



St Andrew's School
— for Girls —
SKILLED FOR LIFE

MATHEMATICS PAPER 2

Grade 11

November 2016

Examiner/s JS, CS, LP

Moderator/s LP, CS, JS, GK

Marks 150

Time 3 hours

- Instructions:**
1. Answer all questions in the space provided.
 2. Ensure your calculator is in DEGREE mode.
 3. Round off your answers to ONE decimal digit where necessary.
 4. All the necessary working details **MUST** be clearly shown.

NAME									
Teacher: GK CSw LP JSt									
Q1		Q2		Q3		Q4		Q5	
Q6		Q7		Q8		Q9		Q10	
Q11		Q12		Q13		Q14			

/150

Useful Formulae

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan\theta$$

In $\triangle ABC$:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{area } \triangle ABC = \frac{1}{2} ab \sin C$$

$$\bar{x} = \frac{\sum fx}{n}$$

$$\sigma^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$$

SECTION A

Question 1 [13 marks]

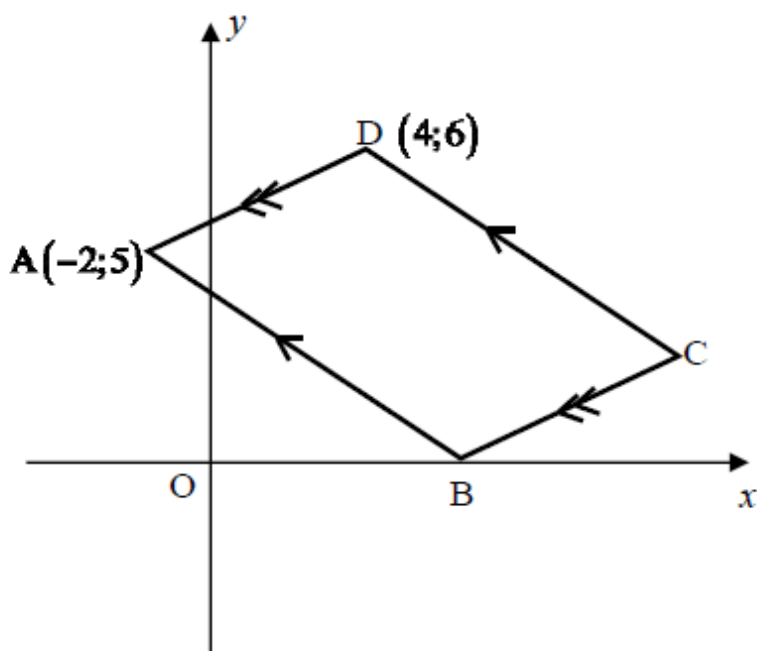
- (a) Given $E(4; 3)$, $F(0; -1)$ and $G(t; 1)$.

Determine the value of t for which:

- (1) E , F and G are collinear (3)

- (2) $\triangle FEG$ is right angled at F (2)

- (b) In the diagram $ABCD$ is a parallelogram with vertices $A(-2; 5)$ and $D(4; 6)$.
 CD is a line with equation $2y = -2x + 16$



(1) Determine \widehat{ABO}

(3)

(2) Determine the equation of AB.

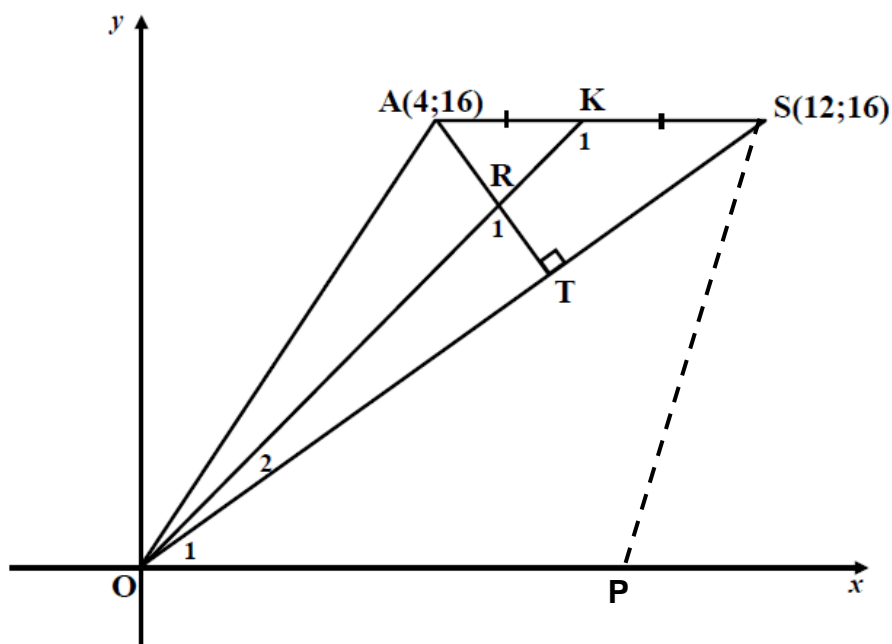
(2)

