

ST. DAVID'S MARIST INANDA



GRADE 12 MATHEMATICS PAPER 2
PRELIMINARY EXAMINATION
13 SEPTEMBER 2016

EXAMINER: Mrs L. Nagy	MARKS: 150
MODERATOR: Mrs C. Kennedy	TIME: 3 hours

NAME: _____

HIGHLIGHT YOUR TEACHER'S NAME:

C. KENNEDY	L. NAGY	L. BLACK	S. RICHARD
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INSTRUCTIONS:

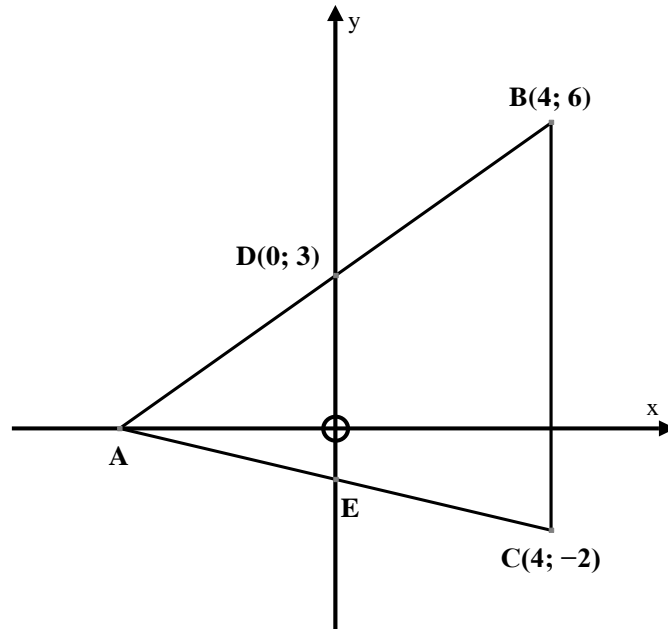
- ✓ This paper consists of 32 pages and a separate Formula sheet. Please check that your paper is complete.
- ✓ Please answer all questions on the Question Paper and read each question carefully.
- ✓ You may use an approved non-programmable, non-graphics calculator unless otherwise stated.
- ✓ Answers must be rounded off to ONE decimal place unless otherwise stated.
- ✓ It is in your interest to show all necessary working details.
- ✓ Work neatly. Do **NOT** answer in pencil.
- ✓ Diagrams are not drawn to scale.

SECTION A	Q1	Q2	Q3	Q4	Q5			TOTAL
MARKS	21	17	23	6	8			75
SECTION B	Q6	Q7	Q8	Q9	Q10	Q11		TOTAL
MARKS	12	14	12	17	10	10		75

SECTION A

QUESTION 1 [21 marks]

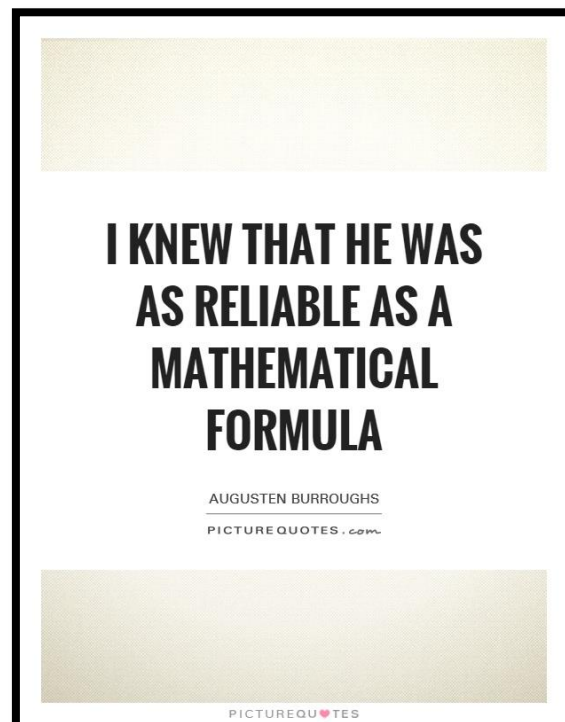
- a) In the diagram below, ABC is a triangle and BC is parallel to the y-axis. AB and AC intersect the y-axis at D and E respectively.



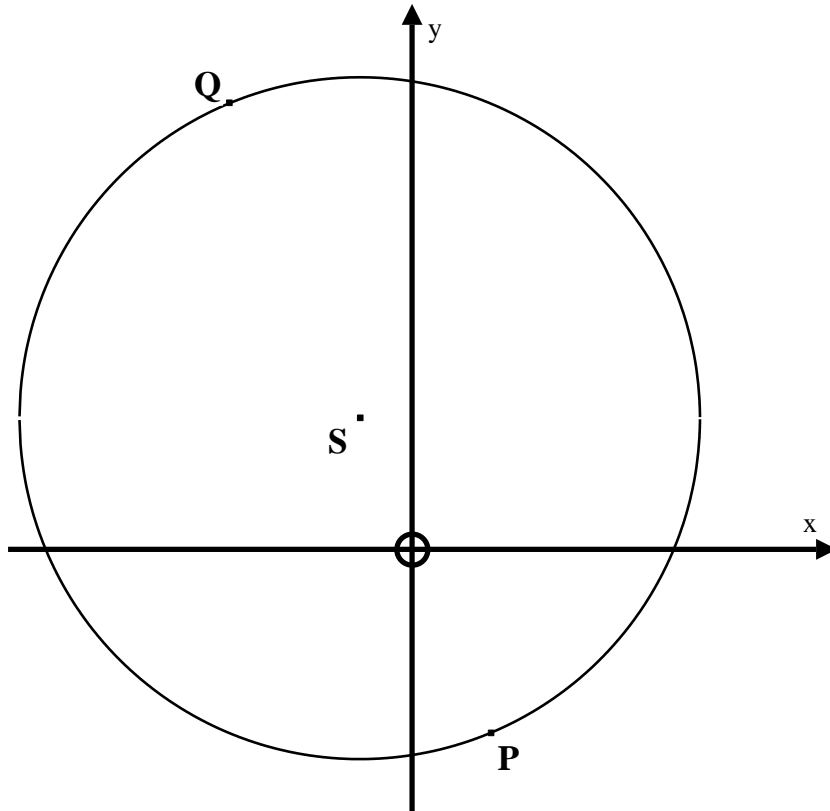
(1) Determine the coordinates of A.

