

*Our Lady of Fatima*  
*Dominican Convent School*



**MATHEMATICS PAPER 2**  
**TRIAL EXAMINATION**

Grade 12

August 2017

Time: 3 hours

Marks: 150

**EXAMINER: Mrs. D. Fell**

**MODERATOR: Mrs. S. Moodley**

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**PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY**

1. This examination paper consists of 26 pages. All questions must be attempted.
2. Answer the questions **ON THE QUESTION PAPER** in the space provided.
3. Any extra lined or blank paper in this booklet may be used if extra space is needed.
4. Number your answers exactly as the questions are numbered.
5. Please refer to the 2 page information sheet supplied.
6. Round off to **2 decimal places** unless otherwise stated.
7. Calculators may be used. Make sure that they are in **DEGREE MODE**.
8. Diagrams are **not** drawn to scale.
9. When you refer to angles ensure that you name them accurately.
10. Write only in black or blue ink.
11. All necessary working as per mark allocation must be clearly shown.
12. It is in your own interest to **write legibly** and to present your work neatly.
13. Read the questions **CAREFULLY**.  
**YOU CAN DO THIS!**



1.3.1 Calculate the radius of the circle. (2)


1.3.2 Hence write down the equation of the circle ABCD. (2)


1.4.1 Why is  $DQ = QC$ ? (1)

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1.4.2 State the co-ordinates of (it is not necessary to show working):

a.) C. (2)

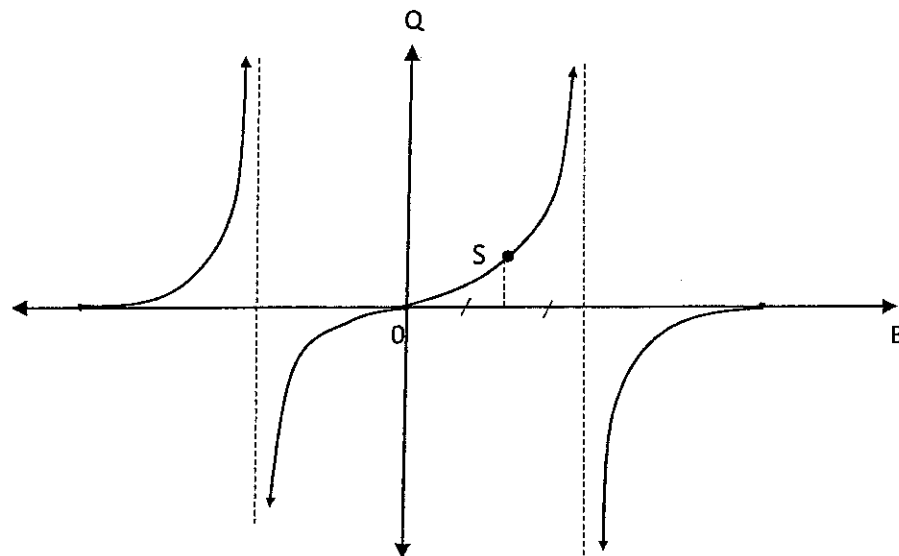
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b.) B (2)

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1.5 Find the equation of the straight line ABE. (3)


2. The function  $Q = \tan 2B$  is sketched above for  $\hat{B} \in [-90^\circ; 90^\circ]$ .



2.1 Give the co-ordinates of the point S.  (2)

2.2 Write down the equation of the asymptote to the right of the Y axis. (1)

2.3 If  $P = \frac{\sin B - 2\sin^3 B}{2\sin^2 B \cdot \cos B}$ , write P in terms of Q. (5)


2.4 Hence, state for which value/s of  $\hat{B} \in [-90^\circ; 90^\circ]$ , P is undefined. (2)

3.1 Prove that  $2 \sin(\theta - 45^\circ) - \sqrt{2} \cos(180^\circ - \theta) = \sqrt{2} \sin\theta$  (4)


3.2 Hence, find the general solution for  $\theta$  rounded to the nearest degree if:

$$2 \sin(\theta - 45^\circ) - \sqrt{2} \cos(180^\circ - \theta) = \cos\theta \quad (5)$$




4.4 Determine the equation of circle ABC.

(4)


[12]

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- (2.) Determine the value of  $\frac{GE}{UN}$ , giving reasons. (4)


- (3.) If, in addition to the above information,  $LA = AU$ , find the length of  $LH$  in cm. (3)


6.

- a.) A team of environmentalists conducted a survey on 14 different countries, recording each country's population as well as their eco-friendly rating (EFR) which was on a scale of 0 to 10 (0 being bad and 10 being outstanding).

