DO NOT WRITE ON THIS PAPER	**TIME** 2 hours	*Paper 1 of 5 from ZigZag Education*
Sample GCSE Examination Paper **Higher Tier Calculator Paper**	Standard Equipment: lined or squared paper, pen, pencil, ruler. Additional Equipment: graph paper Q6 . Notes: Tracing paper optional for Q3.	

1. A biased 4-sided die is thrown 100 times and results summarised in the table below. Estimate the probability that the next throw of the die is a 1.

SCORE	FREQUENCY
1	19
2	11
3	39
4	31

1 mark

2. Simplify the expressions

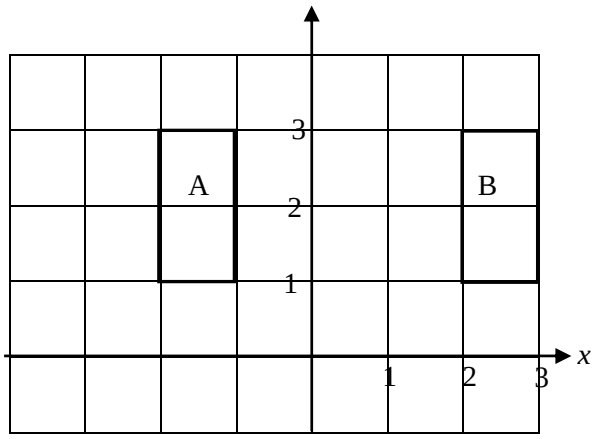
a) $x^5 \times x^5$

b) $\dfrac{6x^5}{3x}$

c) $(x^5)^3$

3 marks

3.



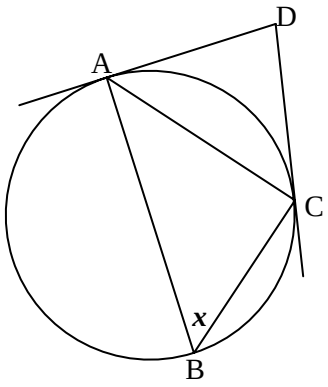
a) Fully describe a rotation that maps A to B.

b) Fully describe the translation that maps A to B.

c) Fully describe the reflection that maps A to B.

5 marks

4. AD and CD are tangents to the circle. AB is a diameter. Angle ABC is $x°$.



ABC and ACD are special types of triangle.

a) What type of triangle is ABC, and explain how you know this to be true.

b) What type of triangle is ACD, and explain how you know this to be true.

c) Work out an expression in terms of x for the size of angle BAC. 6 marks

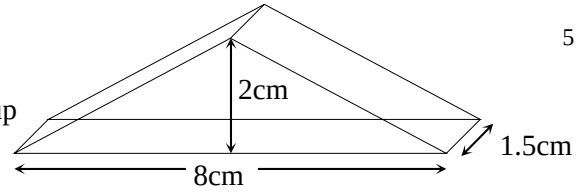
5. John and Jim share £100 in ratio 2:3

a) How much does John receive?

b) Jill and Sunita share £100 in ratio a : b.
Jill gets 39.75.
If a = 159 find b.

5 marks

6. The surface of the following solid prism is made up from 3 rectangles and two isosceles triangles.



Calculate the surface area of the solid.

4 marks

7. a) Make j the subject of the formulae m = 3j + 3.

b) Make r the subject of the formulae V = $\dfrac{1}{3}\pi r^3$.

c) Make w the subject of the formulae pw = w + 1.

7 marks

8. The following table shows the results of 7 students' Mathematics examination results.

Student	Paper 1	Paper 2
1	69	61
2	33	24
3	26	16
4	45	43
5	78	54
6	94	77
7	66	44

a) With paper 1 on the horizontal axis and paper 2 on the vertical axis, draw a scatter diagram to show the results.

b) If appropriate draw on a line of best fit.

c) Describe any correlation.

Joan, who was student 8, sat paper 2 and scored 50. Joan was ill for paper 1.
The examination board would like to know what Joan would have scored should she have been well.

d) Use your graph to estimate Joan's most likely result for paper 1. 6 Marks

9. a) Factorise the expression, $x^2 + 5x + 6$ and hence solve the equation $x^2 + 5x + 6 = 0$.