(5)

- (2) If the equation of AC is $y = -\frac{1}{4}x - 1$, determine the length of AE. (4)



- b) PQ is a diameter of a circle with centre $S(-2; 5)$.
 $P(3; -7)$ and Q are points on the circle.



(1) Determine the coordinates of Q.

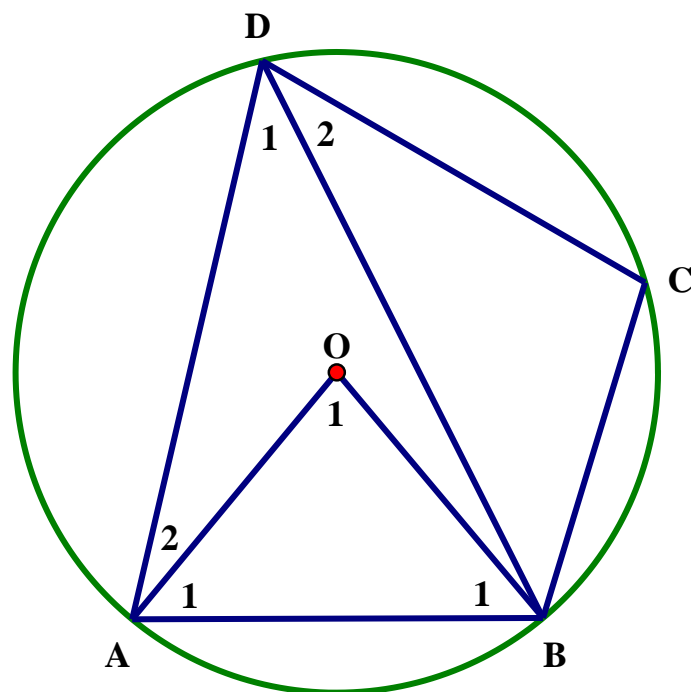
(4)

- (2) Determine the equation of the circle. (3)
- (3) Determine whether the circle with equation $2x^2 + 8x + 2y^2 - 20y = -40$ lies inside the circle with diameter PQ in Question 1b) no 2. (5)

QUESTION 2 [17 marks]

a) In the given diagram O is the centre of the circle.

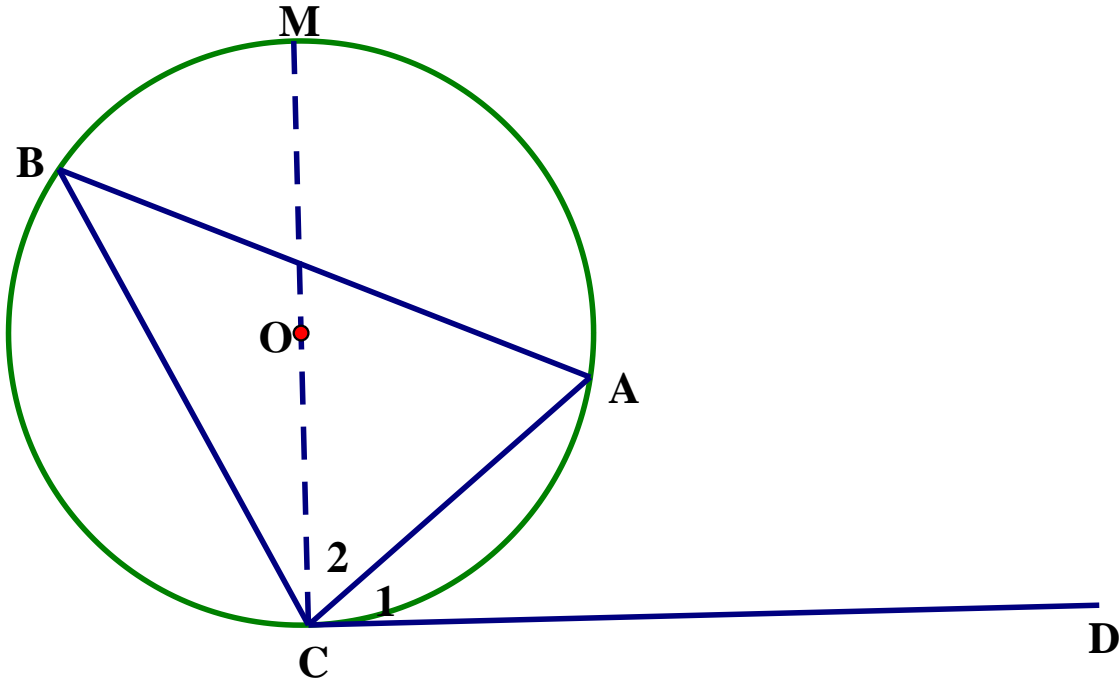
$$\hat{A}_1 = \hat{A}_2 = y$$



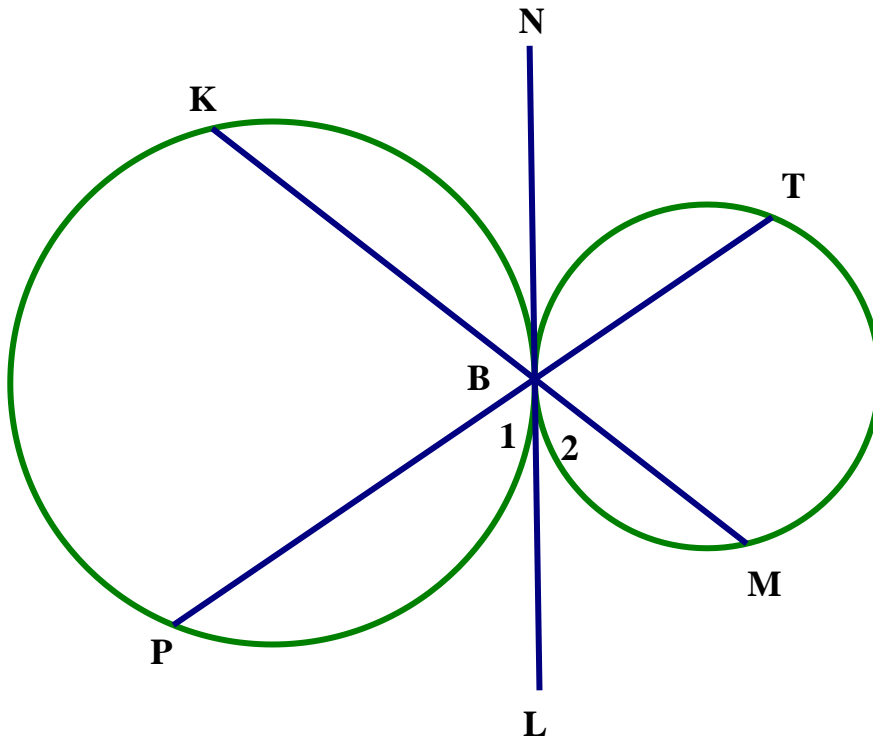
(1) Express \hat{D}_1 in terms of y . (4)

