KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

GRADE 10 INVESTIGATION 2024
CO-ORDINATE GEOMETRY

"The aim of this task is to discover the distance and midpoint formulae and to use them to determine, by analytical methods, the midpoint and distance in application type problems."

DATE	03 May 2024
TOTAL	50 MARKS
TIME	1 HOUR 30 MINUTES

This investigation consists of Six pages, THREE parts.

Pre-requisite Knowledge for this task:
- Calculator use in Algebra.
- Theorem of Pythagoras

| Name of Learner		Class	

	Part A	Part B	Part C	TOTAL
Total	23	17	10	50
Candidate Mark				
Moderated Mark				

INSTRUCTIONS

1. Answer all the questions in all the activities.

2. Answers are to be done on this question paper.

3. Write neatly and legibly.

4. Calculators (where indicated) may be used.

5. No Textbook, rulers, notes, exercise books or any other such resource may be used when answering this task. The task is written under examination conditions.

6. This investigation is an individual task, and NO GROUP WORK is allowed

PART A: Distance is the length of a line between two points.

1. Consider the line segments and the co-ordinates in the Cartesian plane below:
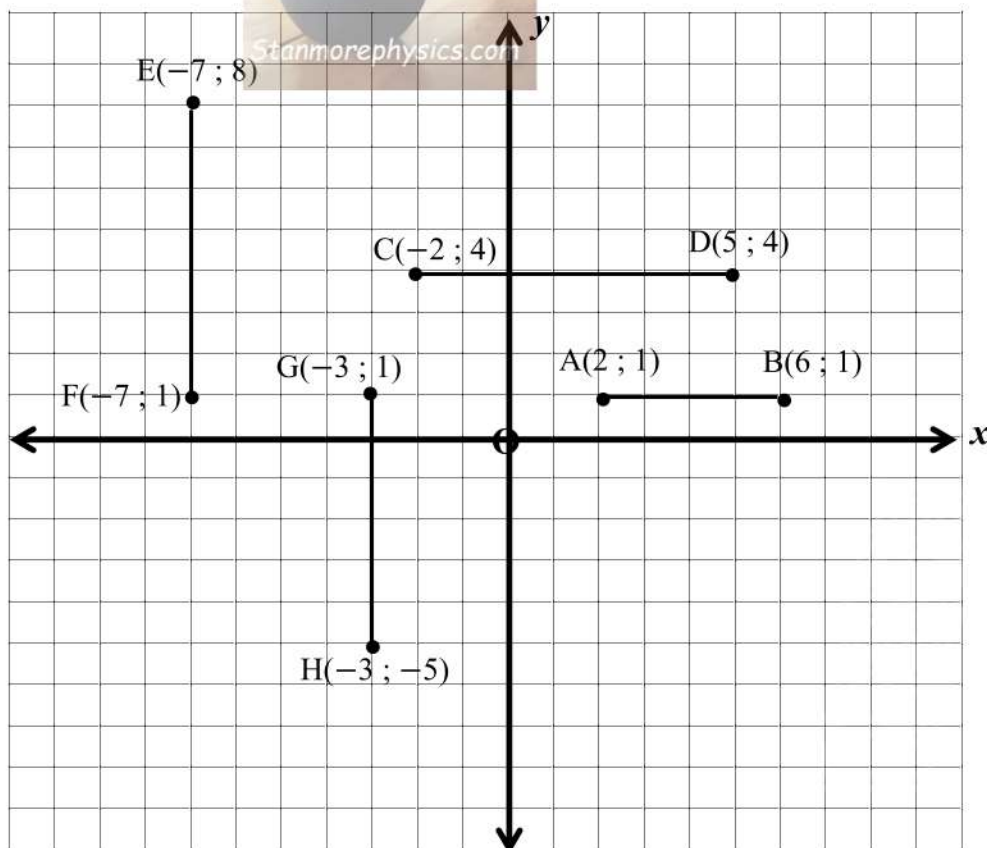
1.1 (a) Calculate the length of AB (1)

(b) Write down the value of : $(x_B - x_A)^2$ (1)

(c)   Write down the value of $(y_B - y_A)$ (1)

(d)   Write down the value of $\sqrt{(x_B - x_A)^2 + (y_B - y_A)^2}$ (1)

(e)   What do you notice about your answers in 1.1 (a) and (d)?   (1)

1.2   (a)   Calculate the length of CD.   (1)

(b)   Write down the value of : $(x_D - x_C)^2$ (1)

(c)   Write down the value of : $(y_D - y_C)^2$ (1)