b) Solve the equations:

i) $2x + 3 = 3x - 3$

ii) $\frac{2}{3}x = \frac{4}{7}$

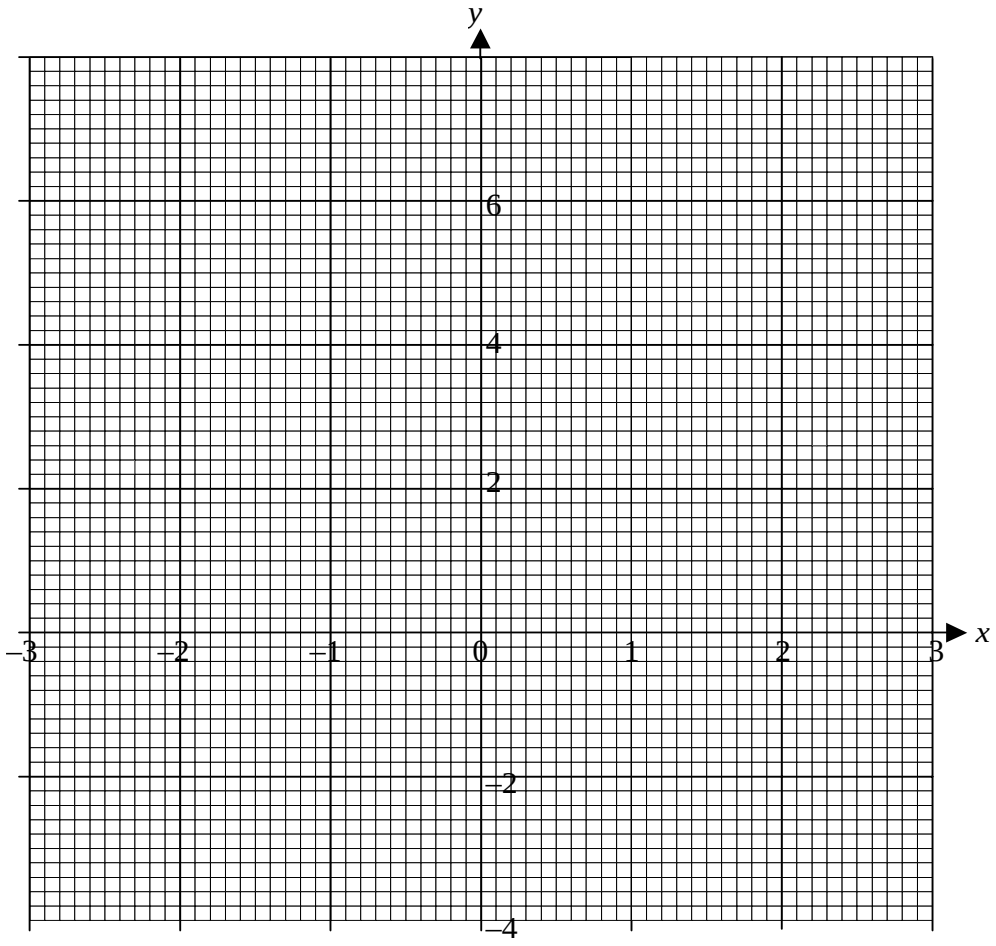
c) Solve the inequality, $2 + 3x < 17x$ 8 marks

10. a) Copy and complete the table of values for $y = x^2 - 2x - 2$

x	–2	–1	0	1	2	3
$y = x^2 - 2x - 2$	6			– 3		1

b) Copy and complete the axis onto graph paper and using the same scale and using the values from your table draw the graph of $y = x^2 - 2x - 2$.

c) Use your graph to solve the equation $0 = x^2 - 2x - 2$. 5 marks



11. a) Copy and complete the table below for the equation $y = 2x^2 + 4x - 8$

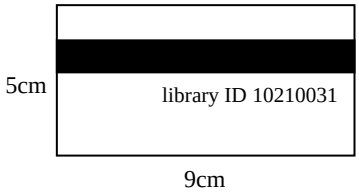
x	–3	–2	–1	0	1	2	3
$y = 2x^2 + 4x - 8$	–2			–8			22

b) Plot the graph of $y = 2x^2 + 4x - 8$, with x ranging from –3 to 3 using the values from your table.

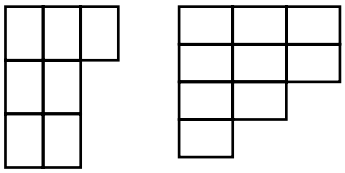
c) Using your graph and the symmetric nature of the graph determine both solutions to the equation $2x^2 + 4x - 8 = 0$

d) By drawing a suitable line on your graph, solve $2x^2 + 4x - 4 = 0$ 10 marks

12. New library cards are being produced for a town library. The cards are 9cm long, to the nearest 1cm, and 5cm wide, to the nearest 1cm. The cards are to be cut from a sheet of plastic which is 2m long, and 0.5m wide. Both measurements are exact.



