



MATHEMATICS: PAPER II

Time: 3 hours

150 marks

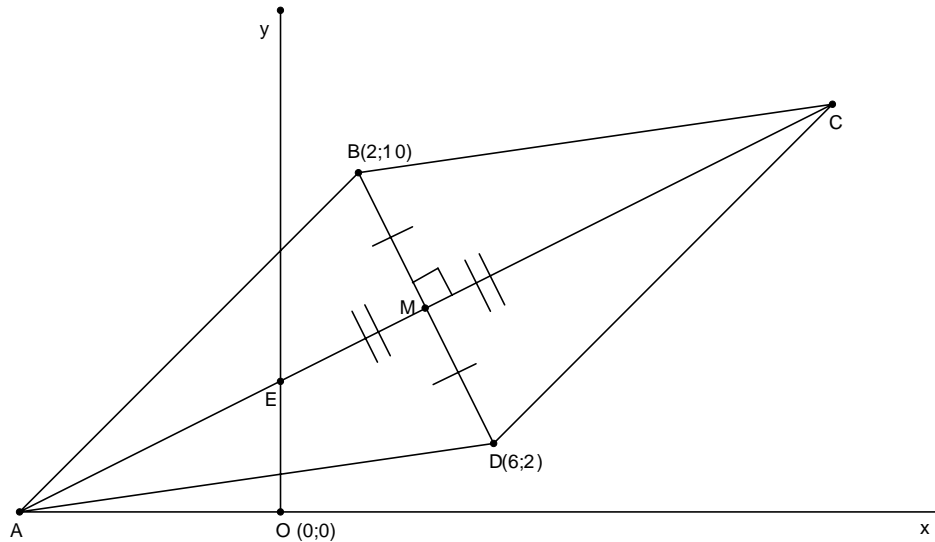
PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 11 pages, and a Formula Sheet. Please check that your paper is complete.
 2. Write your examination number in the space provided.
 3. Please note that diagrams are not necessarily drawn to scale.
 4. All necessary working details must be shown.
 5. Approved non-programmable calculators may be used, unless otherwise stated.
 6. Answers must be rounded off to one decimal digit, unless otherwise stated.
 7. Answer all questions. **Questions 5(a) and 7(b) (2) must be answered on the separate sheet provided and this must be handed in with the answer booklet.**
 8. It is in your own interest to write legibly and to present your work neatly.
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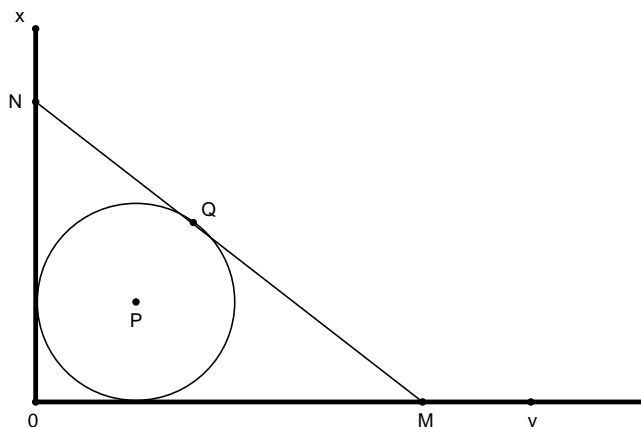
SECTION A

QUESTION 1

- (a) The diagram shows a quadrilateral. The points B and D have coordinates (2; 10) and (6; 2) respectively. The diagonals of ABCD bisect each other at right angles. E is the point of intersection of line segment AC with the y-axis.



- (1) Determine the gradient of AC. (3)
 - (2) Show that the equation of AC is given by $2y = x + 8$ (3)
 - (3) Determine the coordinates of C. (4)
 - (4) Determine \hat{CEO} . (3)
- (b) The circle with centre P has equation $x^2 + y^2 - 4x = 4y$. The circle is inscribed in $\triangle MNO$. M is on the x-axis and N is on the y-axis. MN touches the circle at $Q\left(\frac{18}{5}; \frac{16}{5}\right)$.