(d)   Write down the value of $\sqrt{(x_D - x_C)^2 + (y_D - y_C)^2}$ (1)

(e)   What do you notice about your answers in 1.2 (a) and (d)?   (1)

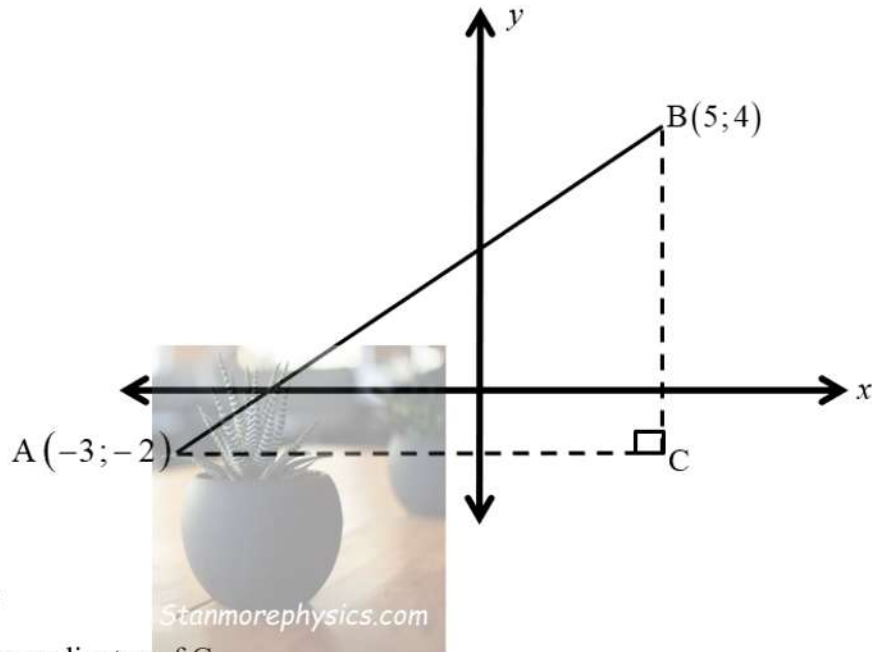1.3   (a)   Calculate the length of EF.   (1)

(b)   Write down the value of : $(x_F - x_E)^2$ (1)

(c)   Write down the value of : $(y_F - y_E)^2$ (1)

(d)   Write down the value of $\sqrt{(x_F - x_E)^2 + (y_F - y_E)^2}$ (1)

(e) What do you notice about your answers in (a) and (d) (1)

[15]

2.1 Consider the diagram below. AB is a line segment with endpoints $A(-3;-2)$ and $B(5;4)$.

2.1 Write down:

    2.1.1 The co-ordinates of C. (2)

    2.1.2 The length of AC (1)

    2.1.3 The length of BC $=$ (2)

    2.1.4 Now calculate the length of AB – Hint: Use Pythagoras' Theorem
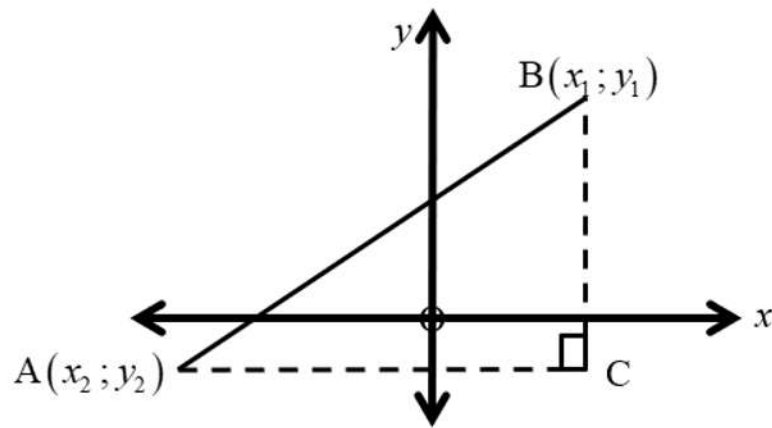 $AB^2 = AC^2 + BC^2$ (Pythag.)