The library cards can be cut from the plastic, using either vertical or horizontal tessellation - shown to right. The tessellation giving the largest number of cards between the two options is chosen.



Calculate the least upper and the greatest lower bound for the number of cards which can be cut from the sheet of plastic.
Show all of your working.

4 marks

13. Chloë is taking part in the Great Western Gliding Race. She glides between Bristol and Exeter and back to Bristol. The distance from Bristol to Exeter is 120km. From Bristol to Exeter, her average speed is x km/h. On the return route, a following wind increases her speed to $x + 10$ km/h.

a) Express the time taken for Chloë to complete the race in terms of x.

Chloë was flying for a total of 5 hours.

b) Using your answer from part a), form an equation involving x

c) Show that this equation can be written as $x^2 - 38x - 240 = 0$

d) Calculate Chloë's speed on the return journey in km/h to 3 significant figures. 9 marks

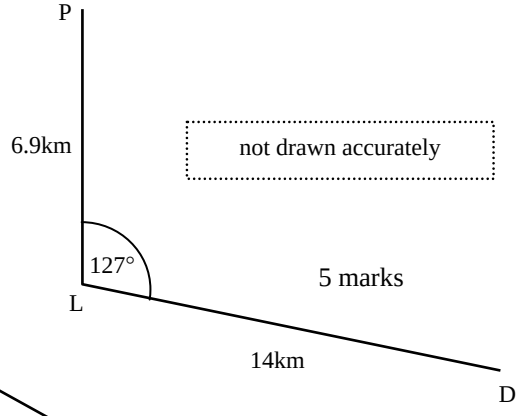
14. The number of speeding tickets, t, per week on a certain section of a road is directly proportional to the square of the average speed, s, of motorists on that road. Last week, there were 30 tickets given, and the average speed of the motorists was 60km/h.

a) Work out an equation for t in terms of s evaluating any constants.

This week a speed camera is placed on the road, and the average speed of the motorists decreases to 45km/h.

b) Estimate how many tickets will there be this week, to the nearest whole number. 5 marks

15. The cargo ship Phobos is 6.9km north of a lighthouse. Another ship, Deimos, is 14km away from the lighthouse, on a bearing of 127°.

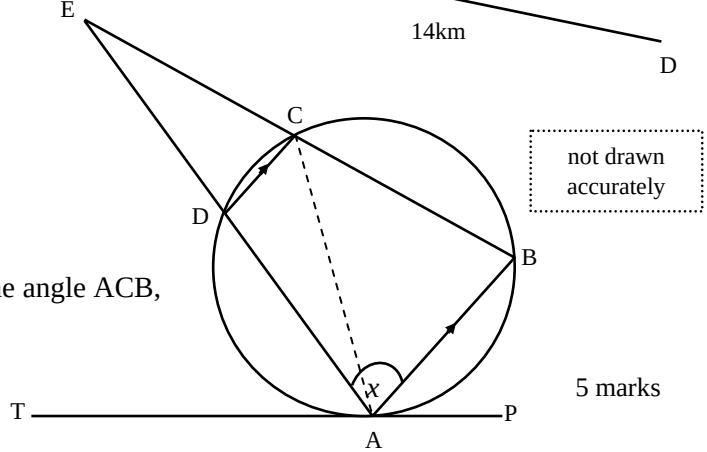


a) Calculate the distance between the two ships

b) Calculate the bearing of Deimos from Phobos, giving your answer to 1 decimal place.

5 marks

16. In the diagram shown to the right, EDA and ECB are straight lines. DC and AB are parallel.

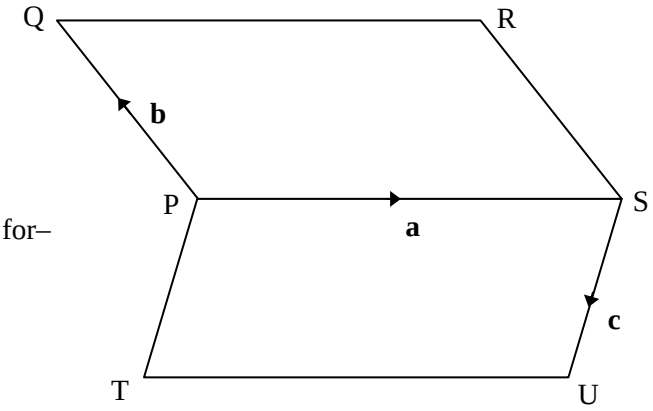


a) Prove that triangle ECD is isosceles.

b) Given that TAD = 47°, find the size of the angle ACB, giving your answer in terms of x.

