

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Pages	Mark
2 - 3	
4 - 5	
6 - 7	
8 - 9	
10 - 11	
12 - 13	
TOTAL	



General Certificate of Secondary Education
Higher Tier


Mathematics

43602H

Past Paper Type Questions by Topic

A* Questions 2H

H

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • a calculator • mathematical instruments. 	
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Time allowed

- 1 hour

Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book.

Information

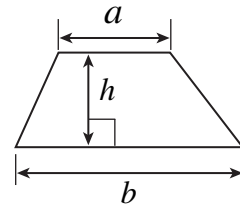
- The marks for questions are shown in brackets.
- The maximum mark for this paper is.
- The quality of your written communication is specifically assessed in some questions. These questions are indicated with an asterisk (*)
- You may ask for more answer paper and graph paper. These must be tagged securely to this answer booklet.

Advice

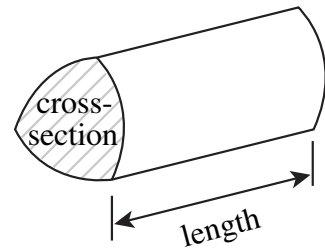
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

$$\text{Area of trapezium} = \frac{1}{2}(a+b)h$$

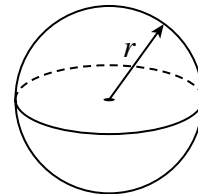


$$\text{Volume of prism} = \text{area of cross-section} \times \text{length}$$



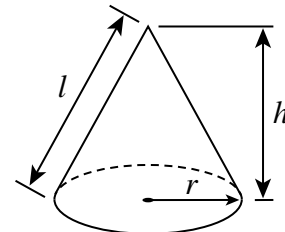
$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

$$\text{Surface area of sphere} = 4\pi r^2$$



$$\text{Volume of cone} = \frac{1}{3}\pi r^2 h$$

$$\text{Curved surface area of cone} = \pi r l$$

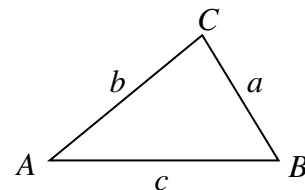


In any triangle ABC

$$\text{Area of triangle} = \frac{1}{2}ab \sin C$$

$$\text{Sine rule} \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$

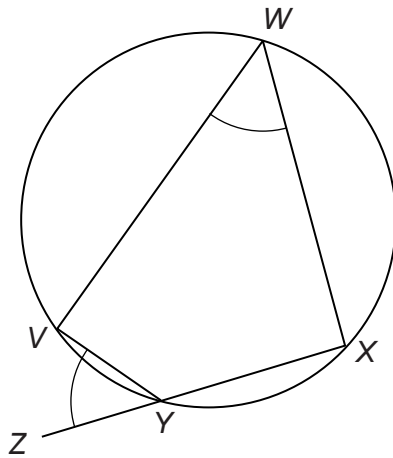


The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- 1 $VWXY$ are points on the circumference of a circle.
The line XY is extended to Z .



Not drawn
accurately

Prove that $\angle VWX = \angle VYZ$

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(3 marks)



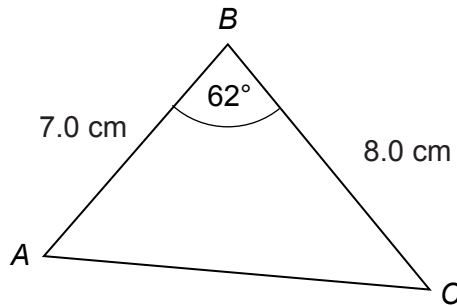
2 (a) Sophie draws a line 6.0 cm long to the nearest mm.

Which of the following is the upper limit of the length of the line?
Circle the correct answer.

- 6.04 cm 6.05 cm 6.1 cm 6.5 cm

(1 mark)

2 (b) Sophie constructs the triangle ABC using a ruler and protractor.
She draws $AB = 7.0$ cm, to the nearest mm.
She draws $BC = 8.0$ cm, to the nearest mm.
She draws angle $ABC = 62^\circ$ to the nearest degree.



Not drawn accurately

Calculate the greatest possible area of the triangle.

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Answer cm² (4 marks)



3 A solution of $x^3 + 5x = 130$ is between 4 and 5

Use trial and improvement to find this solution.
Give your answer to one decimal place.