(3) Calculate the size of \widehat{ADC}

(3)

Question 2 [17 marks]

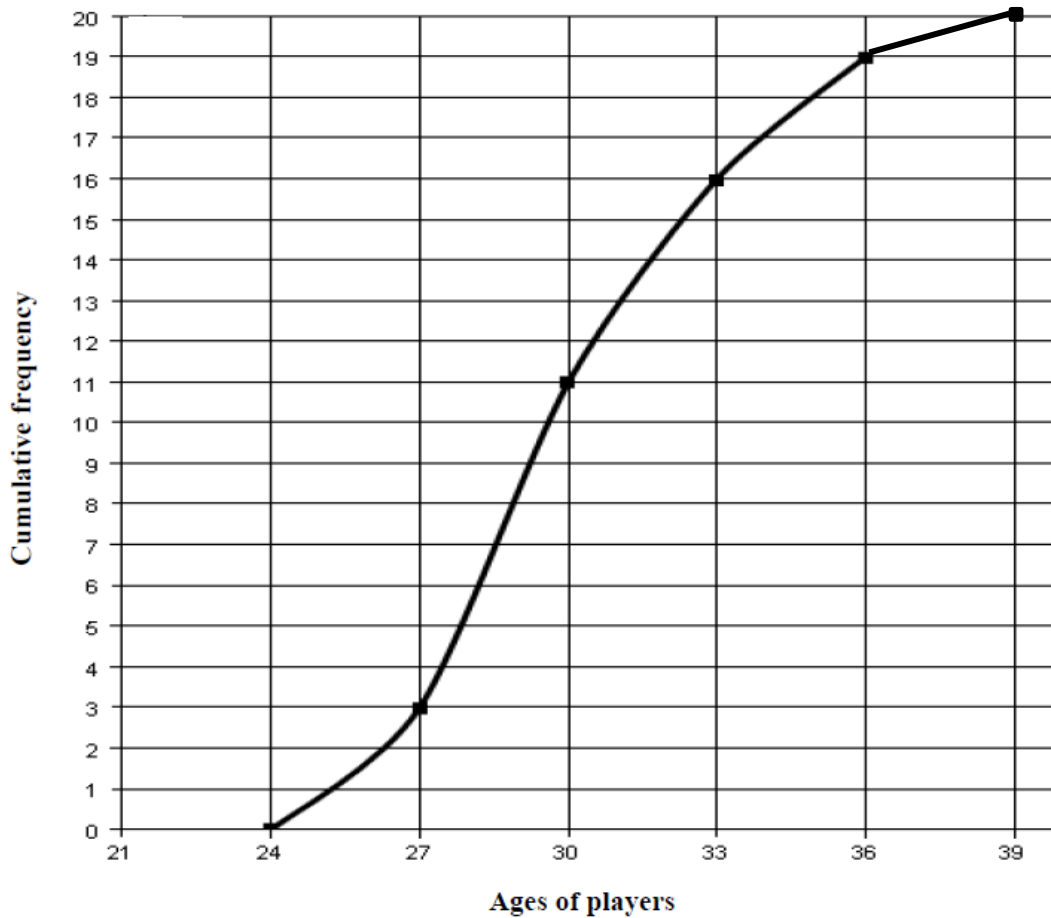
In the diagram K is the midpoint of AS and AT is perpendicular to OS.



