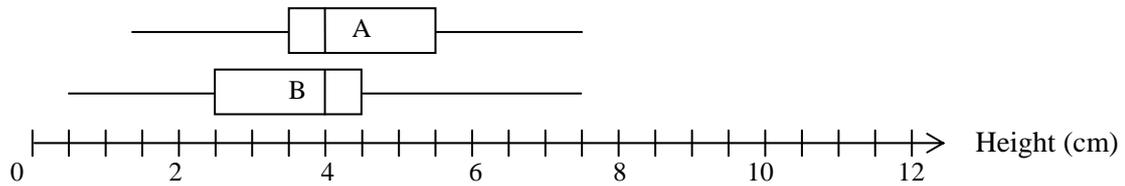


<i>DO NOT WRITE ON THIS PAPER</i>	<b>TIME</b> 2 hours	<i>Paper 3 of 5 from ZigZag Education</i>
<b>Sample GCSE Examination Paper</b> <b>Higher Tier Calculator Paper</b>	Standard Equipment: lined or squared paper, pen, pencil, ruler. Additional Equipment: graph paper, pair of compasses, plain paper.	

1. 100 plant seeds were divided into 2 groups, A and B.  
Group A was grown in field A. Group B was grown in field B.  
The box and whisker plots of the heights of the plants are shown below.

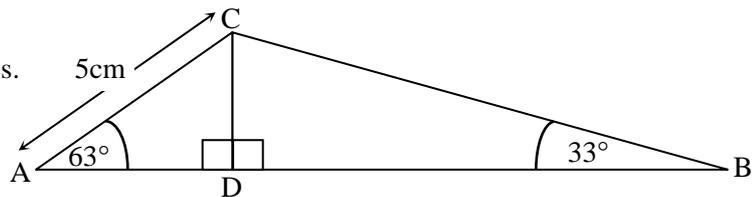


Comment on three statistical features that are the same between the two groups.

4 marks

2. Find length AB to 2 decimal places.

7 marks



3. Simplify the expressions

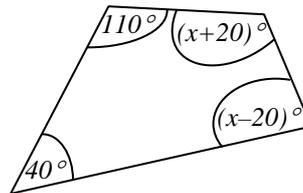
a)  $x^5 \times x^6 \times y \times y^3$

b)  $\frac{6y^5}{2y}$

c)  $(y^6)^4$

4 marks

4. a) Formulate an equation in  $x$ .  
b) Solve your equation to find  $x$ .



4 marks

5. A biased 4 sided die was thrown 100 times and the results are summarised in the table below.

- a) Calculate the median score.  
b) Estimate the probability that the next throw of the dice is a 1.

3 marks

SCORE	FREQUENCY
1	11
2	19
3	32
4	38

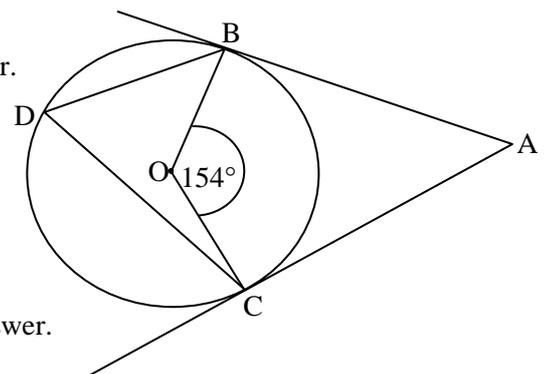
6. a) Calculate angle BDC.  
b) i) Write down angle ABO justifying your answer.  
ii) Calculate angle BAC.

A student says that BCDO is a cyclic quadrilateral.

- c) Are they correct? Justify your answer.

ABOC is a special type of quadrilateral.

- d) What type of quadrilateral is ABOC? Justify your answer.



6 marks

7. Two points A and B are approximately 9cm apart.

~~B~~

Draw two points roughly 9cm apart and label the points A and B.  
Ensure that AB is not horizontal or vertical.