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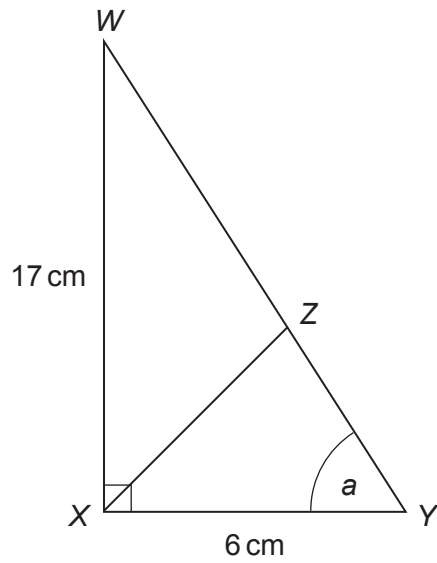
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Answer $x =$ (3 marks)



4

WXY is a right-angled triangle.
 $WX = 17$ cm and $XY = 6$ cm.
The line XZ bisects the angle WXY .



Not drawn accurately

4 (a) Write down the value of $\tan a$.

Answer (1 mark)

4 (b) Calculate the length XZ .

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Answer cm (5 marks)



5

The diagram shows two circles, C_1 and C_2 .

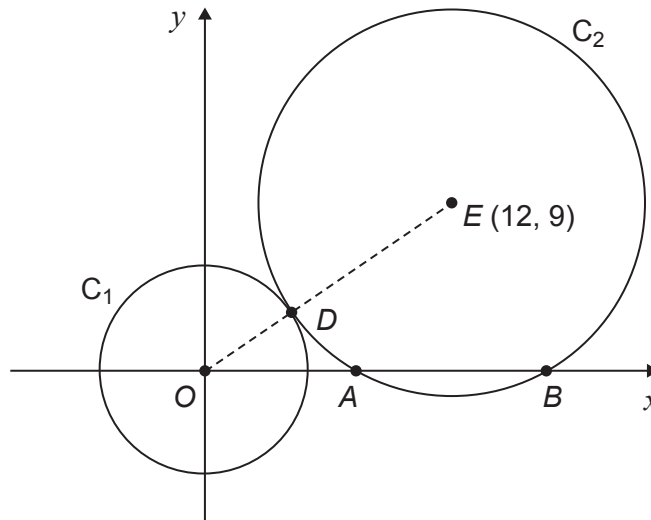
The centre of C_1 is at the origin, O .

The centre of C_2 is at $E (12, 9)$.

The radius of C_2 is twice the radius of C_1 .

The circles touch at the point D .

The circle C_2 crosses the x -axis at A and B .



Not drawn accurately

Calculate the distance AB .

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Answer cm (5 marks)



6

Work out the value of y if

$$\frac{y\sqrt{2}}{5-\sqrt{3}} = 5 + \sqrt{3}$$

Give your answer in the form of $a\sqrt{b}$ where a and b are integers.

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Answer $x =$ (4 marks)

*6 The sum of the squares of two consecutive integers is one greater than twice the product of the integers.

For example $8^2 + 9^2 = 64 + 81$ and $2 \times 8 \times 9 = 144$
 $= 145$

Prove this result algebraically.

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(5 marks)



7 The costs per mile, in pence, and the flight distance, in thousands of miles, are shown for 10 flights on Easyway airlines.

Flight	A	B	C	D	E	F	G	H	I	J
Distance (Thousands of miles)	0.3	0.5	0.8	1.0	1.2	1.4	1.7	2.6	3.3	3.9
Cost per mile (pence)	6.4	5.8	6.2	5.7	5.0	4.6	4.4	3.4	2.4	1.8