- (a) Determine the gradient of line OK. (3)
- (b) Determine the gradient of line AT (2)
- (c) Find \widehat{O}_2 if $\widehat{O}_1 = 53,13^\circ$ (3)
- (d) Hence find \widehat{R}_1 (1)
- (e) Determine \widehat{K}_1 (2)
- (f) If P is a point on the x-axis such that $\widehat{SPO} = 108,4^\circ$, find the equation of SP (to 1 d.p.). (3)
- (g) Calculate the area of $\triangle SPO$. (3)

Question 3 [13 marks]

The ages of a group of football players are summarised in the ogive below.



- (a) How many players are older than 30? (1)
- (b) From the graph determine what percentage of players are between 30 and 36? (2)
- (c) Use the ogive to find the median and the IQR (showing your readings on the graph). (4)

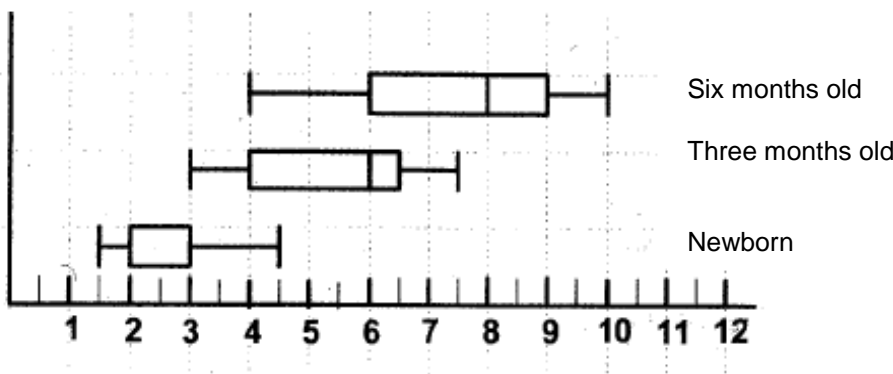
(d) Complete the table. (3)

Ages	Cumulative Frequency	Frequency
$24 \leq x < 27$	3	3
$27 \leq x < 30$		8
$30 \leq x < 33$	16	
$33 \leq x < 36$		
$36 \leq x \leq 39$	20	

(e) Use the table to find the mean and standard deviation for this data. (3)

Question 4 [5 marks]

The three box-and-whisker plots shown below represent the mass in kilograms of 64 newborn babies, 57 three month old babies and 48 six month old babies respectively. The median value for the newborn babies is the same as their upper quartile.



- (a) Approximately what percentage of newborn babies weigh less than all three month old babies? (1)
- (b) Are **most** six month old babies heavier than 9 kg? (1)
- (c) How **many** six month old babies weigh more than 6 kg? (2)
- (d) One of the groups has a mean of 5kg. Which group is this likely to be? (1)

Question 5 [10 marks]

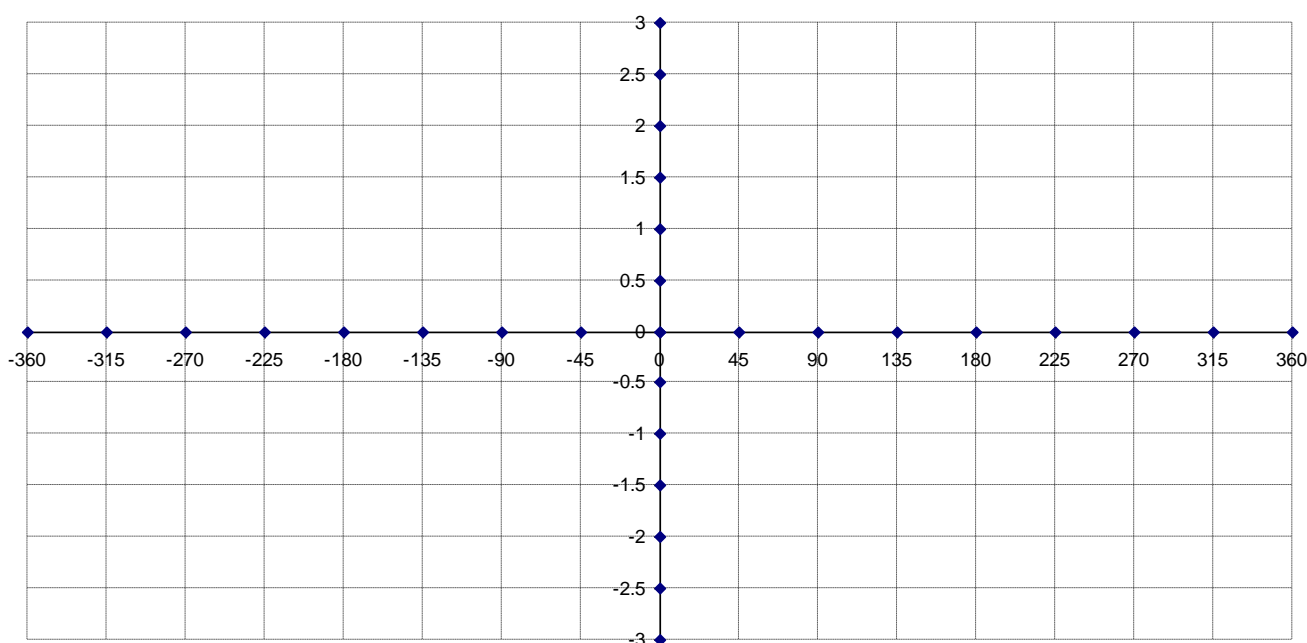
Given the functions: $f(x) = 2\sin x - 1$ and $g(x) = \cos(2x)$