(2) Prove that AD is not a tangent to the circle through B, C and D. (3)

- b) (1) Use the diagram below to prove the theorem that states that the acute angle formed by a tangent and a chord is equal to the angle, which the chord subtends at the circle. (6)



- (2) Two circles touch each other at B. NBL is a common tangent. KBM and PBT are double chords through B so that $\hat{B}_1 = \hat{B}_2$. Prove, by making use of a construction, that KTMP is a cyclic quadrilateral. (4)



QUESTION 3 [23 marks]

YOU MAY NOT USE A CALCULATOR IN THIS QUESTION.

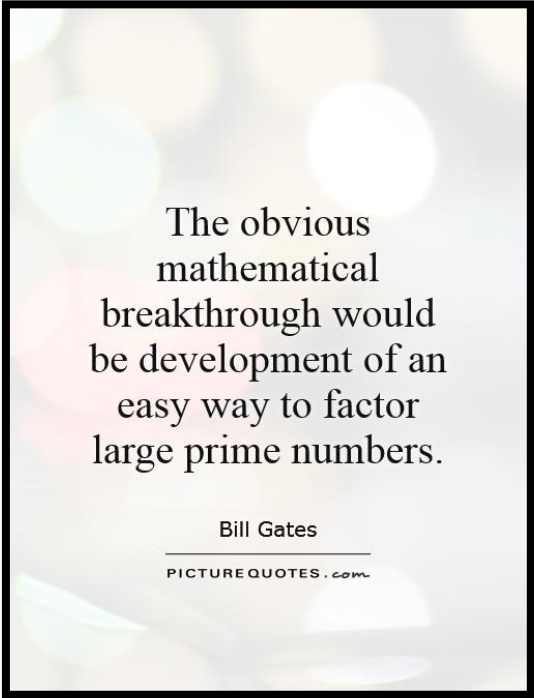
- a) If $4 \tan A + 3 = 0$ and $0^\circ \leq A \leq 270^\circ$, determine using a sketch, the value of $\sin 2A$.
Leave the answer in simplest surd form. (5)

- b) Simplify the following expression:

$$\frac{2 \cos^2 38^\circ}{\cos 256^\circ - 1} \quad (4)$$

- c) Solve for α , if $\alpha \in [-180^\circ; 180^\circ]$ and
 $\cos(\alpha + 20^\circ) + \cos(\alpha - 20^\circ) = \cos 20^\circ$

(6)



The obvious
mathematical
breakthrough would
be development of an
easy way to factor
large prime numbers.

Bill Gates

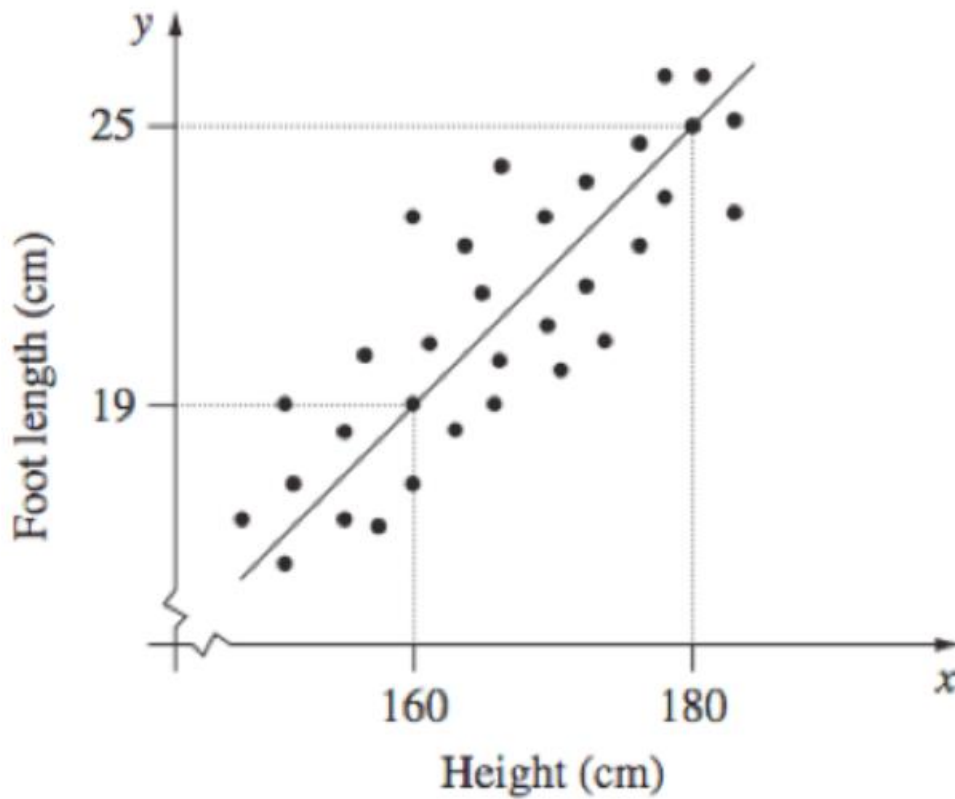
PICTUREQUOTES.COM

d) (1) Prove that $\frac{\sin A - \cos 2A + 1}{\sin 2A + \cos A} = \tan A$ (4)

(2) For which values of A, is the identity above undefined? (4)