Population in millions	5	20	10	45	5	10	50	45	23	25	15	30	40	45
EFR	9	6	7	6	8	8	3	2	7	7	1	5	4	4

- 1.) Determine the equation of the line of best fit. ( 4 decimal places) (2)

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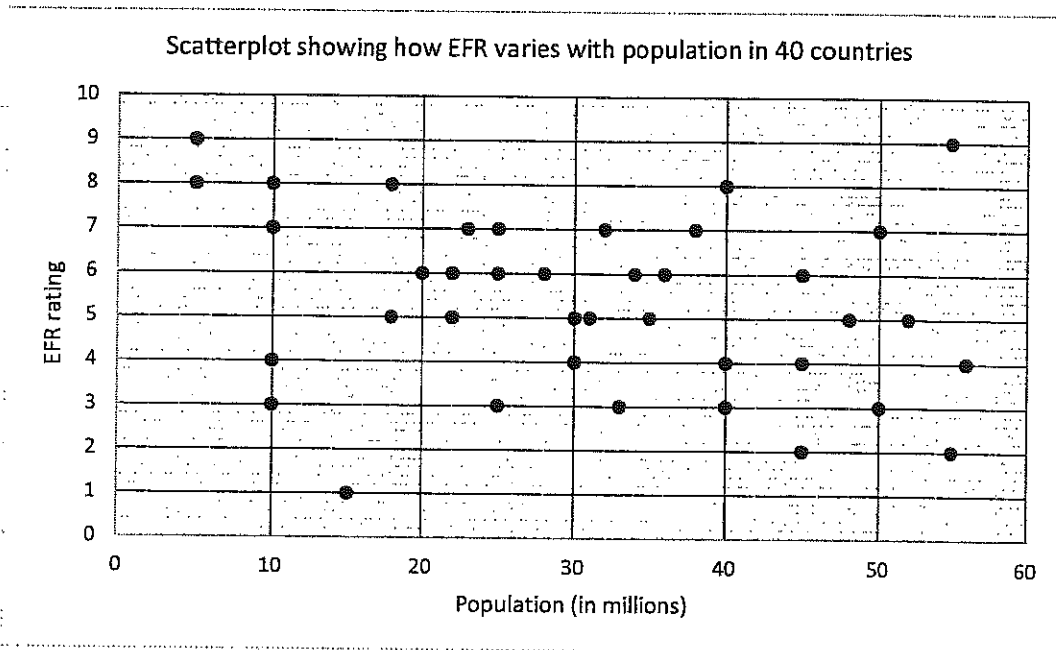
- 2.) If the correlation coefficient,  $r = r_1$  for this sample, calculate  $r_1$  and hence discuss the strength of the correlation, relating to the context. (3)


- b.) The only outlier in this data set is (15 million ; 1).  
 If this outlier is ignored, then  $y = 8,9187 - 0,1132x$  and  $r = r_2 = -0,8862$ .  
 If the team was approached by a 15<sup>th</sup> country, with a population of 15 million, to predict what their EFR would be, based on their survey,

- 1.) Why would the team use the line of best fit calculated without the outlier? (2)


- 2.) Calculate the predicted EFR for this 15<sup>th</sup> country. (to nearest whole number) (2)


c.) The team decided to increase their original sample size by conducting EFR assessments on 26 more countries and their resulting scatterplot for the 40 countries appeared as follows:



In which one of the following intervals is this data set's correlation coefficient most likely to be? ( There is no need to use your calculator here)

- (1.)  $-1 < r < -0,25$
- (2.)  $-0,25 < r < 0,25$
- (3.)  $0 < r < 0,65$
- (4.)  $r < -1$  OR  $r > 1$

(1)