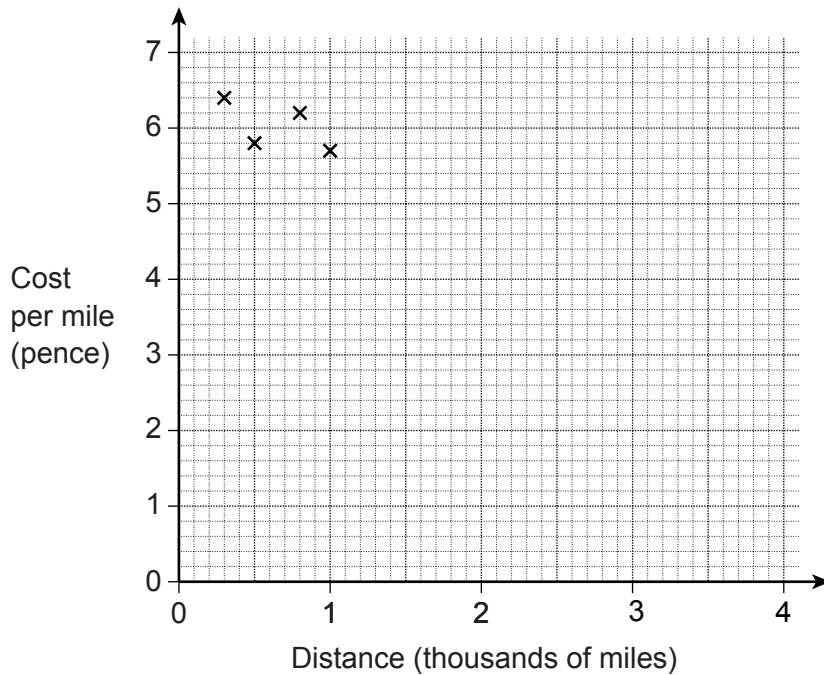
7 (a) Calculate the cost of the ticket for flight A.

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Answer £ (2 marks)

7 (b) The data for the first four flights has been plotted on the scatter diagram.

Plot the data for the remaining flights.



(2 marks)



7 (c) Draw a line of best fit on the diagram.

(1 mark)

7 (d) Estimate the cost per mile, in pence, of a flight of 2000 miles.

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Answer pence (1 mark)

7 (e) The scatter diagram shows negative correlation.

Explain what this means for the relationship between the cost per mile and the distance of the flight.

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(1 mark)



8 The time, T , in seconds, that a pendulum takes to do a complete oscillation is given by the formula

$$T = 2\pi \sqrt{\frac{l}{g}}$$

where l is the length of the pendulum, in metres, and g is the acceleration due to gravity. Take the value of g to be 9.807 m/s^2 .

In the Clock Tower of Big Ben in London there is a pendulum of length 4 m.

- 8 (a) (i) Calculate the value of T for this pendulum.
Give all the figures in your calculator display.
Give your answer as a decimal.

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Answer seconds (1 mark)

- 8 (a) (ii) Give your answer to a suitable degree of accuracy.

Answer seconds (1 mark)

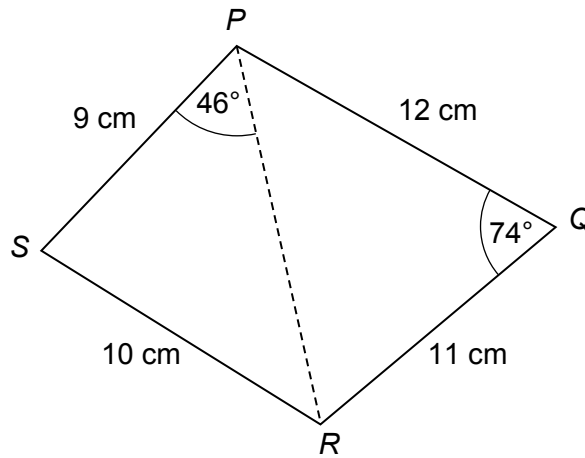
- 8 (b) Calculate the length of a pendulum that will give a value of $T = 1$

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Answer m (4 marks)



- 9 $PQRS$ is a quadrilateral.
 $PQ = 12$ cm, $QR = 11$ cm, $RS = 10$ cm and $SP = 9$ cm
 $\angle PQR = 74^\circ$ and $\angle SPR = 46^\circ$



Not drawn accurately

- 9 (a) Use the cosine rule to find PR .

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Answer cm (3 marks)

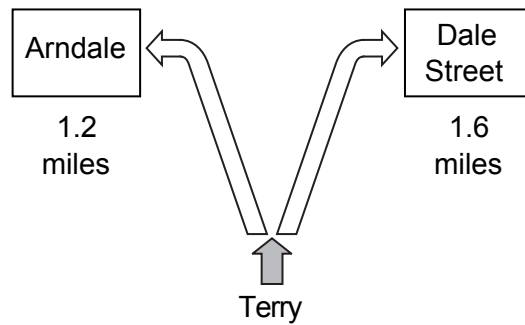
- 9 (b) Use the sine rule to find the size of angle PRS .

