = 2x - 4$

- a. Find $f^{-1}(x)$

1 mark

The transformation $T: R^2 \rightarrow R^2$ with rule $T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} c \\ d \end{bmatrix}$, where a, b, c and d are integers, maps the graph of $y = f(x)$ onto the graph of $y = f^{-1}(x)$.

- b. Find a set of values for a, b, c and d .

3 marks

Question 6 (4 marks)

For the functions $f(x) = e^{2x+2}$ and $g(x) = \frac{x}{2} - 1$;

- a. Find the rule for $f(g(x))$

2 marks

- b.** State a set of transformations that map the graph of $y = f(x)$ onto the graph of $y = f(g(x))$

2 marks

END OF KEY TOPIC TEST