

# Beaulieu College



## Mathematics Department

GRADE 11

MATHEMATICS

PAPER 2

Time: 3 Hours

150 marks

Date: 28 November 2016

Examiner: Ms Smith

Moderator: Mrs Prinsloo

NAME: \_\_\_\_\_

TEACHER:

Khan

Prinsloo

Smith

### PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of 25 pages and an **INFORMATION SHEET** of 2 pages (pages i – ii). Additional space for working out is provided on page 25.
2. Please check that your paper is complete.
3. Write your name in the space provided above and answer all the questions on the question paper.
4. Please note that diagrams are not necessarily drawn to scale.
5. All necessary working details must be shown.
6. Round your answers off to ONE decimal place unless stated otherwise.
7. Approved non-programmable and non-graphical calculators may be used, unless otherwise stated.
8. Ensure that your calculator is in DEGREE mode.
9. It is in your own interest to write legibly and to present your work neatly.

### MARKING GRID

Question	Analytical Geometry	Statistics	Trigonometry	Euclidean Geometry and Measurement
1	/8			
2	/24			
3		/11		
4		/11		
5			/21	
6			/7	
7			/11	
8				/13
9				/8
10				/16
11				/11
12				/9
<b>TOTAL PER TOPIC</b>	<b>/32</b>	<b>/22</b>	<b>/39</b>	<b>/57</b>

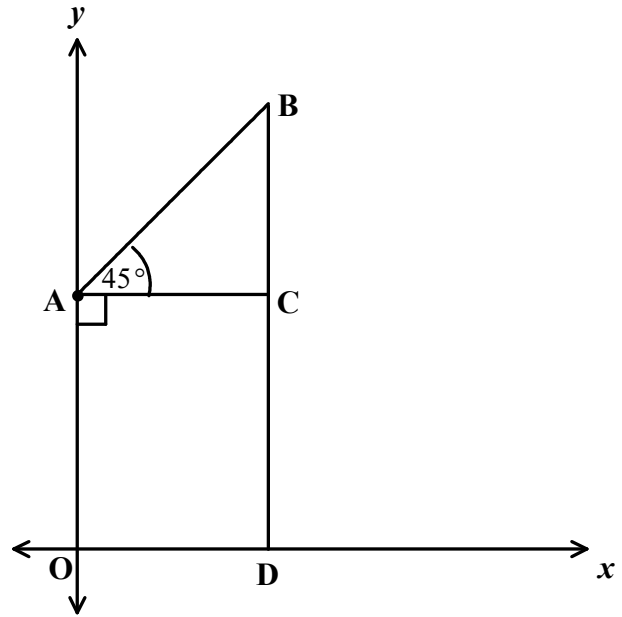
### QUESTION 1

In the diagram alongside, straight line AB makes an angle of  $45^\circ$  with line AC.

AC is parallel to the  $x$ -axis.

AB cuts the  $y$ -axis at A.

B is joined to D, a point on the  $x$ -axis, so that BD is parallel to the  $y$ -axis.



(a) Explain why ABDO is not a cyclic quadrilateral. (1)

(b) If  $OA = 8$  units, determine the equation of line AB. (3)

(c) If  $OD = 6$  units, then determine:

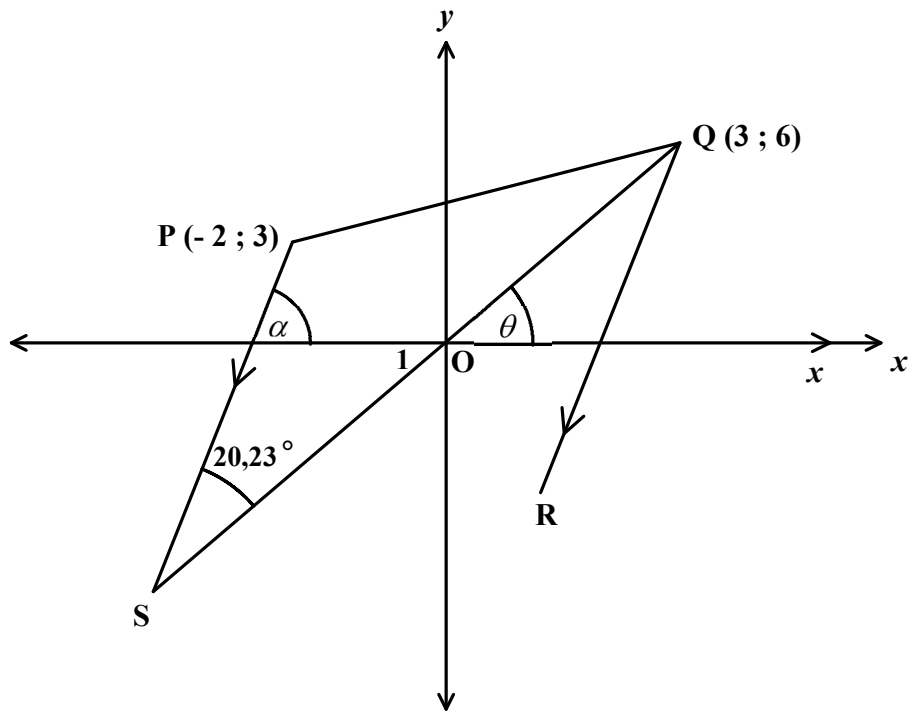
(1) the equation of BD. (1)

(2) the area of ODBA. (3)

[8]

**QUESTION 2**

In the diagram alongside,  $\triangle PQS$  is drawn with vertices  $P(-2; 3)$ ,  $Q(3; 6)$  and  $S$  in a Cartesian plane.



Line  $QS$  passes through the origin at  $O$ .

$PS \parallel QR$  and  $\hat{PSQ} = 20,23^\circ$ .

- (a) Calculate the gradient of  $QS$ . (2)
- (b) Calculate the size of  $\theta$ . (2)
- (c) Determine the gradient of  $PS$ , rounded off to the nearest integer. (4)

(d) Determine the equation of PS. (3)

(e) Determine the coordinates of S. (4)

(f) Calculate the length of QS. (2)

(g) If it is further given that PQRS is a parallelogram, determine the coordinates of R. (3)

- (h) If  $P(-2; 3)$ ,  $Q(3; 6)$  and  $T(k; 12)$  are collinear points, determine the value of  $k$ . (4)

[24]

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### QUESTION 3

Alex asked 15 of the grade 11s at Beaulieu College how many times they went to gym in the last six months. Their responses are given below:

14	19	21	26	29	34	39	40
42	51	58	59	61	66	71	

- (a) Determine the median of the data. (1)
- (b) Determine the interquartile range of the data. (3)

(c) Determine the mean of the data. (2)

(d) Determine the standard deviation of the data. (2)

(e) If a value in the data set is less than  $Q_1 - (1,5 \times IQR)$  or greater than  $Q_3 + (1,5 \times IQR)$ , then that value is an outlier. Show that there are no outliers in this data set. (3)

[11]

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*(Please turn over for Question 4.)*

#### QUESTION 4

You do market research about people who visited Mall of Africa. The table below is a summary of the ages of the people who visited the mall:

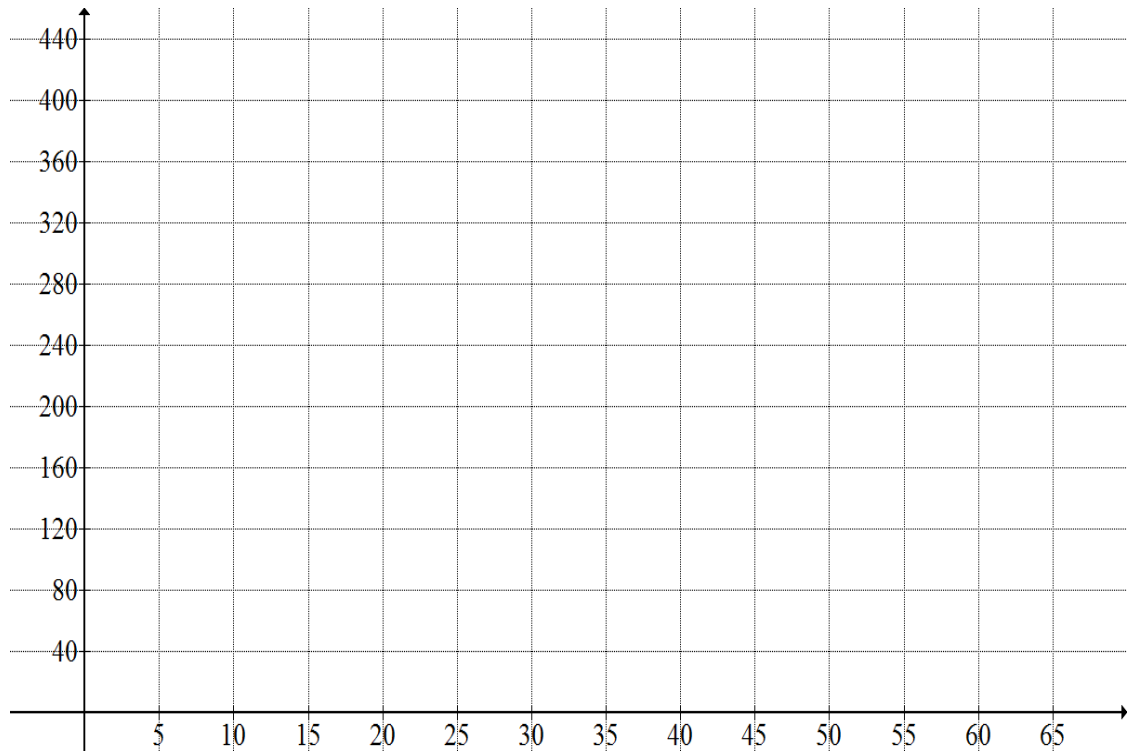
Age	Midpoint	Frequency	Cumulative Frequency
$5 < x \leq 15$	10	48	48
$15 < x \leq 25$	20	<b>A</b>	160
$25 < x \leq 35$	30	124	284
$35 < x \leq 45$	40	98	<b>B</b>
$45 < x \leq 55$	50	32	414
$55 < x \leq 65$	60	26	440

- (a) Calculate the values of **A** and **B** in the table above. (2)
- (b) Calculate the estimated mean age of the people who visited the mall. (2)
- (c) Calculate the estimated standard deviation of the ages of the people who visited the mall. (2)



(d) Sketch the Ogive on the grid below.

(3)



(e) Is the data normally distributed? Explain.

(2)

[11]

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*(Please turn over for Question 5.)*

### QUESTION 5

(a) Given:  $\cos \theta = -\frac{2}{5}$  and  $\theta \in [180^\circ; 360^\circ]$ .

Without the use of a calculator, determine  $\sin \theta$ . (3)

(b) Simplify:  $\frac{\tan \beta \cdot \sin(90^\circ + \beta)}{\sin(180^\circ - \beta)} - \frac{\cos(90^\circ - \beta)}{\sin(-\beta)}$  (6)

(c) Prove the following identity:

$$\left(\tan \alpha + \frac{1}{\tan \alpha}\right)(1 - \cos^2 \alpha) = \tan \alpha \quad (6)$$

(d) Determine the general solution of the following trigonometric equation:

$$\sin \theta - \frac{9}{8\sin \theta} = \frac{3}{4} \quad (6)$$

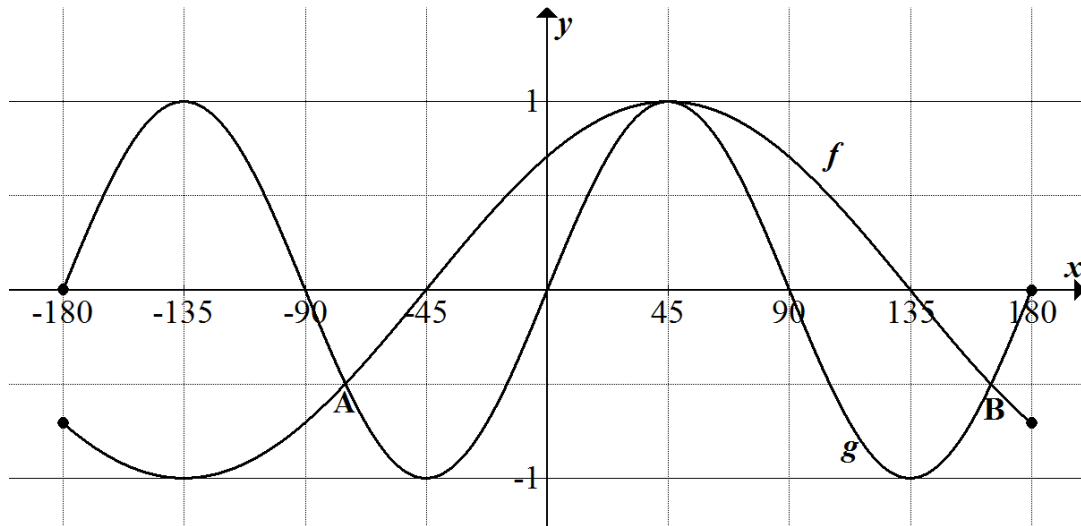
[21]

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*(Please turn over for Question 6.)*

### QUESTION 6

In the diagram below, the graphs of  $f(x) = \cos(x - a^\circ)$  and  $g(x) = \sin bx$  are drawn for  $x \in [-180^\circ; 180^\circ]$ .

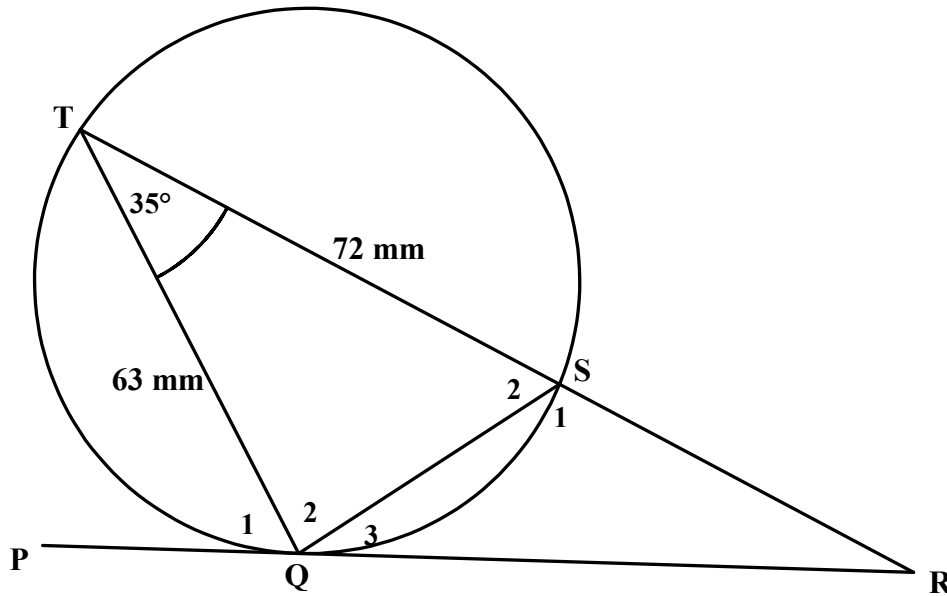


- (a) Determine the values of  $a$  and  $b$ . (2)
- (b) Points A and B are two of the points of intersection between the graphs of  $f$  and  $g$ . If the coordinates of point B is given as  $(165^\circ; -0,5)$ , write down the coordinates of point A. (2)
- (c) For which value(s) of  $x$  is  $f(x) - g(x) < 0$  for  $x \in [-180^\circ; 180^\circ]$ . (3)

[7]

### QUESTION 7

In the diagram below, TSR is a secant of the circle and PQR is a tangent at Q.  $TQ = 63$  mm,  $TS = 72$  mm and  $\hat{T} = 35^\circ$ .