*not to scale*

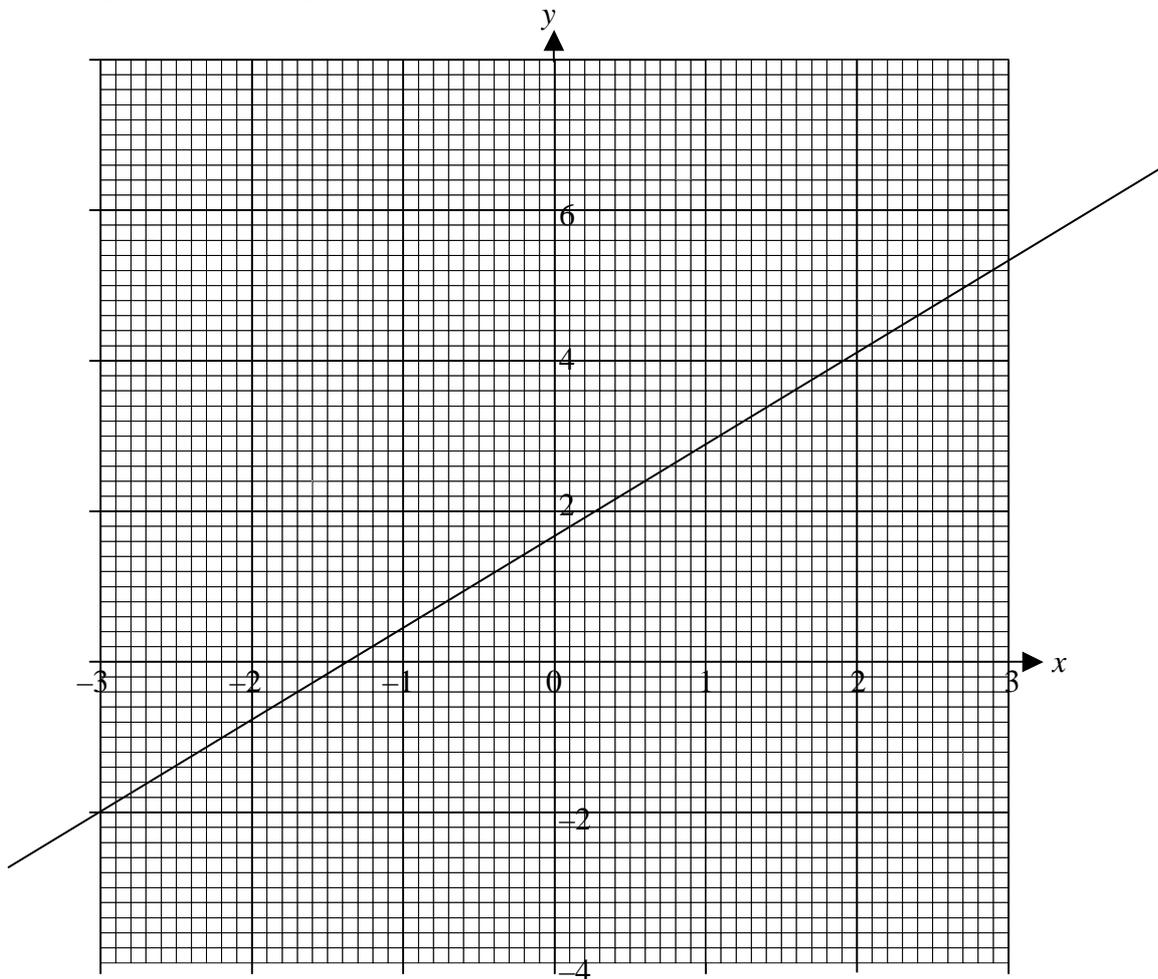
By construction, using a straight edge and compasses only,  
find the mid-point of AB.

3 marks

~~A~~

8. Estimate the equation of the graph of the straight line shown.

6 marks



9. a) Copy and complete the table of values for  $y = x^3$ .

$x$	-3	-2	-1	0	1	2	3
$y = x^3$				0	1	8	

- b) Using your table of values, draw a graph of  $y = x^3$ .

6 marks

10. Make 'w' the subject of the following formulae

- a)  $s = w(r - 14)$   
 b)  $p = qw^3$   
 c)  $vw = w + 2$

6 marks

11.  $x$  is equal to 1.75 correct to two decimal places.  
 $y$  is equal to 12 correct to two significant figures.
- a) Find the least upper bound for  $\frac{y}{x^2 + x}$ , giving your answer to 3 significant figures.
- b) Find the greatest lower bound for  $x^2 - 3y$ , giving your answer to 3 significant figures. 4 marks

12. The function  $f(x)$  is defined as  $\frac{3}{x} + 4$ .

- a) Copy and complete the table of values for  $f(x)$ .

$x$	-3	-2	-1	$-\frac{1}{2}$	$\frac{1}{2}$	1	2	3
$f(x)$								5

Hence plot the graph of  $f(x)$  with  $x$  varying between  $-3$  and  $3$ .

- b) Rearrange the equation  $\frac{3}{x} - 2x + 7 = 0$  into the form  $f(x) = p(x)$ .

Plot the graph of  $y = p(x)$  onto your graph in a) and write down the values of  $x$  at which the two graphs intersect for  $x$  between  $-3$  and  $3$ .