(1)

$$AB^2 = \left(5-(-3)\right)^2 + \left(4-(-2)\right)^2$$

$$AB = \sqrt{\left(\underline{}\right)^2 + \left(\underline{}\right)^2}$$

$$\therefore AB = \underline{}$$

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2.2 In the diagram below, $B(x_1 ; y_1)$ and $A(x_2 ; y_2)$ are the points on the line segment AB. Use the diagram below to:

2.2.1 Write down the co-ordinates of C in terms of x and y. (1)

2.2.2 Complete: $AB^2 = AC^2 + BC^2$ (Pythag. (1)

$$AB^2 = \left(\underline{} - \underline{} \right)^2 + \left(y_2 - y_1 \right)^2$$

$\therefore AB = \sqrt{\left(\underline{} - \underline{} \right)^2 + \left(y_2 - y_1 \right)^2}$ **is the formula used to calculate the length of a line segment between points A and B with** $A(x_2 ; y_2)$ **and** $B(x_1 ; y_1)$**, it is known as the 'distance formula'.**

[8]

PART B: Midpoint of a line segment is the point halfway between two given points.

1.1   Using the line segments and co-ordinates given on the Cartesian plane below, write down the CO-ORDINATES of the MIDPOINTS of the following line segments:
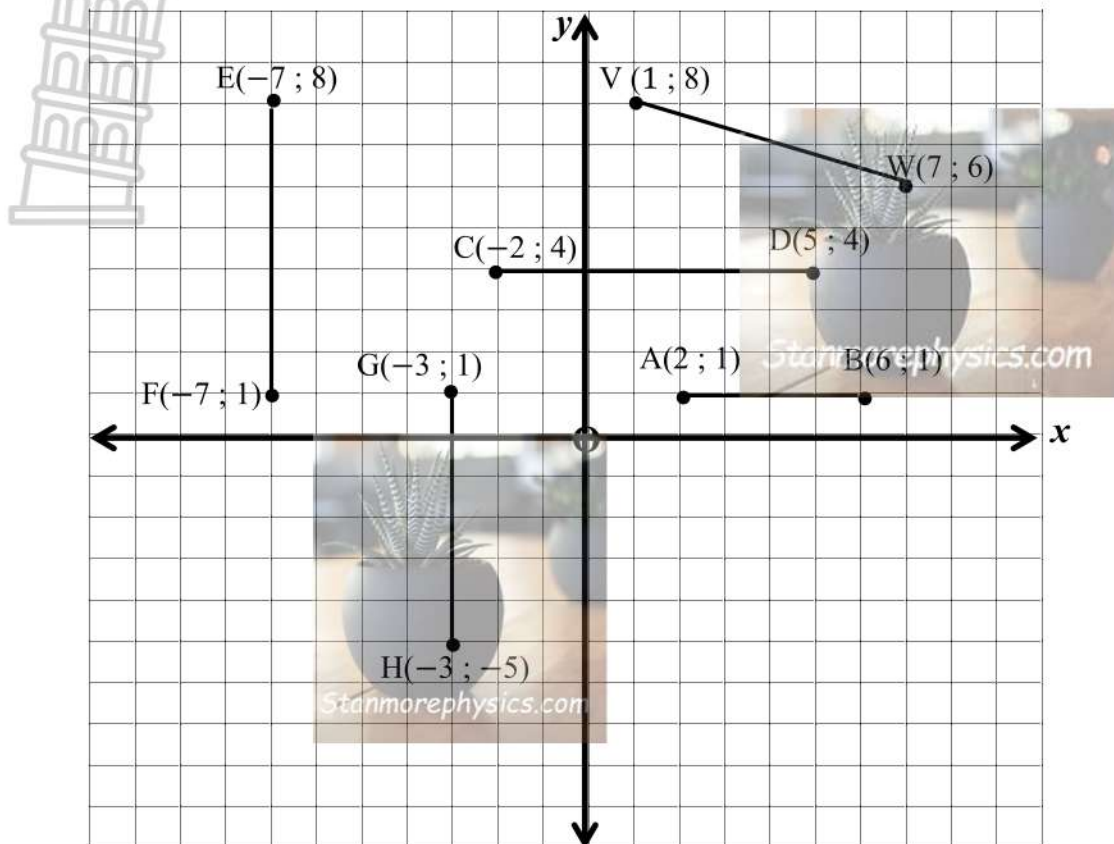
e.g. Midpoint of CD: $\left(1\frac{1}{2};4\right)$	
Midpoint of AB: (_____ ; _____)	
Midpoint of EF: (_____ ; _____)	(2)