(a) Calculate the length of QS.

(3)

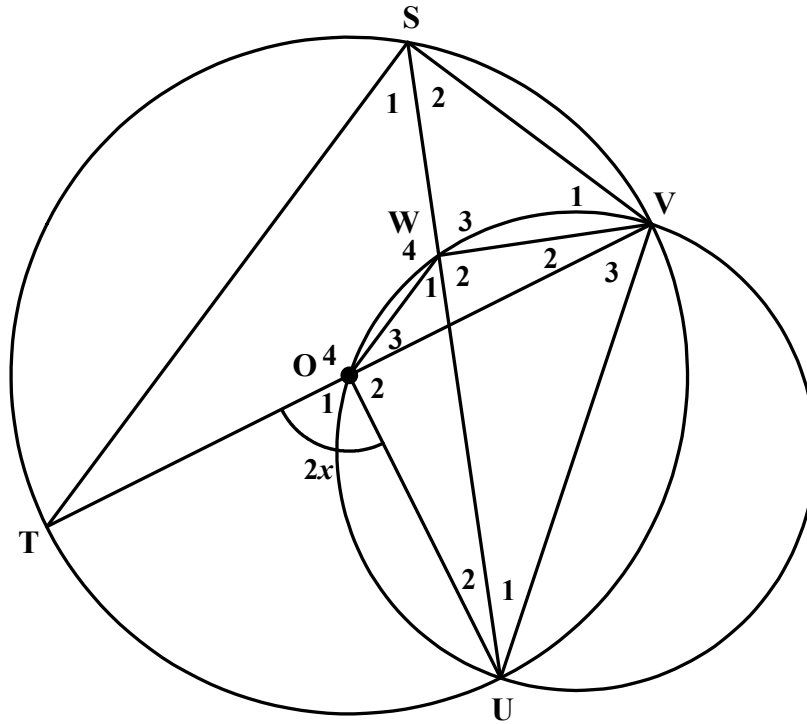
(b) Calculate the size of  $\hat{Q}_2$ . (3)

(c) Calculate the length of secant TSR. (5)

**[11]**

**QUESTION 8**

In the diagram below, O is the centre of the bigger circle and O lies on the circumference of the smaller circle. OWVU are points on the circumference of the smaller circle. TSVU are points on the circumference of the bigger circle.  $\hat{O}_1 = 2x$ .



(a) Complete the reasons for each of the given statements. (4)

STATEMENT	REASON
$\hat{S}_1 = x$	
$\hat{V}_3 = x$	
$\hat{W}_1 = x$	
$\hat{V}_3 + \hat{V}\hat{U}\hat{O} = 2x$ $\therefore \hat{V}\hat{U}\hat{O} = x$	



(b) Determine the size of  $\hat{W}_2$  in terms of  $x$  with reasons. (3)

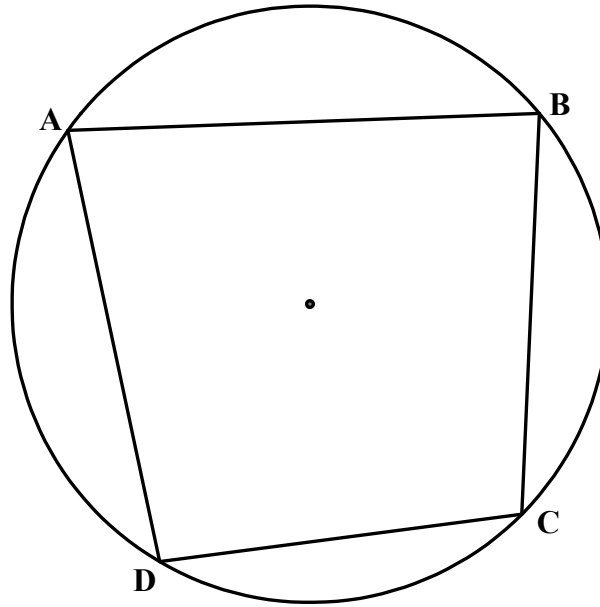
(c) Prove that  $WS = WV$ . (6)