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Answer degrees (3 marks)



- 10** Terry is sitting in his car at some traffic lights.
 He knows that he is 1.2 miles from Arndale and 1.6 miles from Dale Street.
 He knows his average speed is 10 miles per hour in city traffic.



A sign on the traffic lights shows the number of spaces currently available in each car park. Terry is sitting at the lights for one minute.

In that time the sign changes as shown below.

START		1 MINUTE LATER	
	SPACES		SPACES
Arndale	510	Arndale	450
Dale Street	700	Dale Street	630

- 10** (a) It will take Terry 7.2 minutes to drive to Arndale at 10 mph.

How long will it take Terry to drive to Dale Street at 10 mph?

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Answer minutes (2 marks)



10 (b) Which car park will give Terry the better chance of finding a space?
You **must** show your working.

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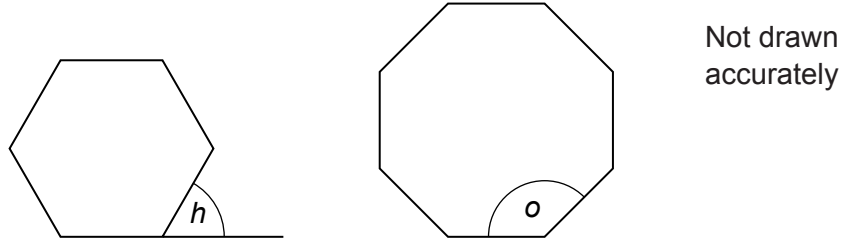
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(4 marks)



11 A regular octagon and a regular hexagon have sides of the same length.



11 (a) Write down the size of the exterior angle, h , of the hexagon.

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Answer degrees (1 mark)

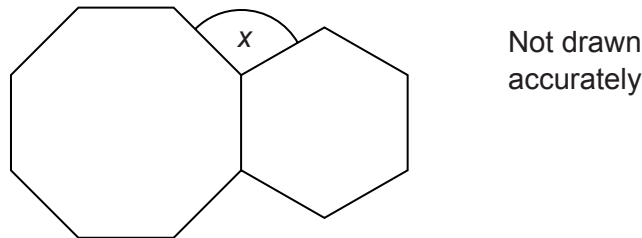
11 (b) Work out the size of the interior angle, o , of the octagon.

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Answer degrees (2 marks)

11 (c) The octagon and the hexagon are placed together as shown.



Work out the size of the angle marked x .

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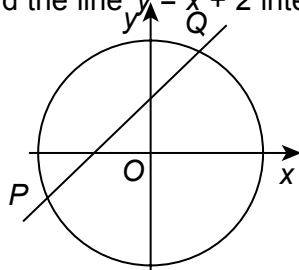
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Answer degrees (2 marks)



12 The circle $x^2 + y^2 = 16$ and the line $y = x + 2$ intersect at the points A and B .



Not drawn accurately

12 (a) Show algebraically that the x -coordinates of points P and Q satisfy the equation

$$x^2 + 2x - 6 = 0$$

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(3 marks)

12 (b) Write the equation $x^2 + 2x - 6 = 0$ in the form $(x + a)^2 - b = 0$

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Answer (2 marks)

12 (c) Hence, or otherwise, solve the equation $x^2 + 2x - 6 = 0$
Give your answers in surd form.

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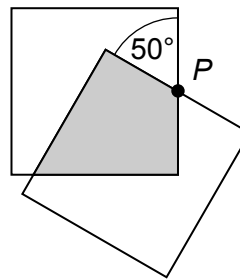
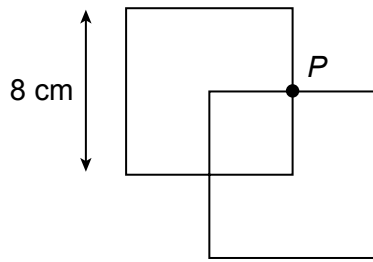
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Answer (2 marks)



- 13 Two squares with sides 8 cm overlap so that the corner of one square is at the centre of the other square, as shown in the first diagram.



Not drawn accurately

The lower square is rotated about the point P until the angle between the sides is 50° as shown in the second diagram.

The shaded area is a kite.

Calculate the shaded area.