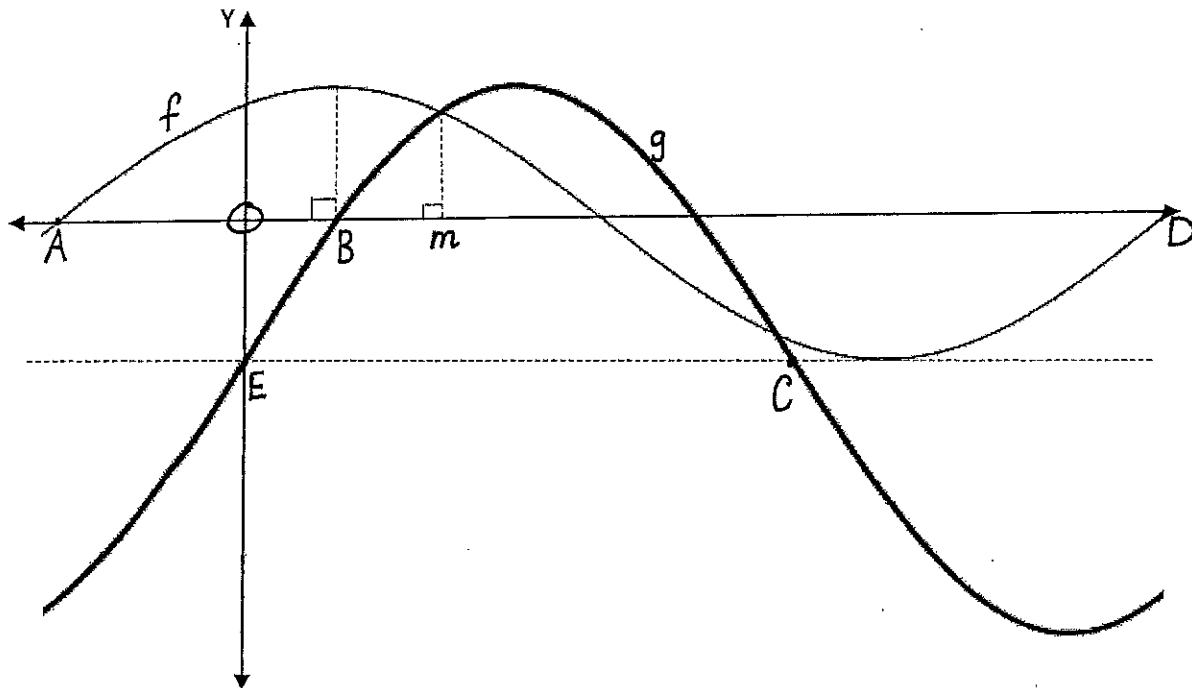
[10]

SUB-TOTAL SECTION A: [75]

## SECTION B

7. The equations of the two graphs sketched below are

$$f(x) = \cos(x - 30^\circ) \text{ and } g(x) = 2\sin x - 1$$



7.1 Determine the co-ordinates of the following points:

- a.) A
- b.) B
- c.) C
- d.) D

(4)

7.2 Give the equation of the straight line passing through E and C.

(1)

7.3 Use the graphs above to find the value/s of  $x$  if  $f(x) = g(30^\circ)$ . (3)

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7.4 From your graph it looks like  $m = 60^\circ$ .  
Show by calculations whether this is true or false. (3)

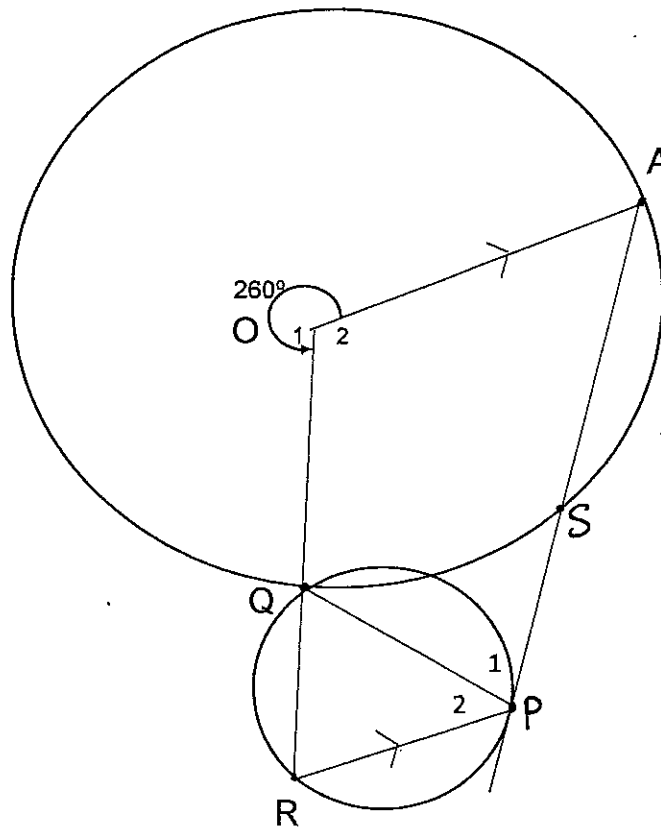

[11]

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9.