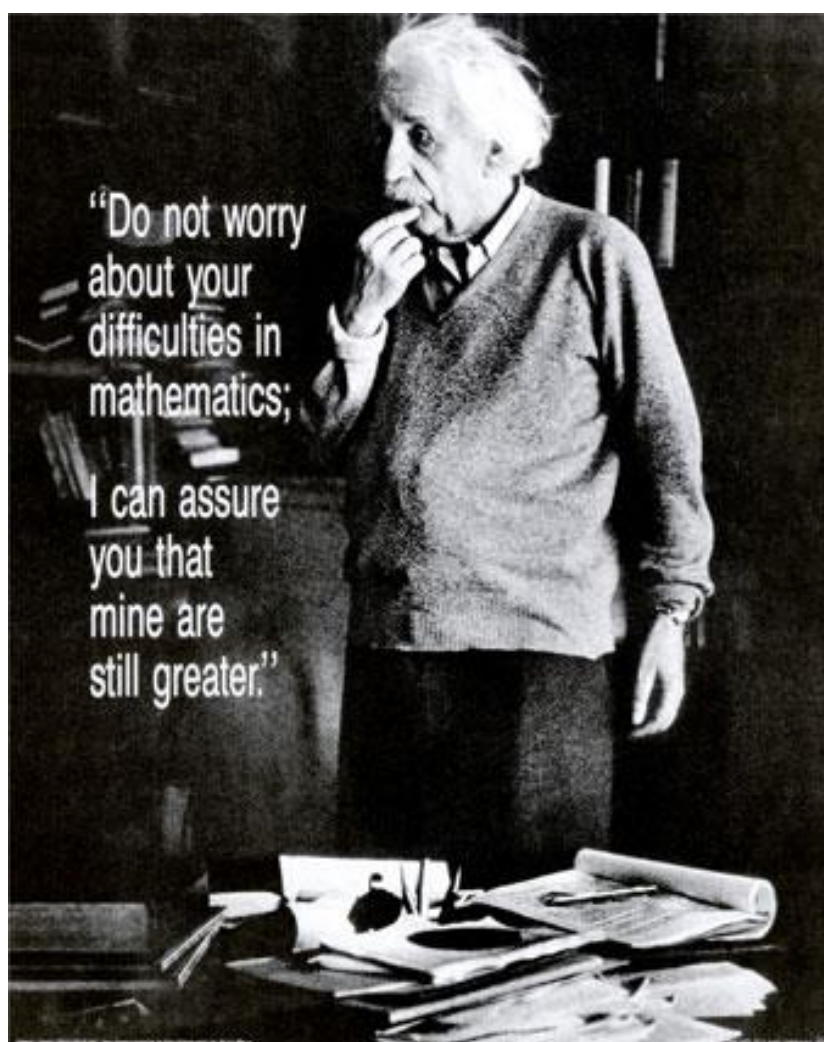
QUESTION 4 [6 marks]

The scatter plot below shows the relationship between the height and foot length of a group of males.



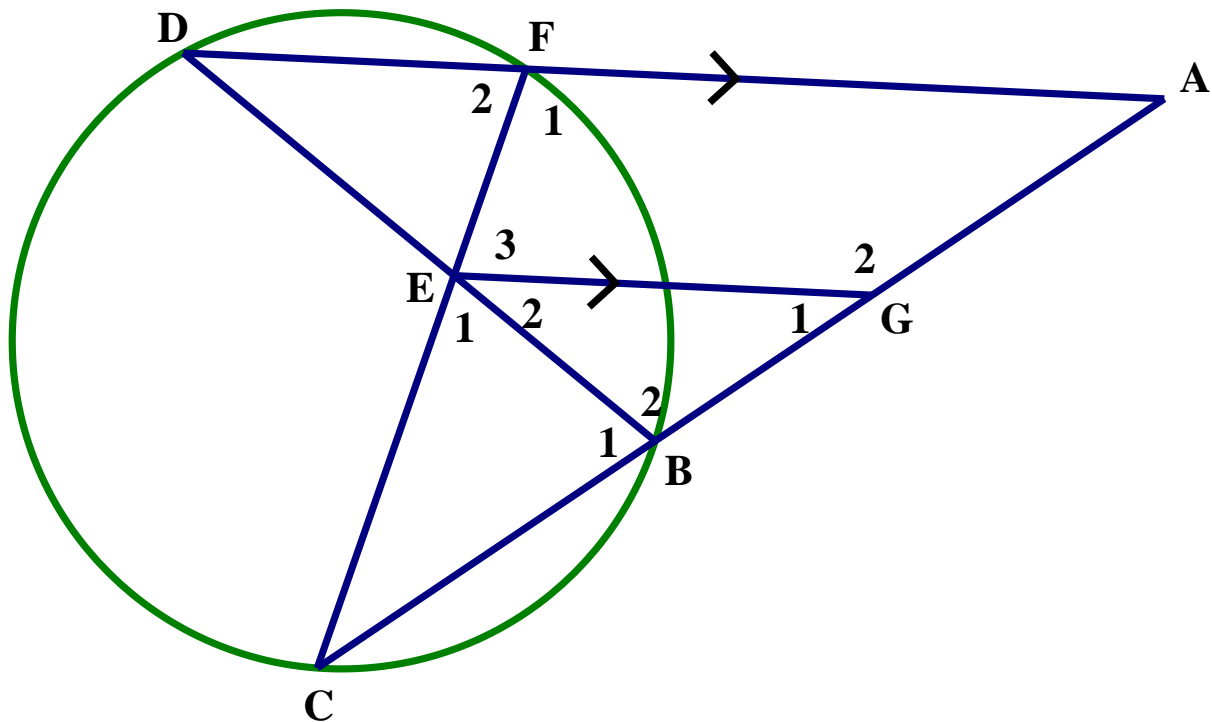
- a) Explain why the y-intercept of the line of best fit makes no sense. (1)
- b) Adam is 10 cm taller than his brother Thomas. Use the line of best fit to estimate the difference in their foot lengths. (3)
- c) Mrs Kennedy calculated a correlation co-efficient of $-1, 2$ for the data above. Give two reasons why she has to be wrong. (2)

PLEASE TURN TO PAGE 14 TO CONTINUE.



QUESTION 5 [8 marks]

In the accompanying diagram, AFD and ABC are secants drawn from point A outside the circle. BD and CF intersect in E. EG is drawn parallel to DA.




Prove that:

a) $\triangle ADB \sim \triangle ACF$

(4)

b) If it is further given that $\triangle AFC \parallel \triangle GBE$, prove that $\frac{AD}{DB} = \frac{GE}{BE}$ (4)



One of the pleasures of
looking at the world through
mathematical eyes is that you
can see certain patterns that
would otherwise be hidden.

