DO NOT WRITE ON THIS PAPER	**TIME** 2 hours	*Paper 2 of 5 from ZigZag Education*
Sample GCSE Examination Paper **Higher Tier Calculator Paper**	Standard Equipment: lined or squared paper, pen, pencil, ruler. Additional Equipment: pair of compasses, plain paper. Notes: graph paper or squared paper useful for Q6, Q19.	

1. a) Multiply out and simplify the expression $(x - 3)(x + 4)$.

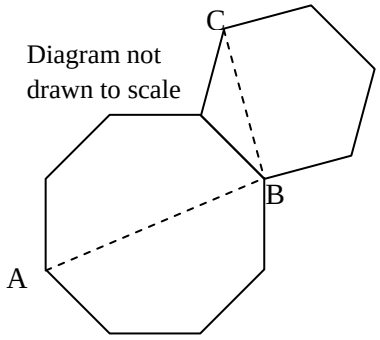
   b) Factorise the expressions:

   i) $x^2 + 3x$

   ii) $x^2 - 10x - 11$

6 marks

2. The diagram shows two regular polygons of side 3cm. Calculate lengths AB and length BC, giving your answers to 2 decimal places.



10 marks

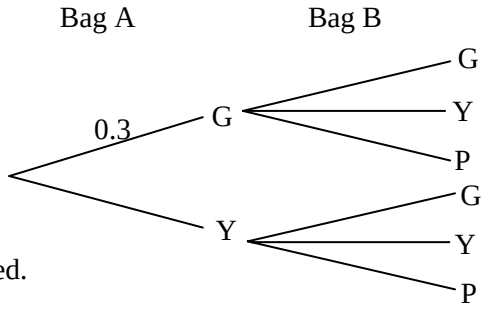
3. a) Write 48 as the product of primes.

   b) Write 48^3 as the product of primes.

4 marks

4. Bag A contains 3 green balls and 7 yellow balls
   Bag B contains 7 green balls and 2 yellow balls and a pink ball.

   a) Copy and complete the tree diagram with probabilities



   b) Calculate the probability that no yellow balls are selected.

4 marks

5. The speed of light in vacuum is exactly 299,792,458 m/s.

   a) i) Write 299,792,458 in standard index form to 4 significant figures.

   ii) Write 299,792,458 in standard index form to 3 significant figures.

   The metre is defined as the length of the path travelled by light in vacuum during a time interval of $\frac{1}{299\,792\,458}$ of a second.

   b) Write 1 ÷ 299 792 458 in standard index form to 3 significant figures.

   The speed of sound in dry air is given approximately by v, where

   $v = 331.4 + 0.6T$ m/s (where T is the Celsius temperature.)

   c) Calculate the speed of sound at 54°C, where C stands for Celsius.

   d) Taking the speed of sound to be 331.4m/s, calculate the ratio of the speed of light to the speed of sound in the form n:1, with n given to 2 significant figures.

7 marks

6. The heights of 100 people in an army regiment are summarised in the following table:

Height in metres	Frequency
$1.4 < h \leq 1.5$	15
$1.5 < h \leq 1.6$	25
$1.6 < h \leq 1.7$	34
$1.7 < h \leq 1.8$	26

The smallest height was 1.44m. The largest height was 1.78m tall. The median height was1.62m. The first quartile height was 1.53m. The third quartile height was 1.72m.

Using a suitable scale, draw a box and whiskers plot of the heights of the people in the squad. 3 marks

7. The scale used in this diagram is 1cm represents 5km.
Reproduce the sketch map showing points A and B roughly 5cm apart, and make sure that the line AB is not horizontal or vertical.
Points A and B represent mines in a mine field in the ocean.
A boat navigates its way through the middle of the two mines such that it is always equidistant from each mine.

Use a ruler and compasses only to show the path of the boat.
Clearly mark on the diagram the path of the boat. 5 marks

8. The hire charge for a jeep £54 per day plus £2 per mile.
Ahmid wishes to hire the jeep for 3days. He spends £x with x > £162 and he travels **y** miles.
a) Write down an expression for the cost of Ahmid's trip in terms of **y**.
b) Find an expression for the distance travelled **y** in terms of x. 5 marks

9. In the following, Diagram 1 uses 4 tiles.

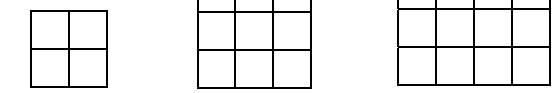


Diagram 1 Diagram 2 Diagram 3

a) Formulate an expression in terms of n, for the number of tiles in the n^{th} diagram.

The outside square of tiles are shaded, as shown for diagram 3:
Diagram 3 has 12 shaded tiles and 4 white tiles.