1.2   Given that the midpoint between V (1; 8) and W (7; 6) is (4; 7). The value of 4 (the x co-ordinate of the midpoint) is determined using the x co-ordinates of V and W, as shown in the mathematical expression $\dfrac{x_v + x_w}{2} = \dfrac{1+7}{2} = 4$.
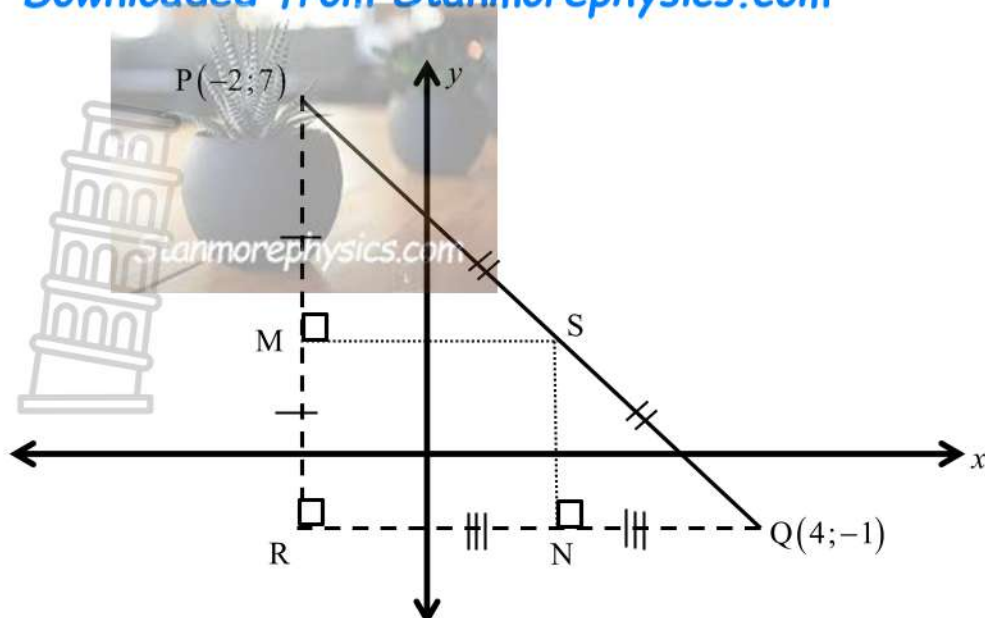
Hence, write down a mathematical expression to explain how you would use the y co-ordinates of points V and W to arrive at the value of 7 (the y value of the midpoint).

(2)

[4]

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2.

2.1 Write down the co-ordinates of R. (2)

2.2.1 Explain by means of a mathematical expression how you would calculate the y-co-ordinate of the midpoint of PR. (2)

2.2.2 Write down the co-ordinates of M, the midpoint of PR (1)

2.3.1 Explain by means of a mathematical expression how you would calculate the x co-ordinate of the midpoint of RQ. (2)

2.3.2 Write down the co-ordinates of N, the midpoint of RQ. (1)

2.4 Show that the co-ordinates of S, which is the midpoint of PQ are (1 ; 3), by using a mathematical expressions. (3)

[11]

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3.1 Using the diagram below, write down the co-ordinates of M, in terms of x_1, x_2, y_1 and y_2, if M is the midpoint of the line segment AB.
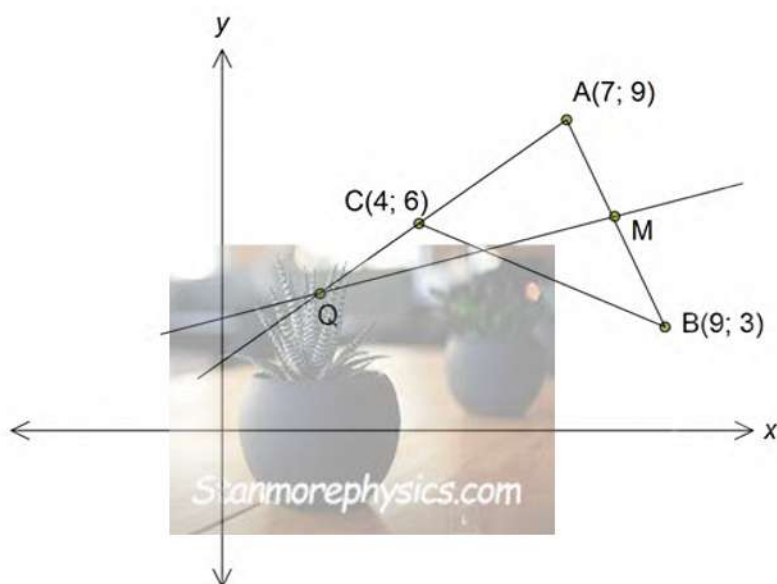