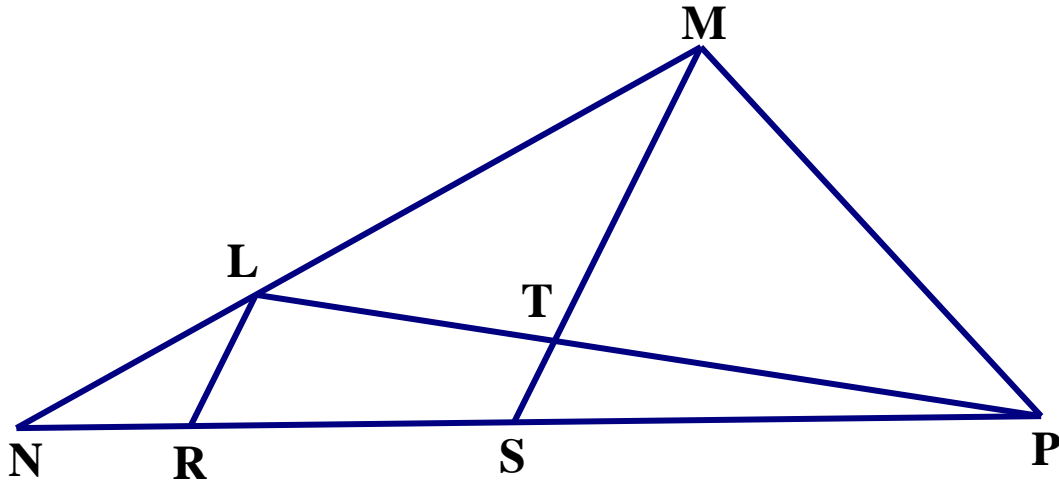
Steven Strogatz

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SECTION B

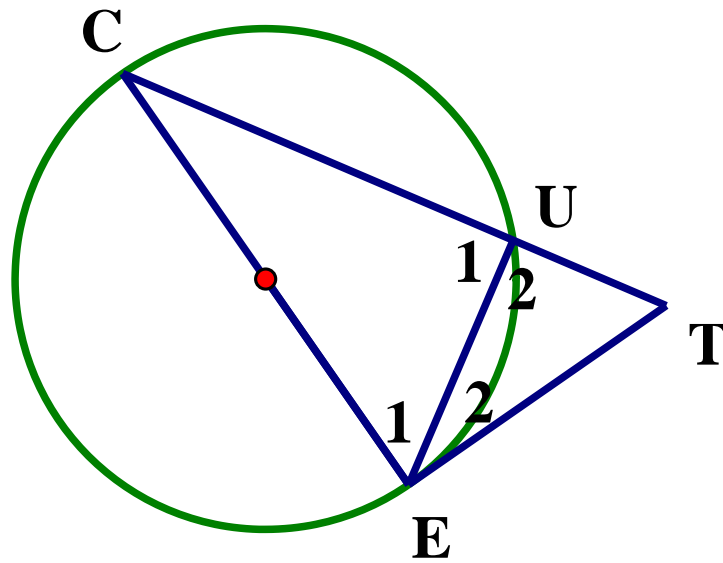
QUESTION 6 [12 marks]

- a) In the given diagram
- $NS : NP = 4 : 9$
- .



Calculate the $\frac{\text{Area of } \triangle NSM}{\text{Area of } \triangle SPM}$. (4)

- b) In the diagram below, EC is the diameter of the circle. TE is a tangent to the circle at E.



- (1) Write down the size of
- (1.1) $\hat{E}_1 + \hat{E}_2$ (1)
- (1.2) \hat{U}_1 (1)
- (2) Complete: $\triangle CUE \sim \triangle EUT \sim \triangle$ _____ (1)
- (3) Determine the perimeter of $\triangle EUT$ if $CU = 8$ cm and $UT = 4$ cm.
Round your answer off to the nearest cm. (5)

QUESTION 7 [14 marks]

a) (1) If $1 + \tan \theta = \cos 2\theta$ and $\cos \theta \neq 0$, show that

$$\sin \theta = 0 \text{ or } 2 \sin \theta \cdot \cos \theta = -1 \quad (4)$$

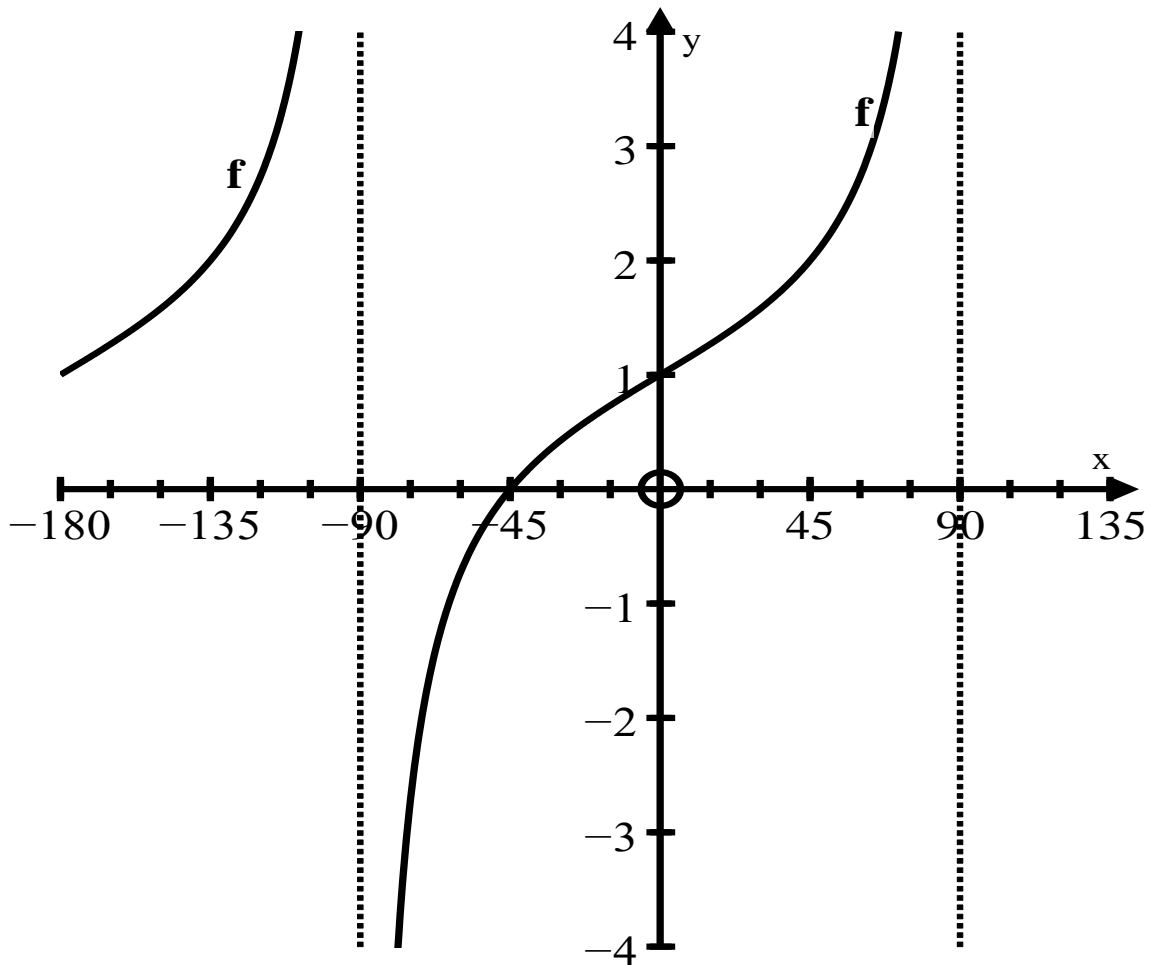
(2) Hence, solve for θ . (3)

b) The graph of $f(\theta) = 1 + \tan \theta$; $\theta \in [-180^\circ; 90^\circ]$ is drawn below.