[13]

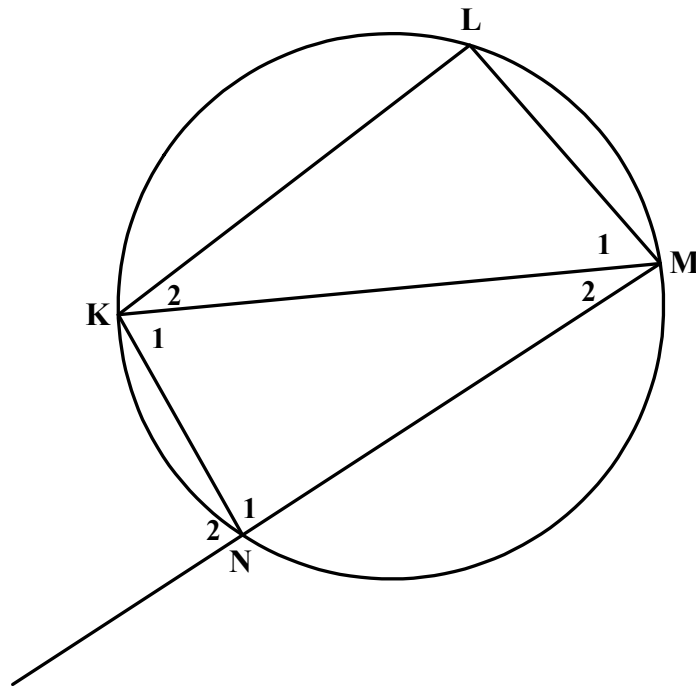
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### QUESTION 9

- (a) Use the diagram below to prove the theorem that states that the opposite angles of a cyclic quadrilateral are supplementary. (5)



(b) In the diagram below K, L, M and N lie on the circumference of a circle.



Prove  $\hat{L} = \hat{K}_1 + \hat{M}_2$ .

(3)

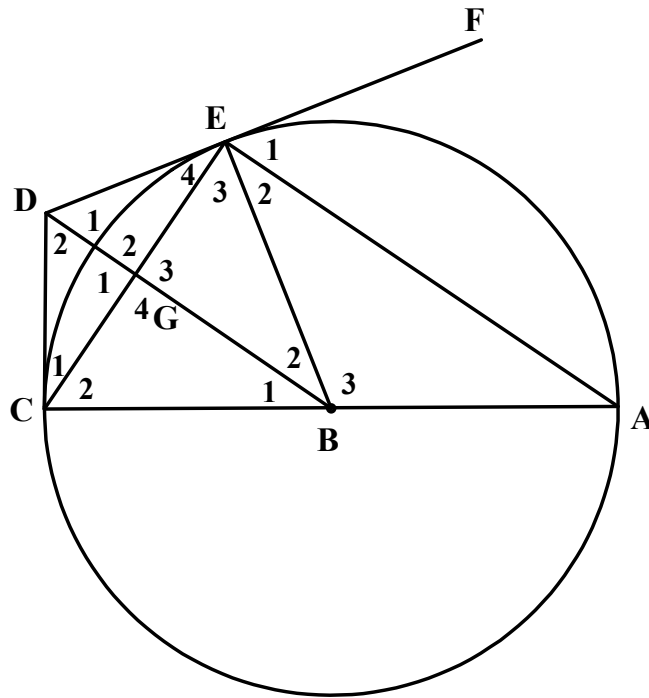
[8]

**QUESTION 10**

In the diagram below, AC is a diameter of the circle with centre B.

FED is a tangent to the circle at E and  $BG \perp EC$ .

BG produced cuts FE produced at D. DC is drawn.



(a) Prove  $BG \parallel AE$ .