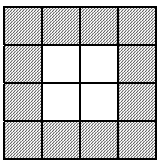


Diagram 3

b) Formulate an expression in terms of n, for the number of shaded tiles in the n^{th} diagram, with n > 1.

c) Formulate an expression in terms of n, for the number of white tiles in the n^{th} diagram, with n > 1.
6 marks

10. x is equal to 12.4 correct to 1 decimal place.
y is equal to 14 correct to 2 significant figures.

Find least upper and greatest lower bounds writing down the full calculator display for $\frac{3(x^2 - y)}{2}$.
4 marks

11. The population of the world is growing at an **annual** rate of 1.4%.
In 1999, the population of the world was 6000 million.

a) Calculate an estimate for the population of the world in 2018, to 4 significant figures.
b) Plot a graph showing world population from 1999 to 2004. 5 marks

12. The width of a rectangular swimming pool is x metres.
The length of the pool is 5m greater than its width.
The total area of the pool is $45m^2$.

a) Show that $x^2 + 5x - 45 = 0$
b) Find the width of the pool, giving your answer correct to 4 significant figures. 5 marks

13. Solve the simultaneous equations below, to find x and y.

$2x - y = -3$
$y = x^2 + x - 3$ 5 marks

14. The distance that a diving board bends at the tip, d cm, is proportional to the square of the weight of the diver, w kg standing on the board.

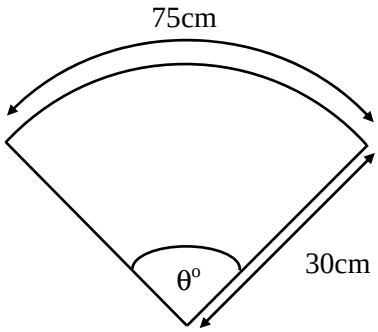
The diving board bends down by 20cm when a diver weighing 65kg is standing on it.

a) Find a formula for d in terms of w evaluating any constants.

b) How much will the diving board bend down by when a diver weighing 85kg is on it? 5 marks

15. A straight line passes through the point (4, –2) and is perpendicular to the line with equation $6x + 4y = 14$. Find the equation of the line. 5 marks

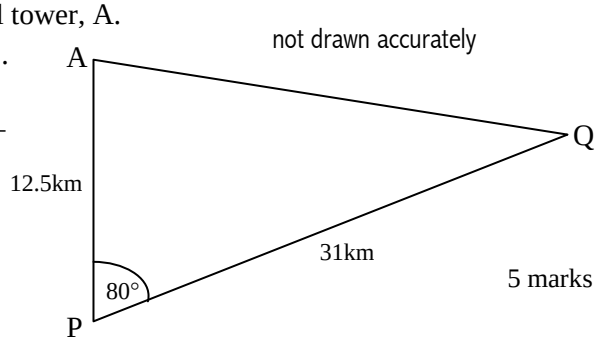
16. The sector shown to the right has arc length 75cm, and a radius of 30cm.



a) Calculate θ to 1 decimal place.

b) Calculate the area of the sector. 4 marks

17. A plane, P, is 12.5km due south of an air traffic control tower, A.
Another plane, Q, is 31km from P on a bearing of 080°.

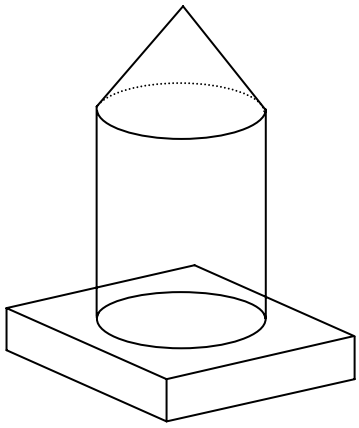


Calculate, giving your answers to 3 significant figures–

a) The distance of Q from A.

b) The bearing of A from Q. 5 marks

18. The lamp shown to the right is made of a cuboid base, a cylindrical middle, and a cone top.
The cuboid has a square base of side 8cm, and a height of 2cm.
The cylinder is of radius 6cm, and height 25cm.
The cone has a radius of 6cm, and a height of 4cm.



Find the volume of the compound object, giving your answer to 4 significant figures. 5 marks

19. This table shows information about the ages of 78 employees of a large publishing house, from a survey taken in 2001.

Age	Number of employees
$15 \le y < 20$	6
$20 \le y < 25$	20
$25 \le y < 30$	22
$30 \le y < 40$	16
$40 \le y < 50$	10
$50 \le y < 80$	4

a) Draw a histogram to show this information.

b) Estimate the mean age of the employees, giving your answer to 2 decimal places. 7 marks