5 marks

13. A quadratic function  $f(x) = (x + 4)^2 + 2$  has a minimum point of  $(-4, 2)$ .

Give the minimum points for the following functions—

- a)  $f(x + 3)$   
 b)  $3f(x)$

4 marks

14. Boyle's Law states that 'The volume of a fixed quantity of gas maintained at constant temperature is inversely proportional to the pressure'.

A sample of oxygen in a container has a volume,  $v$ , of 50ml, and a pressure,  $p$ , of 20 atmospheres.

- a) Work out an equation for  $v$  in terms of  $p$ , showing your working.

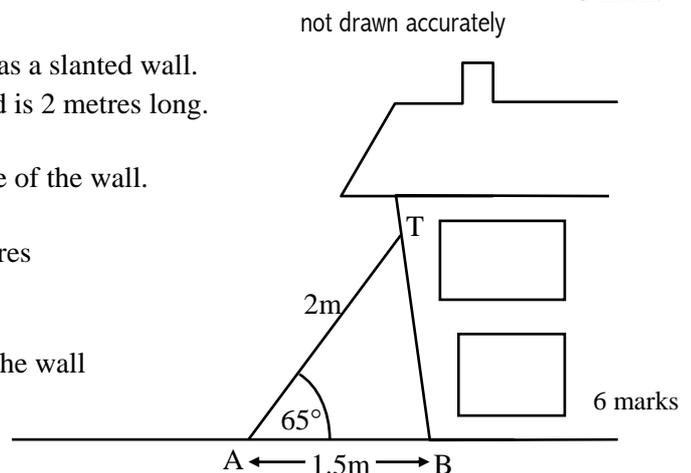
The oxygen is compressed, while the temperature was kept constant, until its volume was 13ml.

- b) Calculate the new pressure of the gas, giving your answer to 3 significant figures. 4 marks

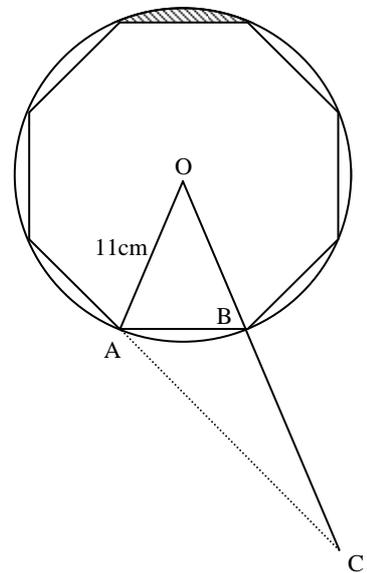
15. a) Simplify  $2ab \times a^{-1}$   
 b)  $3^a \times 27^{2a} = 3^k$ . Express  $k$  in terms of  $a$ . 3 marks

16. A cleaner is cleaning the side of a house which has a slanted wall. His ladder is at an angle of  $65^\circ$  to the ground, and is 2 metres long. The ground is horizontal. The base of the ladder is 1.5 metres from the base of the wall.

- a) Calculate  $TB$ , giving your answer in metres correct to 3 significant figures.
- b) Calculate the acute angle  $ABT$  between the wall and the ground, giving your answer correct to 3 significant figures.



17. The diagram to the right shows a regular octagon in a circle. AB is a side of the octagon. O is the centre of the circle. The radius of the circle is 11cm.



- a) Calculate the area of the shaded segment, giving your answer to 3 significant figures.

OB and a side of the octagon are extended.

- b) Calculate OC, correct to 3 significant figures.

8 marks

18. a) Solve  $x^2 - 3x - 4 = 0$  by completing the square.  
 b) Solve  $-2x^2 + 4x + 1 = 0$  using the quadratic formula, giving your answers to 3 significant places.

5 marks

19. Solve the simultaneous equations below.

$$\begin{aligned} x^2 - 4 + y^2 &= 0 \\ y - 2x &= 1 \end{aligned}$$

5 marks

20. The table below shows the numbers of students attending a college yesterday, arranged into groups.

Group	Number of students
1	155
2	125
3	205
4	160

The head of the college conducted a study into the time taken for students to commute to the college that day. The results of this survey were as follows.

The mean time for Group 1 students was 36 minutes

The mean time for Group 2 students was 10 minutes less than the mean time for all 645 students.

The mean time for Group 3 students was 14 minutes

The mean time for Group 4 students was 24 minutes

- a) Calculate the mean time for all 645 students, correct to the nearest minute.

The head of the college decides to interview 20 students to find out their feelings on daily travel. She selects a stratified sampling method.

- b) Calculate the number of students from each group who should be in her sample.

7 marks