- (1) Determine the co-ordinates of P, the centre of the circle. (4)
- (2) Write down the radius of the circle. (1)
- (3) Determine the equation of MN. (4)

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QUESTION 2

The circle $x^2 + y^2 = 36$ is given.

- (1) The equation of the new circle when the original circle is translated under a given rule is $(x + 7)^2 + (y - 3)^2 = 36$. Explain the translation in words, and state the effect the translation has on the original radius. (3)
- (2) Write down the equation of the new circle if the original circle is enlarged by a factor of 2,5 through the origin. (3)
- (3) By what scale factor will the area of the new circle increase? (2)

[8]

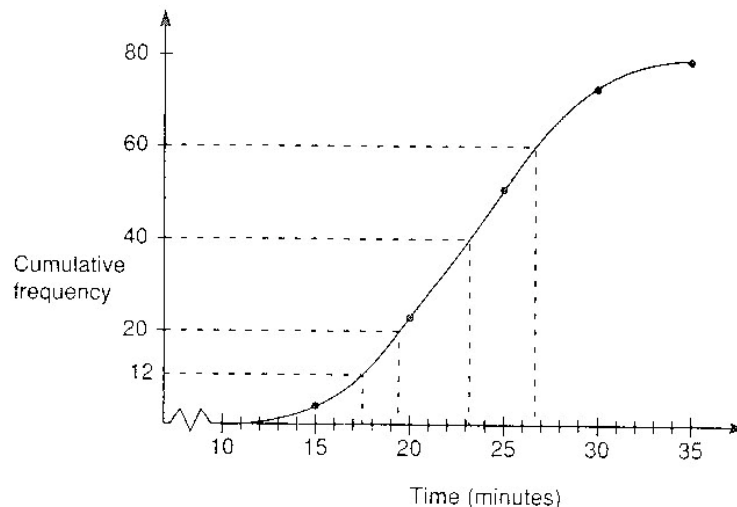
QUESTION 3

- (a) Jenny keeps a record of the time she and her peers work in their Mathematics class on Mondays, which is a 90 minute period. The results, to the nearest minute, for 10 Monday lessons are given below.

43 44 46 48 48 49 52 58 62 90

- (1) Find the five number summary for the data above. (4)
- (2) Construct a box and whisker plot for the data above. (3)
- (3) If the mean for the data above is 54 minutes, give a reason as to why you think Jenny worked for 90 minutes in one of the 10 Monday lessons. (1)

- (b) On the Game of SURVIVAL, a piece of music was played to a group of 80 contestants and afterwards they were asked to estimate how long the piece of music had lasted. The estimates in seconds are given in the cumulative frequency graph below.



Using the graph, determine:

- (1) the median (1)
 - (2) the interquartile range (1)
 - (3) the number of contestants that overestimated the playing time of the piece of music, if in fact the music lasted 17, 5 minutes. (2)
- [12]**

QUESTION 4

- (a) Use your calculator to simplify $\frac{\cos 2\theta}{2} + \tan^2 \alpha$ correct to four decimal places if $\theta = 45^\circ$ and $\alpha = -116^\circ$ (3)

- (b) Simplify as far as possible:

$$\frac{\sin(180^\circ - 2x) \cdot \tan(-45^\circ)}{\cos(x - 90^\circ)} \tag{4}$$

