	DO NOT WRITE ON THIS PAPER	TIME 2 hours	Paper 4 of 5 from ZigZag Education
Sample GCSE Examination Paper		Standard Equipment: lined or squared paper, pen, pencil, ruler.	
]	Higher Tier Non-Calculator Paper	Additional Equipment: graph paper.	
1.	There are 50 trillion cells in the averag A trillion is 1,000,000,000,000.	je human.	human cell

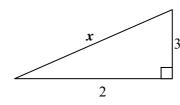
- a) i) Write a trillion in standard index form.
 - ii) Write the average number of cells in a human in standard index form.

The area inside the orbital path of Pluto is 36 quintillion square miles, where a quintillion is 1×10^{18} .

- b) Assuming the orbital path is circular, estimate the radius of the orbital path. Use 1.5 as an estimated value for $\sqrt{\pi}$.
- 2. a) Display the inequality $-1 \le x \le 3$ on a number line.

Solve the inequalities

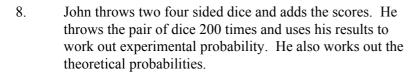
- b) i) $-1 \le 2x + 4$
 - ii) -1 < -2x
- 3. Calculate the missing lengths x and y, giving your answer exactly.



- 4. A rhombus has side of 5cm and a smallest angle of 40°. Using the estimate $\cos 20^{\circ} \approx \frac{94}{100}$, calculate the length of the longest diagonal of the rhombus.
- 5. a) Work out the highest common factor of 112 and 64
 - b) Work out the lowest common multiple of 112 and 64.
- 6. An ink blot is spilt on some tissue paper and ink blot has an area of approximately 0.16 cm².
 - a) Calculate the area of the ink plot in square millimetres.

The volume of ink spilt to create the blot is approximately 0.032 cm³.

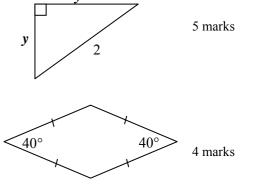
- b) What is this volume, in cubic millimetres?
- c) Assuming the blot penetrates the tissue paper to an equal depth, estimate the depth of the ink penetration in mm. 5 marks
- 7. Write down the reciprocal of:
 - a) 17 b) $\frac{1}{3}$ c) $-\frac{2}{3}$



- a) Copy and complete the table of probabilities.
- b) Calculate the number of times his sum was 8. 5 marks

p1

Sum of the	Experimental	Theoretical
two dice	Probability	probability
2	0.07	1/16
3	0.14	
4	0.2	
5		
6	0.24	
7	0.15	
8	0.04	1/16



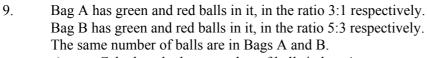
4 marks

3 marks

Pluto

5 marks

6 marks



a) Calculate the least number of balls in bag A.

A ball is selected from each bag.

The diagram shows the part of a tree diagram.

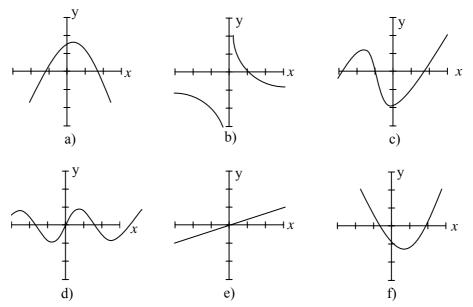
b) Calculate the probability that both balls selected are red.

The number of balls in bags A and B is changed but the ratio of balls remains 3:1 and 5:3 as before. Bag C has green and red balls in it, in the ratio 5:1 respectively.

The same number of balls are in Bags A, B and C.

- c) Calculate the least number of red balls that are contained altogether in the three bags. 8 marks
- 10. Match-up the six sketch graphs to the six suggested curves,
 - i) Quadratic with a minimum point ii) Reciprocal iii) Sin curve
 - iv) Quadratic with a maximum point v) Cubic vi) Linear

As an example, the graph labelled i) is a quadratic function.



11. Calculate-

13.

a)
$$27^{-\frac{2}{3}}$$
 b) $(16^{\frac{1}{4}})^3$

3 marks

12. Gavin is investigating the distribution of shoe sizes among pupils in his school. He decides to take a random stratified sample of his school to perform the survey. He divides the schools into 10 strata by year group and gender. There are 1000 pupils in Gavin's school and he decides to use a sample of size 100.

	Year	Boys	Girls
	7	120	110
	8	80	90
)	9	105	100
,	10	95	100
	11	98	102

BAG A

BAG B

·R

If simple rounding is used in calculations to decide the make up of the sample; what problem does this cause in this case and suggest a solution. Hence decide the make up of the sample for a sample size of 100 pupils.

3 marks

- a) Sketch the graph of $y = \sin x$ for $0 \le x \le 360^\circ$.
 - b) One solution to the equation $\sin x = 0.5$ is $x = 30^{\circ}$, find another solution such that $0 \le x \le 360^{\circ}$.
 - b) One solution to the equation $\sin x = \frac{\sqrt{3}}{2}$ is $x = 60^\circ$, find another solution such that $0 \le x \le 360^\circ$.
 - c) Sketch the graph of $y = \sin 2x$ for $0 \le x \le 180^\circ$.

p2

c) $4^{0} + 16^{\frac{1}{2}}$

5 marks

- d) Solve the equation $\sin 2x = 0.5$ for $0 \le x \le 180^\circ$.
- 14. When objects are launched upwards through a fluid with an initial velocity, v metres per second, they achieve a maximum height of h metres.

h is directly proportional to the square of *v*. When v = 10, h = 5.

- a) Work out an equation for *h* in terms of *v*, evaluating any constants.
- b) Calculate the value of v when h = 8.45.

Two identical balls are launched upwards. The ratio of their initial speeds is 5:2.

- c) Work out the ratio of the maximum heights achieved.
- 15. A student is analysing the results from a game of chance, which had 20 rounds. In the last 20 rounds, he won 8 rounds, lost 4 rounds, and drew 8 rounds.

Estimate the probability that-

- a) In the next two rounds, they win one round and lose the other.
- b) They lose the next three rounds.
- 16. A is the point (4, 1), B is the point (-3, 5) and O is the point (0,0).
 - a) i) Write \overrightarrow{AB} as a column vector.
 - ii) Find the length of \overrightarrow{AB} leaving your answer as a surd.

D is a point such that *BD* is parallel to $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$ and the length of \overrightarrow{AD} is the same as the length of \overrightarrow{AB} .

b) Find *OD* as a column vector.

C is the point such that *ABCD* is a rhombus.

c) Find the coordinates of *C*.

pЗ

17. The lengths of the sides, in metres, of a rectangle are $3 - \sqrt{5}$ and $3 + \sqrt{5}$ respectively.

Find, in their simplest forms-

- a) The rectangle's perimeter.
- b) The rectangle's area.

18. Make *Q* the subject of the equation,
$$\frac{Q}{V^2} = 2Qp + 12$$
 4 marks

19. Solve the equation,
$$\frac{1}{x} + \frac{6x}{x-1} = 6$$
 5 marks

20. a) Show that the *x*-coordinate of the points of intersection of the line
$$y = 2x + 2$$
 and the circle $x^2 + y^2 = 8$ must satisfy the equation $5x^2 + 8x - 4 = 0$.

- b) Hence find the coordinates of the points where the line y = 2x + 2 intersects the circle $x^2 + y^2 = 8$.
 - 6 marks

7 marks

6 marks

4 marks

8 marks

4 marks