If $g(\theta) = \cos 2\theta$,

(1) write down the period of g . (1)

(2) draw $g(\theta) = \cos 2\theta$; $\theta \in [-180^\circ; 90^\circ]$ on the given set of axes. (2)

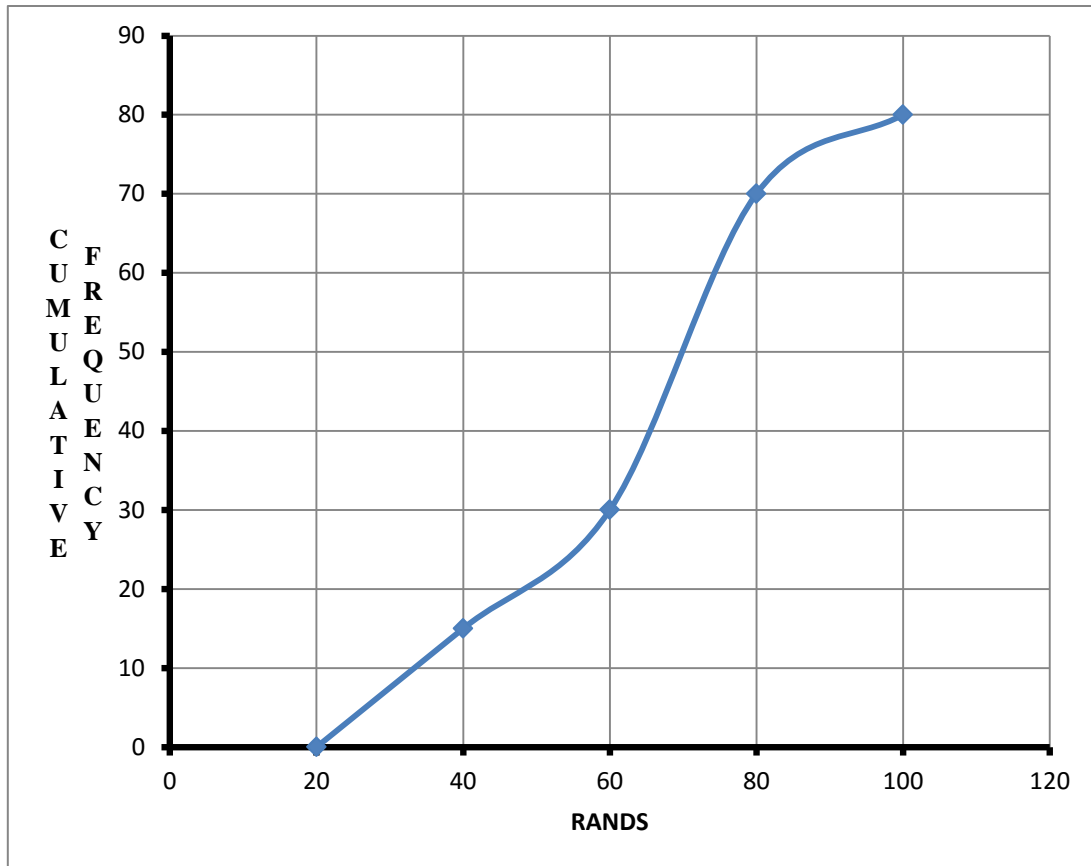


3) Determine the equations of the asymptotes of $f(\theta - 15^\circ)$ for $\theta \in [-180^\circ; 180^\circ]$ (2)

4) Determine, by using the graphs, the value(s) of θ for which $\tan \theta \geq \cos 2\theta - 1$ for $\theta \in [-180^\circ; -45^\circ]$ (2)

QUESTION 8 [12 marks]

- a) In the diagram below, the cumulative frequency curve shows the marked prices of 80 items that are for sale.



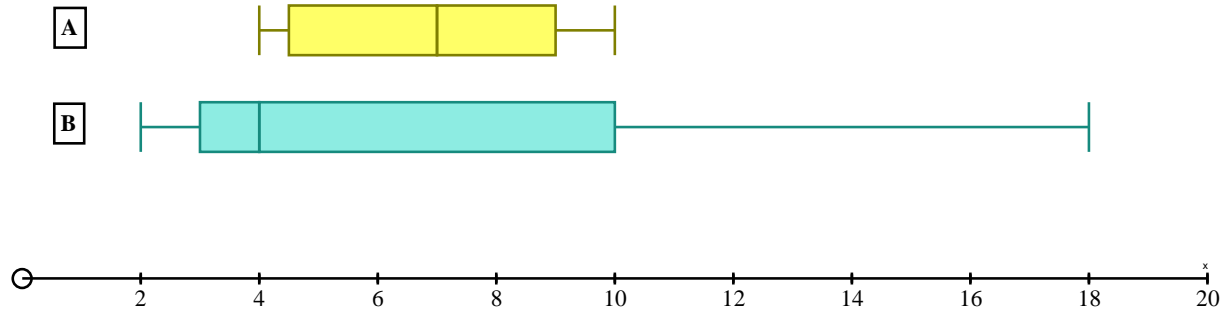
If the items are sold at half price,

- (1) redraw, on the given set of axes, the cumulative frequency curve for the new prices. (2)

- (2) what effect would this have on the standard deviation of the marked prices? Explain. (2)

- b) Mr James and his Biology class often go to one of two large city parks.
In Green Park there are 40 trees and the trees are mostly of similar height.
In Serene Park there are 28 trees and most of the trees are young trees.
The box and whisker plots of their tree heights are displayed below:

TREE HEIGHTS (METRES)