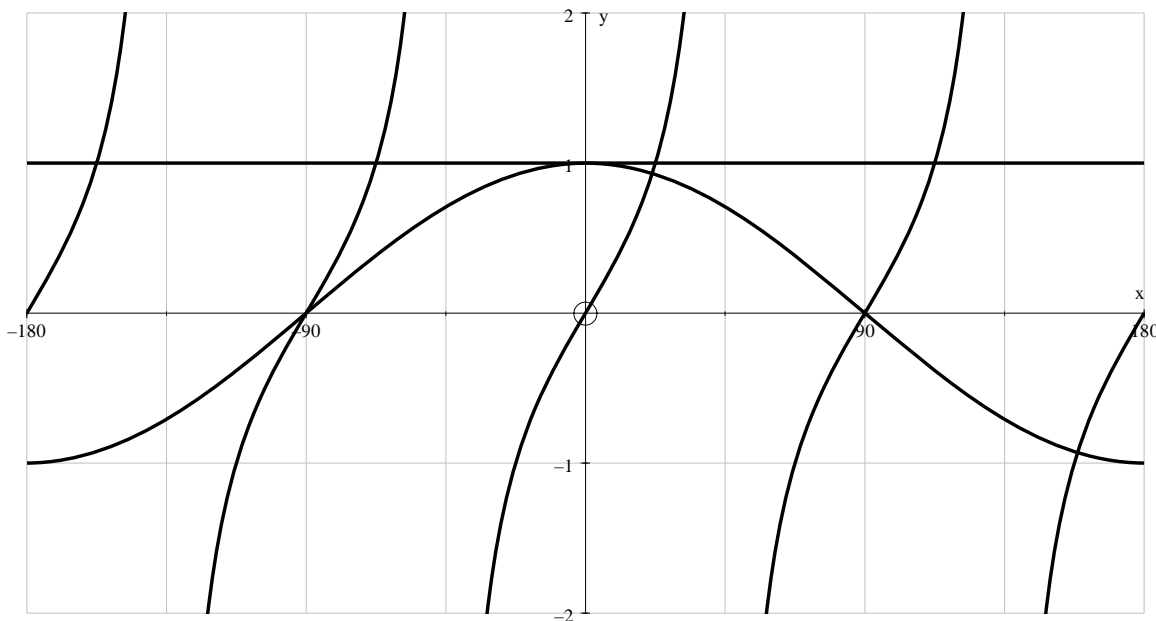
- (c) John’s teacher asked him to sketch the following graphs:

$$f(x) = \tan 2x;$$

$$g(x) = \sin(90^\circ - x);$$

$$h(x) = \cos^2(60^\circ - x) + \sin^2(60^\circ - x); \text{ for } x \in [-180^\circ; 180^\circ]$$

Given below is John’s attempt.



- If each graph carried a mark allocation of 2, give the mark(s) that John received for each graph and the reason(s) why he attained the marks that he did. (6)

(d) Given: $\frac{1 - \cos 2\theta}{\sin 2\theta} = \tan \theta$

(1) Prove the identity. (5)

(2) Hence, determine the value of $\tan 22,5^\circ$, without using a calculator. (4)

(e) Given that $\sin A = \frac{8}{17}$ and $90^\circ < A < 180^\circ$

(1) Find, using a sketch and without a calculator, the value of $\cos A$. (3)

(2) If it is further given that $\sin B = \frac{12}{13}$, and \hat{B} is acute, find without using a calculator the value of $\tan(720^\circ + A + B)$. (4)

(f) Find the general solution to

$\sin \theta = -2 \cos \theta$. (4)

[33]