5 marks

17. The diagram below shows two parallelograms PQRS and PSUT.



The vector $\overrightarrow{PS}$ is **a**, $\overrightarrow{PQ}$ is **b**, and $\overrightarrow{SU}$ is **c**.

Write down, in terms of **a**, **b** and **c** expressions for–

a) $\overrightarrow{ST}$
b) $\overrightarrow{PU}$
c) $\overrightarrow{TX}$, where X is the midpoint of TR.
d) $\overrightarrow{PY}$, where Y is the midpoint of QS

4 marks

18. A charity game has been set up. To play, you roll four ten-sided dice.
If your 4 numbers are all the same, then you win the jackpot.

a) i) What is the probability of winning the jackpot, by rolling all ten's with one roll of the four dice?
ii) What is the probability of winning the jackpot, with one roll of the four dice?

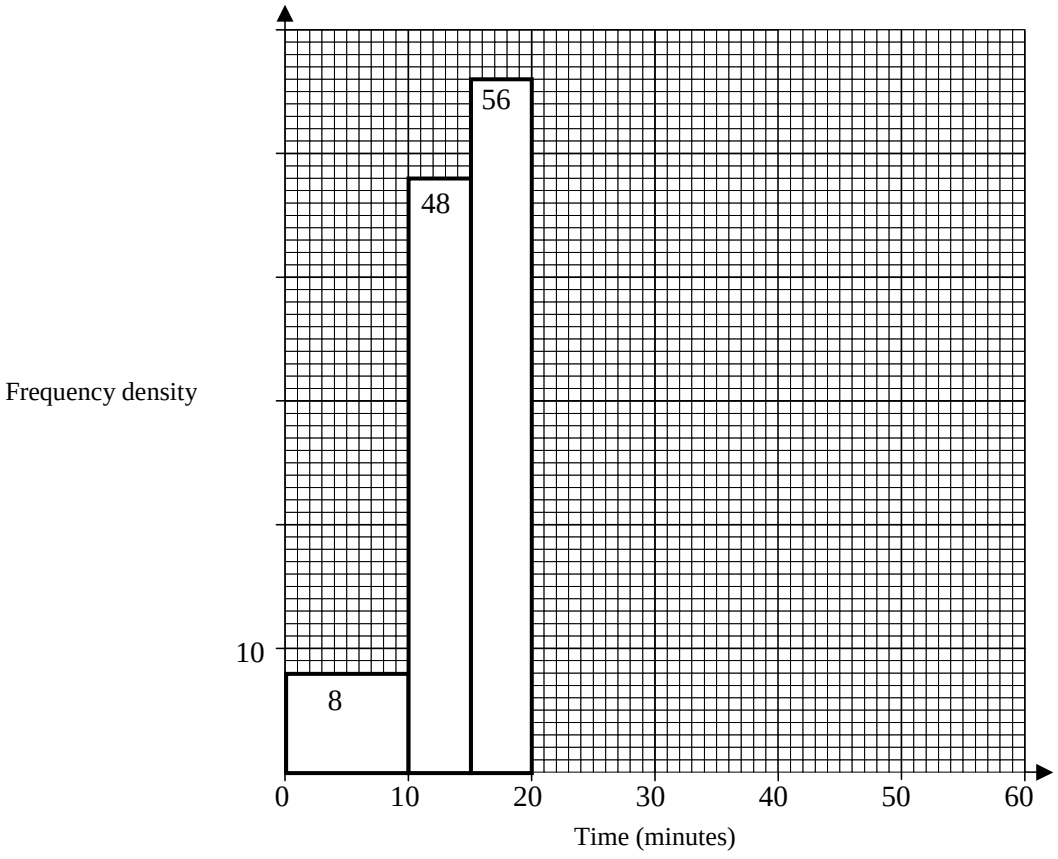
The game is changed so that the amount of dice to roll increases to *n*. The dice all still ten-sided and to win you must still throw the same number on all of the dice thrown.

b) What is the probability of winning the jackpot, with one roll of the *n* dice. 4 marks

19. As part of a study into traffic patterns, employees at a large office were asked how long it had taken them to commute into work that morning. Some of the results are shown in this table.

	Frequency
0 minutes up to, but not including 10 minutes	16
10 minutes up to, but not including 15 minutes	
15 minutes up to, but not including 20 minutes	
20 minutes up to, but not including 30 minutes	24
30 minutes up to, but not including 45 minutes	12
45 minutes and over	0

a) Using the information from the table above, and the partially completed histogram below, copy and complete the histogram.



b) Calculate the number of employees who did not complete the survey, given that the total number of employees at the office is 170. 4 marks