In the diagram above:

- Circle, centre  $O$ , has reflex  $Q\hat{O}A = 260^\circ$ .
- A smaller circle  $PQR$  intersects the bigger circle at  $Q$ .
- $OQ$  is produced to intersect the smaller circle at  $R$ .
- $AP$ , a tangent to the smaller circle at  $P$ , intersects the bigger circle at  $S$ .
- $RP \parallel OA$ .

9.1 Prove that  $OAPQ$  is cyclic.

(5)

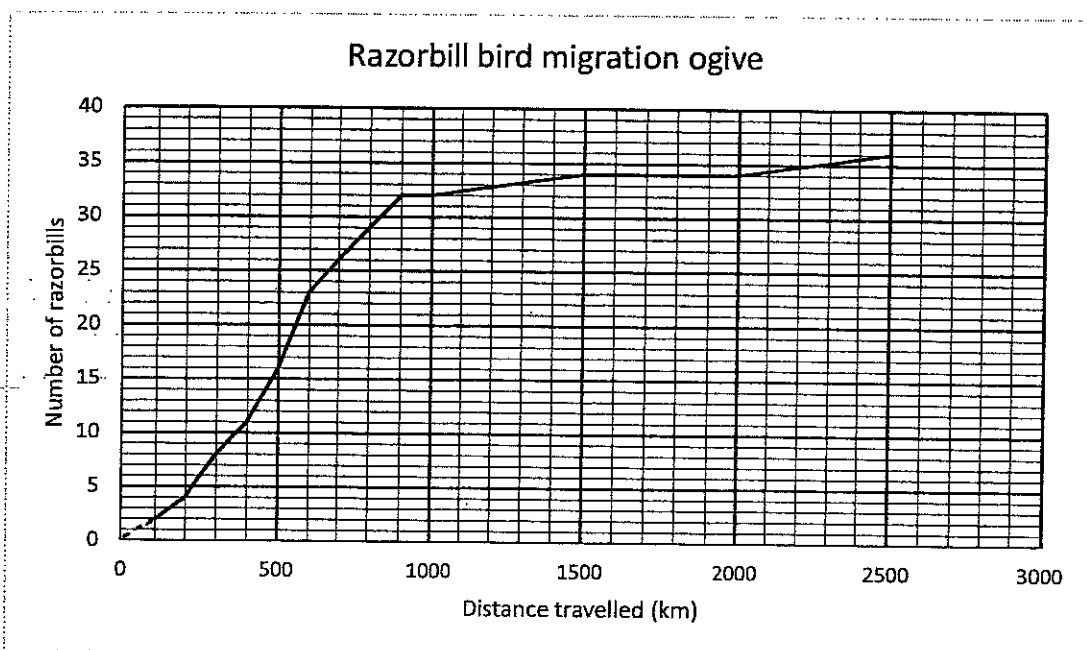


9.2 Use a simple construction to prove that  $PS = PQ$ .

(6)


[11]

10. The data shown in the ogive (cumulative frequency graph) below, deals with a bird migration survey conducted with **36 razorbills**.



- 10.1 Use the graph to estimate the distance exceeded by 50% of these razorbills during their migration.

(2)


- *The estimate for the mean distance travelled by razorbills was calculated to be 611,11 km:*

- 10.2 Is this data normally distributed or left skewed or right skewed? Give a reason. (2)