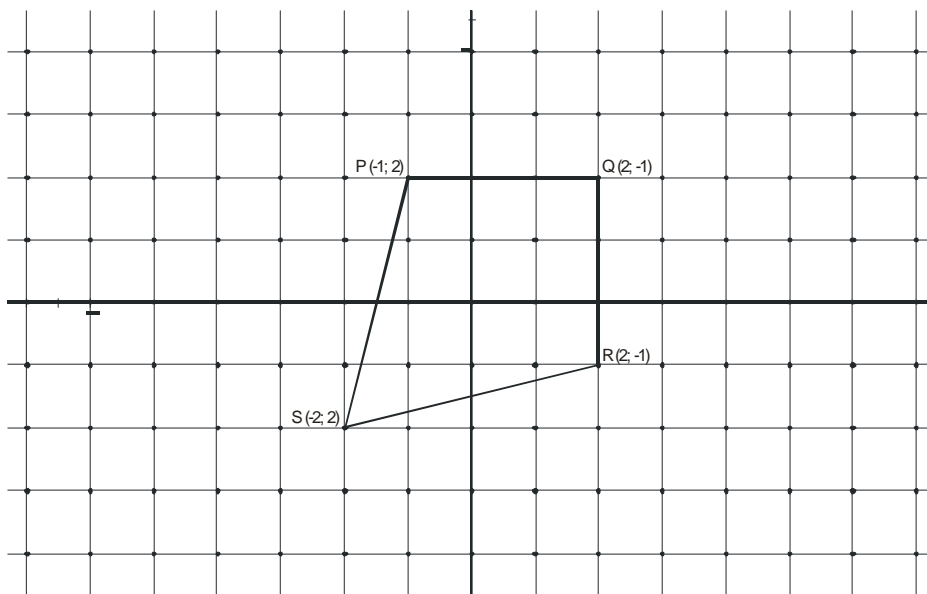
75 marks

SECTION B

QUESTION 5

ANSWER 5 (a) ON THE SEPARATE SHEET PROVIDED AND HAND THIS IN WITH YOUR ANSWER BOOKLET.

(a) In the grid below, Kite $PQRS$ is sketched.



(1) On the same grid, sketch the image, $P'Q'R'S'$ the image of $PQRS$ if it is enlarged through the origin by a factor of 2. (4)

(2) Given:

$$\text{AREA OF A KITE} = \frac{1}{2} \times \text{product of the diagonals}$$

Dino hypothesizes that the area of a polygon that has been enlarged by a factor of k will increase by a factor of k^2

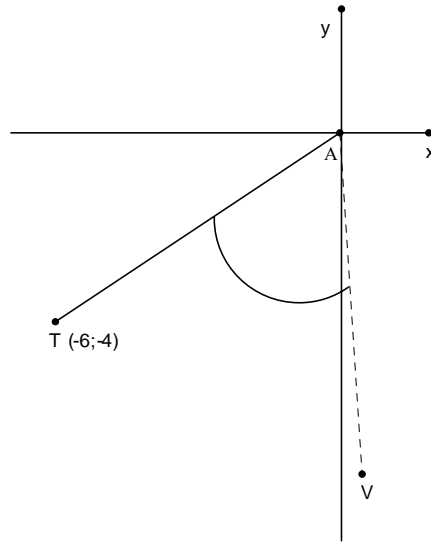
If it is given that the area of $PQRS$ is 12 units², use the formula given to calculate the area of $P'Q'R'S'$ and hence verify that Dino's hypothesis is true. (4)

(3) Study the following definition of a kite:

A kite is a quadrilateral with diagonals intersecting at 90° .

Use analytical methods and the definition of a kite given to show that the transformation has preserved shape. (3)

(b) A point $T(-6;-4)$ rotates around the origin through an angle 60° to a new point V . Show, without the use of a calculator, that the co-ordinates of point V can be written as $(-3 + 2\sqrt{3}; -2 - 3\sqrt{3})$. (8)