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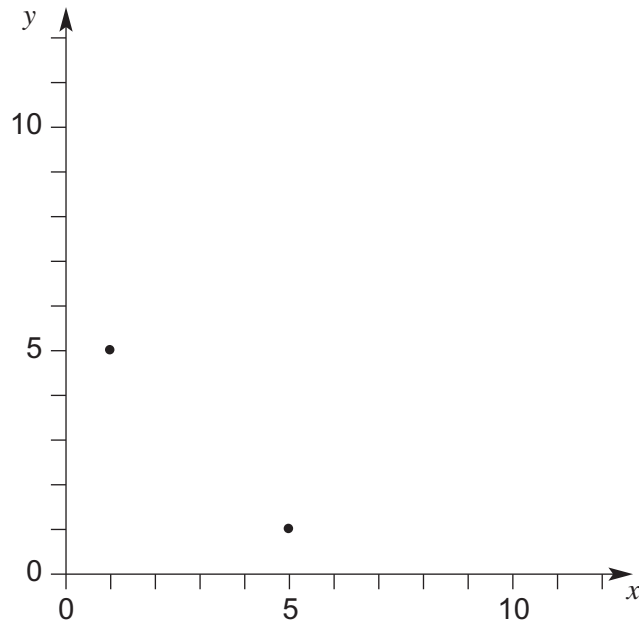
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Answer cm^2 (5 marks)



14

Two points (5, 1) and (1, 5) on the graph of $y = \frac{5}{x}$ for $x > 0$ are plotted.



14 (a) Complete a sketch of the graph of $y = \frac{5}{x}$ for $x > 0$

(2 marks)

14 (b) Calculate the coordinates of the point where this curve intersects with the line $y = x$

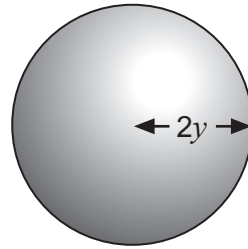
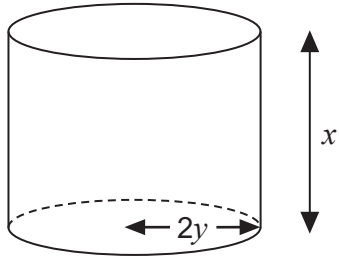
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Answer (..... ,) (2 marks)



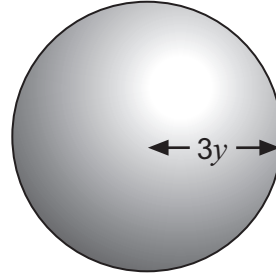
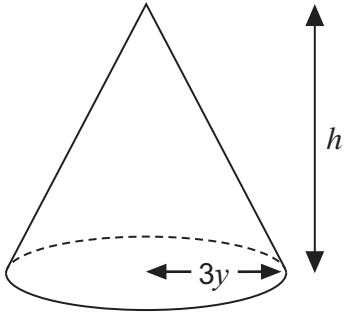
15

This cylinder and sphere have the same volume.



Not drawn accurately

This cone and sphere also have the same volume



Not drawn accurately

Find h in terms of x

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Answer

(5 marks)



16

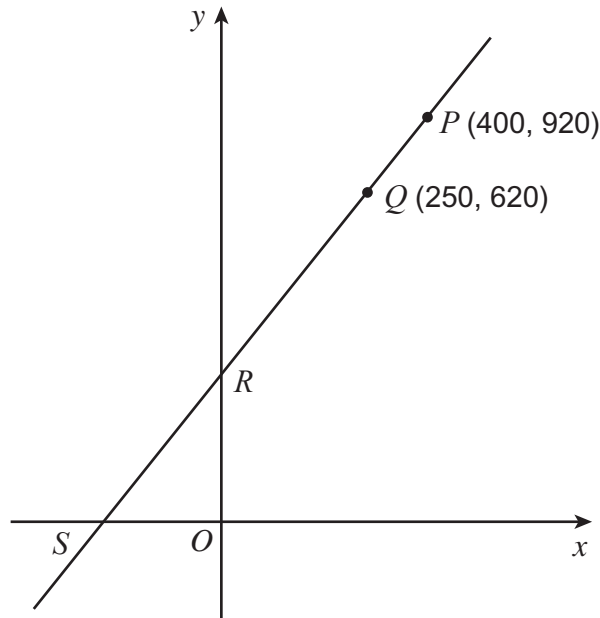
The diagram shows a line $PQRS$.

P is the point $(400, 920)$.

Q is the point $(250, 620)$.

The line cuts the y -axis at R and the x -axis at S .

Not drawn accurately



Work out the coordinates of R and S .

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Answer R (..... ,)

S (..... ,)

(4 marks)