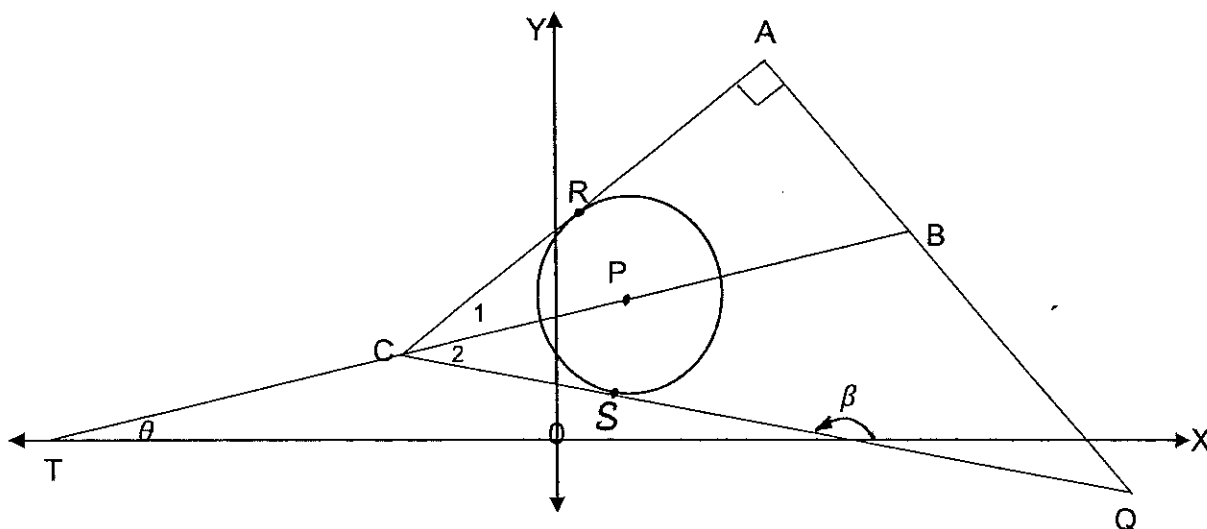

**A similar survey is conducted with a different type of bird and :**

- **the median is 610,5 km**
- **the IQR (interquartile range) is 100 km less than the IQR of the razorbill sample**
- **the data is normally distributed.**

10.3 Calculate an estimate for the upper and the lower quartiles for this second data set. (5)


11. In the diagram below,

- CSQ and CRA are tangents to the circle, centre P, at S and R respectively.
- PC is produced on both sides to intersect the X axis at T, and AQ at B.
- $\widehat{CAQ} = 90^\circ$



- The equation of the circle is  $x^2 - 4x + y^2 - 6y + 8\frac{3}{4} = 0$  :

11.1 Find the co-ordinates of P. (3)


11.2 What is the length of RP? (leave your answer in surd form if necessary) (1)


- $Q = (12; -1\frac{5}{8})$  and  $C = (-4; a)$  and
- The equation of CQ is  $8y + 2x = 11$ .

11.3 Find the value of a. (2)


11.4 Find the gradient of BC. (2)


11.5 Prove that  $\widehat{C}_2 = 20^\circ$  to the nearest degree. (4)


11.6.1 Name two congruent triangles that make  $\widehat{C}_1 = \widehat{C}_2$  .

(1)

11.6.2 Hence show that  $\frac{AB}{BQ} = \sin 50^\circ$  (4)

P.T.O for more lines




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- 12.2 If  $r_1 : r_2 = 5 : 6$  where  $r_1$  = the radius of the smaller circle and  $r_2$  = the radius of the bigger circle, find the length of TP in terms of  $x$ , showing reasoning. (7)



[11]

13. Part of a table decoration at a function involves folding a circular piece of filter paper, as shown below to line a cocktail glass in the shape of a cone.  
 The filter paper is folded such that OA meets up with OB where  $\widehat{AOB} = 60^\circ$ , to form the three dimensional cone which lines the cocktail glass.  
 AP (or BP) is the diameter of the cocktail glass.

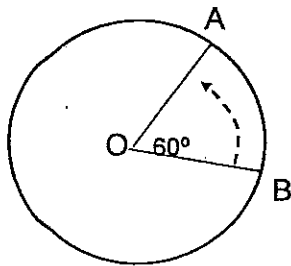


Figure 1. Filter paper

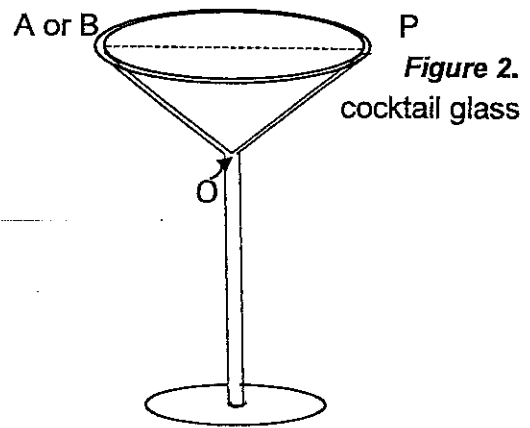


Figure 2. cocktail glass

- 13.1 If the circumference of filter paper in figure 1 =  $C_1$ , and  
 the circumference of the top of the cocktail glass in figure 2 =  $C_2$ ,

Show that  $C_2 = \frac{5}{6} C_1$  (2)


Hence:

- 13.2.1 If the radius of the filter paper in figure 1 is 10 cm, show that the diameter of the top of the cocktail glass in figure 2, AP, is  $16\frac{2}{3}$  cm. (2)


13.2.2 Calculate the size of  $\hat{AOP}$  in degrees (to the nearest degree) (4)


13.3 Calculate the volume of the cocktail glass in cubic cm to 1 decimal place.

(Volume of a cone =  $\frac{1}{3} \pi . r^2 . h$ ) (3)


[11]

SUB-TOTAL-SECTION B : [75]