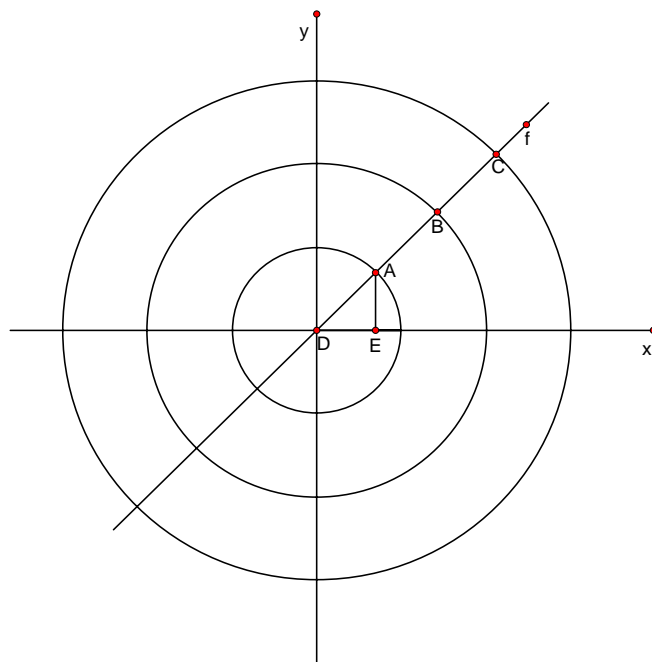


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QUESTION 6

Three concentric circles are sketched below with centre D (0; 0). It is further given that:

- $DE=AE$,
- $DA=AB=BC$,
- $A(x;1)$,
- point E lies on the x-axis,
- line f passes through point D, and through points A, B and C which lie on the circumference of the respective circles.



Determine:

- (1) The equation of line f . (2)
 - (2) The equations of the three circles. (6)
 - (3) The equations of the tangents to the three circles at points A, B and C respectively. (6)
 - (4) Hence, find the equation of the circle which has a tangent at a given point with equation $y = -x + 2n$ and centre D (0; 0). (3)
- [17]**

QUESTION 7

- (a) Study the following sets of 5 numbers and the given standard deviation:

						σ
Set 1	1	1	1	1	1	$0\sqrt{2}$
Set 2	1	2	3	4	5	$1\sqrt{2}$
Set 3	1	3	5	7	9	$2\sqrt{2}$
Set 4	1	4	7	10	13	$3\sqrt{2}$
Set 5	1	5	9	13	17	$4\sqrt{2}$

- (1) Without any further calculations, write down the standard deviation for the following set of 5 numbers: (1)

					σ
8	508	1008	1508	2008	

- (2) Find the mean and standard deviation if the 5 numbers are: (4)

					\bar{x}	σ
a	$a + d$	$a + 2d$	$a + 3d$	$a + 4d$		

- (3) Make a conjecture by completing the following statement: (2)

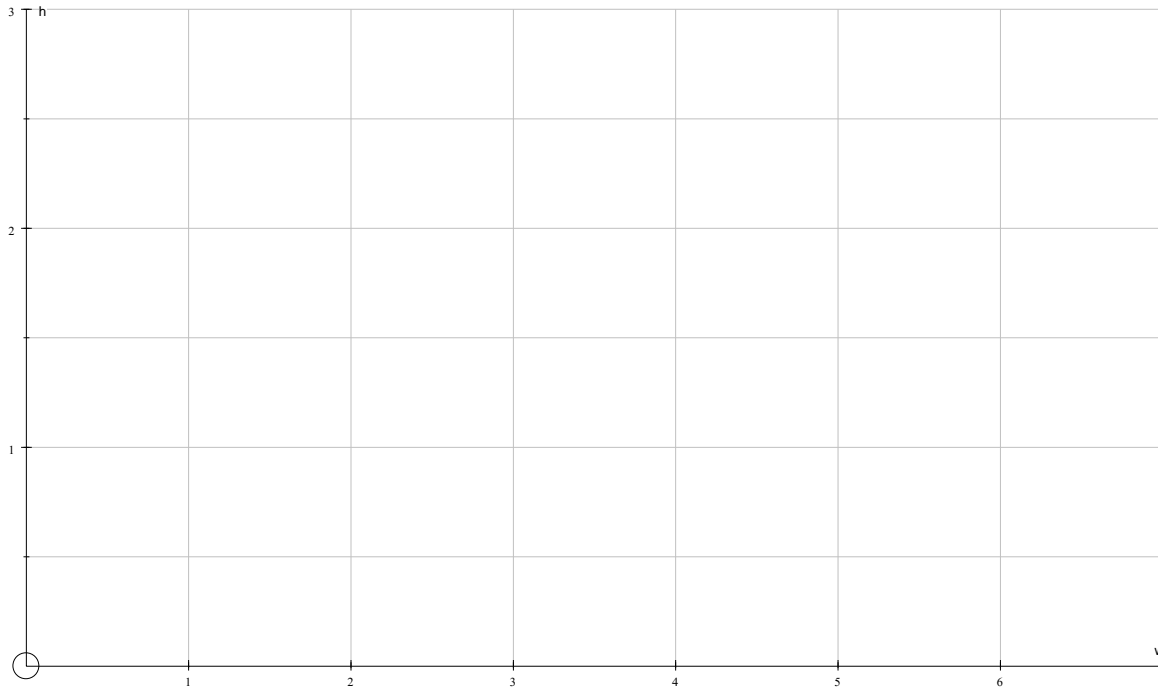
If 5 numbers are in an series with a common difference then the standard deviation is