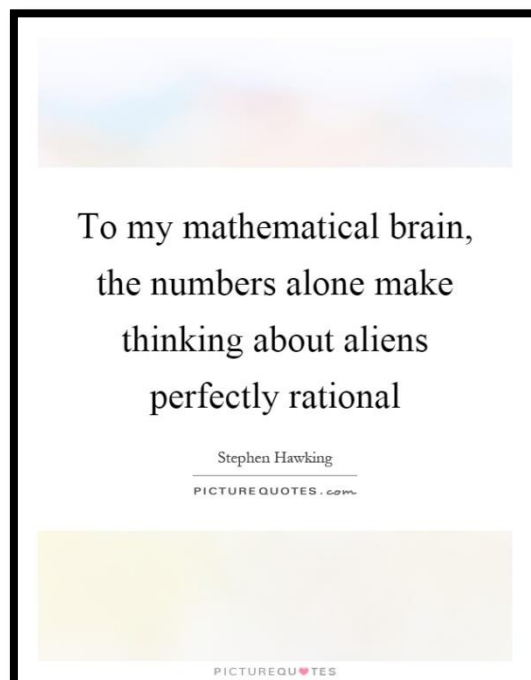
- (1) Can you tell which plot belongs to which park? Explain. (2)

- (2) How many trees are between 4 metres and 10 metres in each park? (2)

(3) Assuming the parks have the same area and the trees are spaced out equally in each, decide, by examining the skewness of the distributions, and giving reasons, which park the group of friends should go to:

(3.1) if they want to swim and tan in the sun. (2)

(3.2) if they want to have a picnic and nap in the shade under the trees. (2)



QUESTION 9 [17 marks]

a) The lines with equations $kx - 5y + 4 = 0$ and $4x - 2y + 5 = 0$ are given.

(1) Determine the value of k for each of the different cases below:

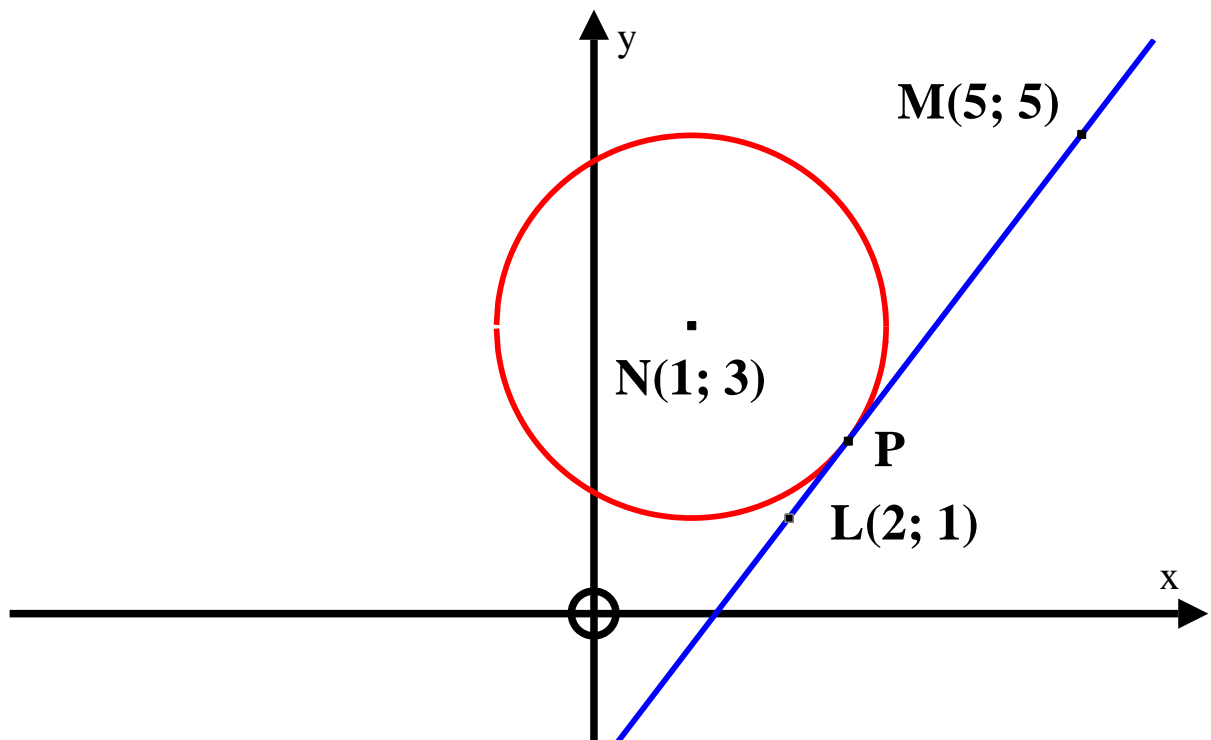
(1.1) The lines are the parallel sides of a trapezium. (3)

(1.2) The lines are the diagonals of a rhombus. (1)

(2) (2.1) Determine the angle of inclination of $4x - 2y + 5 = 0$ (2)

(2.2) Hence, determine the value of k if the lines intersect forming an angle of 50° and $0 < k < 10$. (3)

- b) In the diagram below $N(1; 3)$ is the centre of the circle passing through P . The tangent to the circle at P passes through $L(2; 1)$ and $M(5; 5)$.



(1) Determine the equation of the line NP .

(4)

(2) Hence, determine the equation of the circle.

(4)