(4)

(b) Prove BCDE is a cyclic quadrilateral. (4)

(c) Prove DC is a tangent to circle EAC. (4)

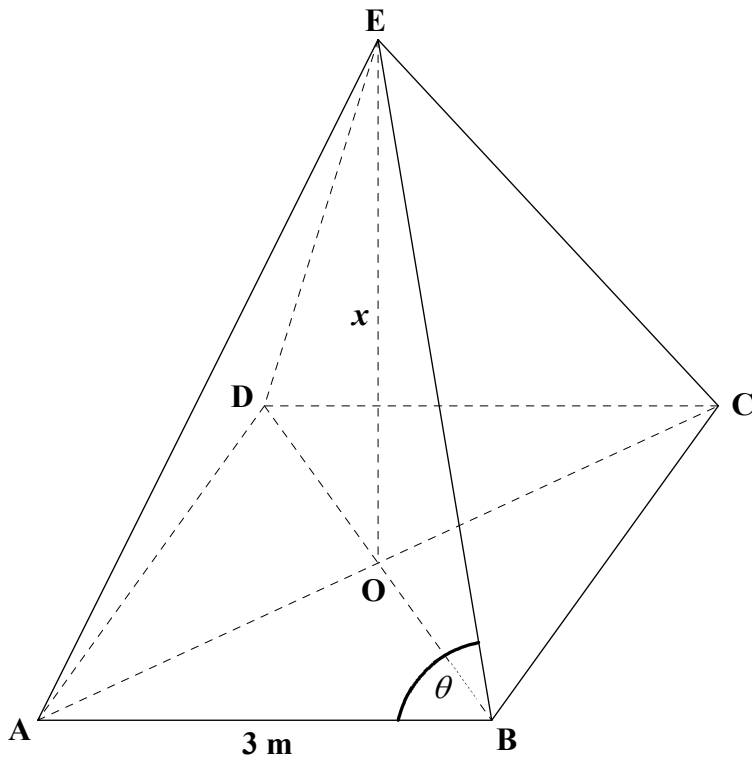
(d) Prove DC is a tangent to circle BCG. (4)

[16]

### QUESTION 11

E is the apex of a pyramid, having a square base ABCD. O is the centre of the base.  $\hat{E}BA = \theta$ ,  $AB = 3$  m and EO, the perpendicular height of the pyramid is  $x$ .

Volume of a pyramid = $\frac{1}{3}$ (area of the base) $\times$ ( $\perp$ height)
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- (a) Calculate the length of OB, leaving your answer in surd form. (3)

(b) If the volume of the pyramid is  $15 \text{ m}^3$ , determine the value of  $\theta$ .

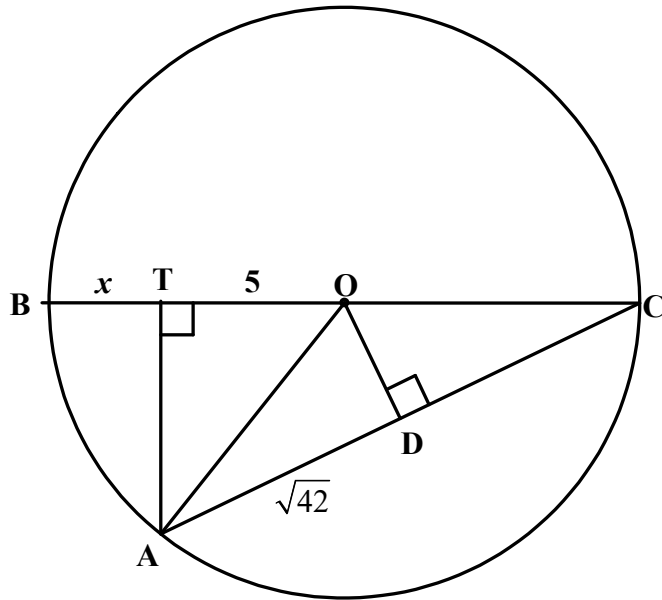
(8)

[11]

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**QUESTION 12**

BC is a diameter of circle ABC with centre O.  $OD \perp AC$  and  $AT \perp BOC$ .  $BT = x$ ,  $TO = 5$  units and  $AD = \sqrt{42}$ .



Determine, with reasons, the value of  $x$ .

(9)

[9]

**TOTAL: [100]**



**ADDITIONAL SPACE FOR WORKING OUT**