- (b) The table below gives the values of the height, h cm, of a plant w weeks after germinating.

w	1	2	3	4	5	6	7
h	0,41	0,57	0,78	1,07	1,46	2,01	2,76

(1) Suggest intuitively whether a linear, quadratic or exponential function would best fit the data. Motivate your response. (2)

(2) Draw a scatter plot to represent the data in the table above. PROVIDE YOUR ANSWER IN THE SEPRATE SHEET PROVIDED AND HAND THIS IN WITH YOUR ANSWER BOOKLET. (3)



[12]

QUESTION 8

(a) Given: $\sin(A + B) - \sin(A - B) = 2 \cos A \sin B$

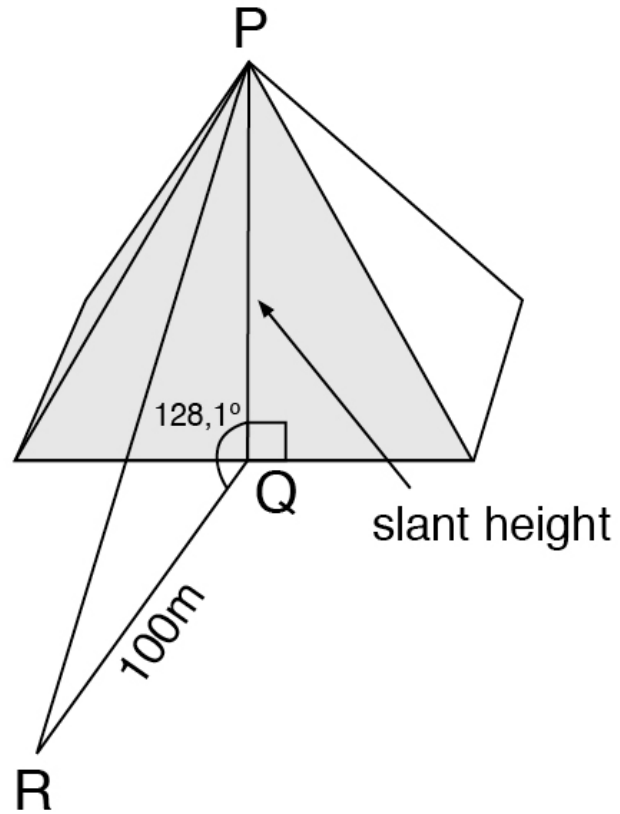
(1) Prove the identity above. (3)

(2) Use the identity in Question 8a (1) to factorise $\sin 5x - \sin x$. (4)

(3) Hence, or otherwise find the general solution for x if $\sin 5x - \sin x = 0$. (5)

(b) Solve the equation $\cos(2x + 20^\circ) = -\cos(x - 11^\circ)$ giving all the solutions in the interval $-180^\circ < x < 180^\circ$. (7)

(c) The Great Pyramid of Giza, also known as the Pyramid of Khufu, was built in 2600BC and is one of the remaining wonders of the world. When it was first built, its height scaled to an amazing 146 metres. The slope angle of the pyramid is $51,9^\circ$.