(2)
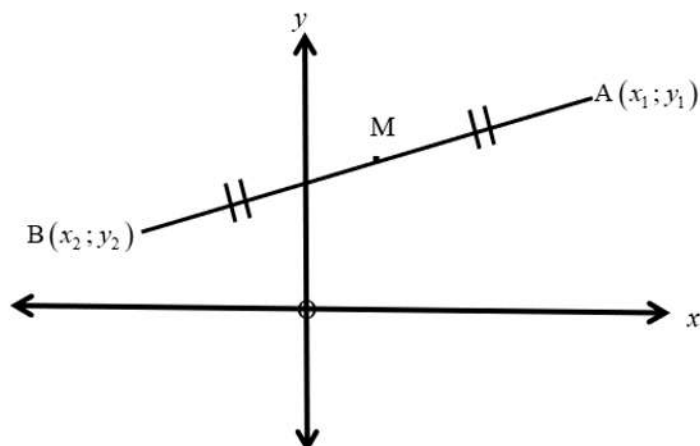
$M(x_M ; y_M) = M(\underline{\hspace{3cm}} ; \underline{\hspace{3cm}})$ is the formula used to calculate the midpoint of a line segment between points A and B, it is known as the 'midpoint formula'.

[2]

PART C: APPLICATION

Points A(7; 9), B(9; 3) and C(4; 6) are given. M is the midpoint of AB, and Q lies on AC produced.

4.1 Determine the coordinates of M. (2)

4.2 Show analytically that QA = QB, if it is further given that point Q has co-ordinates $(2;4)$. (4)

4.3 Use the Theorem of Pythagoras to show that ΔAQM is a right-angled triangle. (4)

[10]

TOTAL: 50 marks

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EDUCATION
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GRADE 10

MATHEMATICS
TOPIC TEST
MARKING GUIDELINE
EUCLIDEAN GEOMETRY
15 May 2025

MARKS: 25

TIME: 30 minutes

Question 1		
1.1	$\hat{D}_1 = \hat{B}_2$ (Alt $\angle$s, AD//BC) $\hat{O}_1 = \hat{O}_3$ (Vertically opp. $\angle$s) AD = BC (Opp. sides of a parm) $\therefore \Delta AOD \equiv \Delta COB$ (AAS or $\angle\angle$S) $\therefore$ DO = OB and AO = OC	✓**A** S ✓**A** R ✓**A** S ✓**A** R ✓**A** S/ R ✓**A** R (6)
Question 2		
2.1	$3x + 2x + x = 180°$ (sum of $\angle$s of a Δ) $x = 30°$	✓S ✓R ✓Simplification ✓answer (4)
Question 3		
3.1	$\hat{B}_1 = \hat{B}_3$ (Given) $\hat{A} = \hat{C}$ (Angles opp. equal sides) $\hat{E}_1 = \hat{A} + \hat{B}_1$ (Ext. $\angle$ of a Δ) $\hat{D}_2 = \hat{C} + \hat{B}_3$ (Ext. $\angle$ of a Δ) $\therefore \hat{E}_1 = \hat{D}_2$ **OR** In ΔBAE and ΔBCD $\hat{B}_1 = \hat{B}_3$ (Given) BA = BC (Given) $\hat{A} = \hat{C}$ (Angles opp. equal sides) $\therefore \Delta BAE \equiv \Delta BCD$ (AAS) $\therefore \hat{E}_1 = \hat{D}_2$	✓**A** S/R ✓**A** S ✓**A** R ✓**A** S/R ✓**A** S/R ✓**A** S/R ✓**A** S/R ✓**A** S/R ✓**A** S ✓**A** R (5)
Question 4		
4.1	*DE // BC* $\hat{D}_2 = \hat{A}$ $\hat{B}_1 = \hat{A}$ $\hat{D}_2 = \hat{B}_1$ DR = RB ΔRDB is isosceles	✓ S ✓ R ✓ S/R ✓ S/R ✓ S/R (5)
Question 5		
5.1	TS $\parallel$ UR (Midpt.Theorem) $\therefore$ TS $= \dfrac{1}{2}$ UR	✓S ✓ R

PV=VS (Line through midpoint ‖ to 2nd side)		✓S ✓ R	
$\therefore$ UV $= \dfrac{1}{2}$ TS TS $= 2x$ 2TS $=$UR $\therefore$ $4x =$UR VR$=$ UR $-$ UV $= 4x - x = 3x$		✓answer	(5)