**EQUATIONS ARE JUST
THE BORING PART OF
MATHEMATICS. I
ATTEMPT TO SEE THINGS
IN TERMS OF GEOMETRY.**

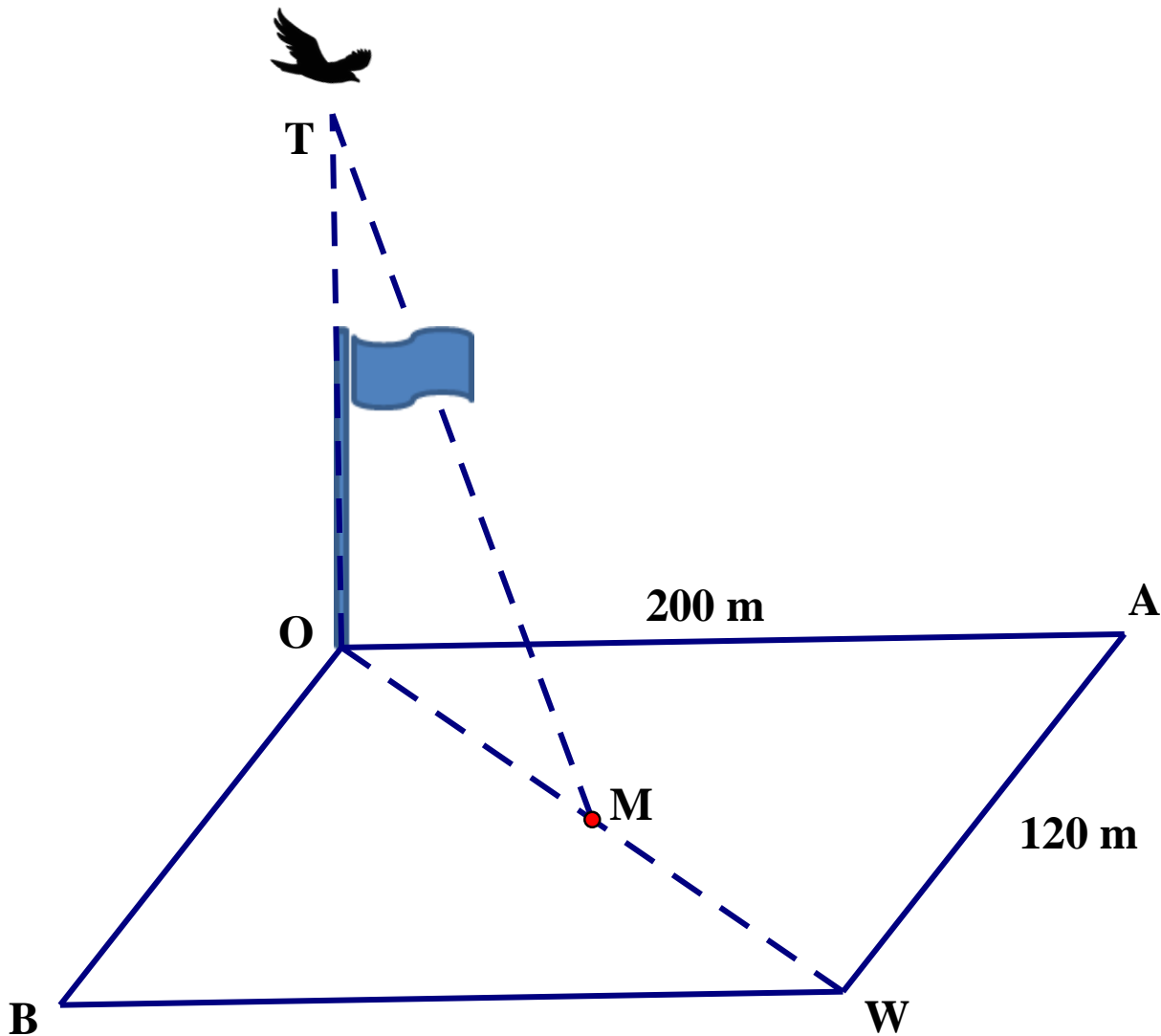
Stephen Hawking

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QUESTION 10

[10 marks]

A flagpole is in the corner of a park. The park, OAWB, is in the shape of a parallelogram and measures 200 metres by 120 metres. $\hat{OAW} = 75^\circ$ and $\cos \hat{TBO} = 0,8$



A bird flies in a straight line from a point (T) directly above the top of the pole to the centre of the park (M).

a) Determine, correct to one decimal place, the distance from,

(1) O to M

(3)

(2) B to T

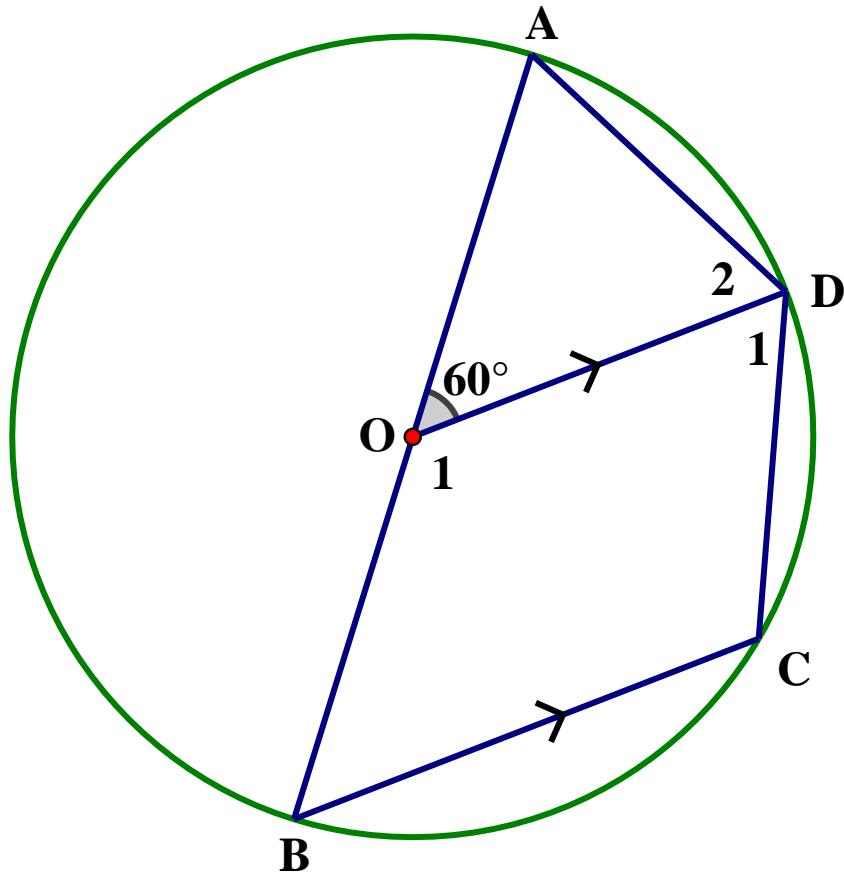
(3)

b) Hence, determine TM , the distance the bird flies.

(4)

QUESTION 11 [10 marks]

In the diagram below, AB is the diameter of the circle with centre O.
 $OD \parallel BC$ and $\hat{AOD} = 60^\circ$.



- a) Determine the size of \hat{D}_1 , giving reasons.

(4)

- b) A, C and D remain fixed whilst B is a variable point moving clock-wise on the circle. Describe how the size of \widehat{ABC} changes as it moves around the circle until it reaches its original position.

[Hint: draw diagrams to help you.]

(6)

TOTAL MARKS: 150