(1) Calculate the slant height, PQ, of the pyramid. (2)

(2) A tourist stands at a point 100 metres from the foot of the pyramid. Calculate the distance, PR, to the top of the pyramid. (2)

(3) If the Volume of the Khufu Pyramid is $2\,590\,000\text{ m}^3$

(i) determine the area of its base, if it is given that:

$$\text{Volume of Pyramid} = \frac{1}{3} \times \text{area of base} \times \perp \text{height} \quad (2)$$

(ii) On average, the soccer stadiums for the 2010 World Cup Soccer will have an area of $7\,700\text{ m}^2$. To the nearest integer, determine how many soccer stadiums make up the base of the Khufu Pyramid. (2)

[27]

75 marks

TOTAL FOR THIS PAPER: 150 MARKS

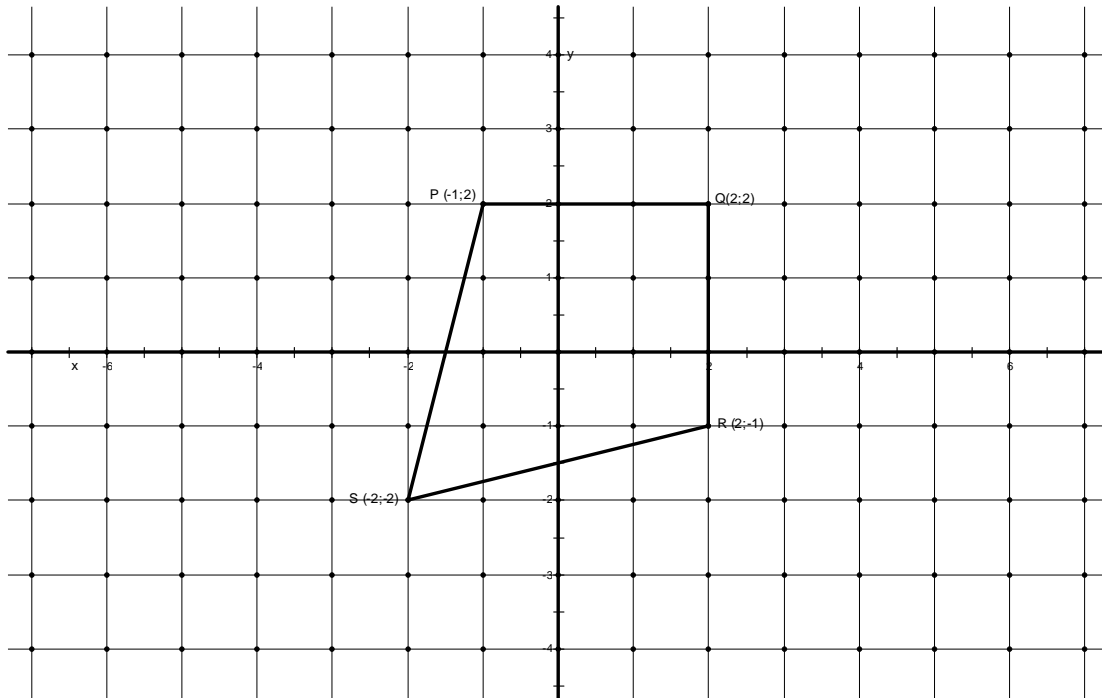
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HAND THIS SHEET IN WITH YOUR ANSWER BOOKLET

QUESTION 5

(a)



QUESTION 7

(b) (2)