(a) State the amplitude of $f(x)$ _____ (1)

(b) State the new equation of $f(x)$ if it is shifted 40° to the left and 3 units up (2)

(c) State the period of $g(x)$ _____ (1)

(d) Sketch the functions on the axes below for $x \in [-360^\circ; 360^\circ]$ (6)

**Question 6 [5 marks]**

Given $\cos 25^\circ = p$, determine the value of the following in terms of p :

(a) $\sin(115^\circ)$ (2)

(b) $\tan(385^\circ)$ (3)

Question 7 [9 marks]

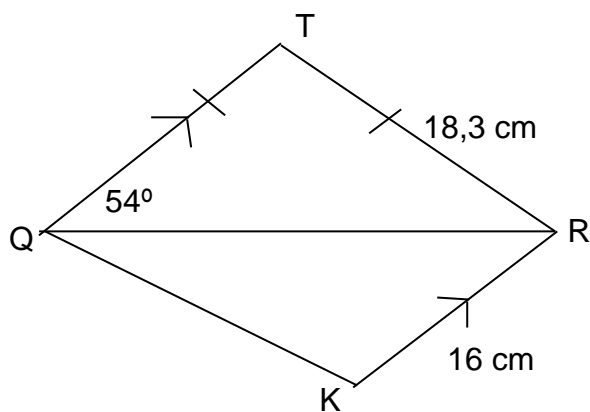
Simplify the following without the use of a calculator:

(a)
$$\frac{\tan(210^\circ) \cdot \sin(480^\circ) \cdot \sin(10^\circ)}{\cos(-80^\circ) \cdot \cos(225^\circ) \cdot \sin(315^\circ)}$$
 (5)

(b)
$$\cos(90^\circ - x) \cdot \tan(180^\circ + x) \cdot \cos(360^\circ - x) - \cos(-x) \cdot \sin(x - 90^\circ)$$
 (4)

Question 8 [6 marks]

(a) Using the diagram below, answer the following questions:



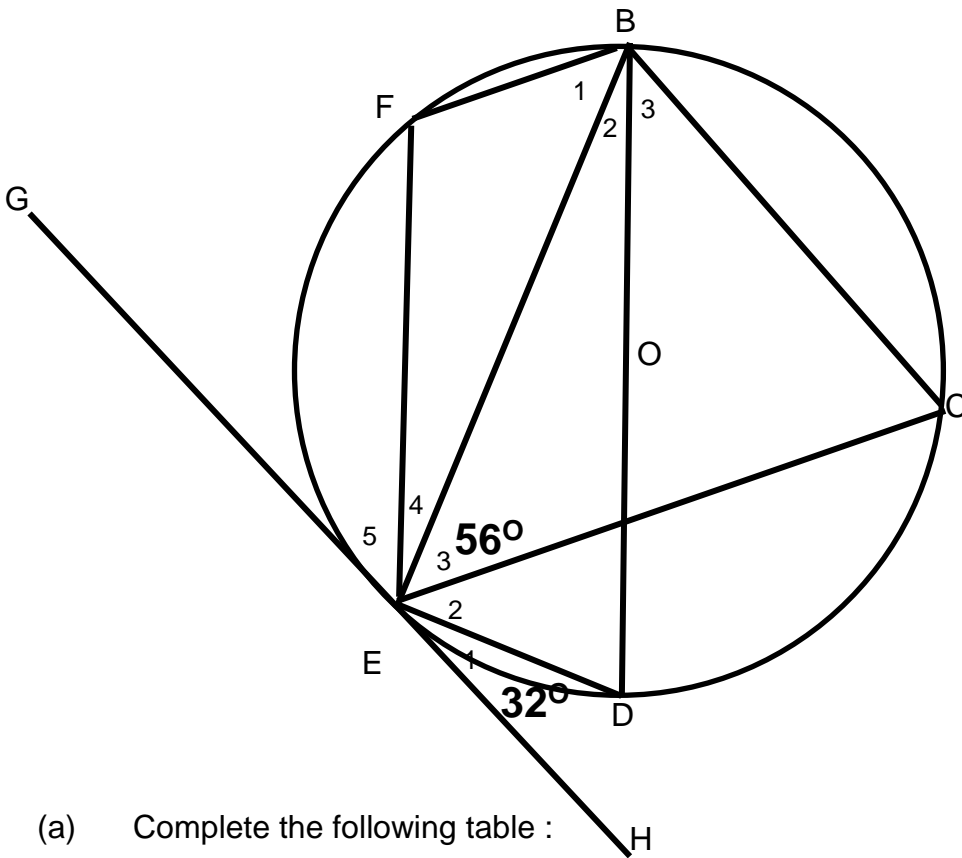
(1) Determine the length of QR (3)

(2) Determine the area of quadrilateral QTRK

(3)

Question 9 [14 marks]

GEH is a tangent to the circle at E. F and C are two points on the circle and FB, FE, BC, CE and BE are drawn. $\hat{E}_1 = 32^\circ$ and $\hat{E}_3 = 56^\circ$. BOD is the diameter of the circle.



(a) Complete the following table :

(12)

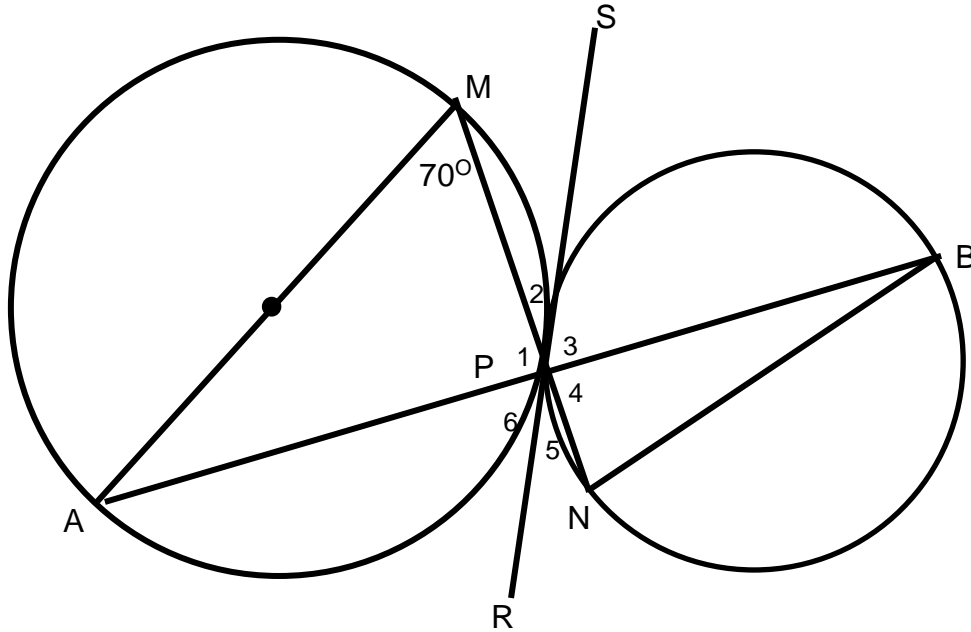
Statement	Reason
$\hat{E}_2 =$	
$\hat{B}_2 =$	
$\hat{B}_3 =$	
$\hat{F} =$	
$\hat{C} =$	
$\hat{D} =$	

(b) Is BD a tangent to circle BFE? Give a reason for your answer.

(2)

Question 10 [9 marks]

In the diagram, AM is the diameter of the bigger circle AMP. RPS is a common tangent to both the circles at P. APB and MPN are straight lines. **(Reasons must be given for all statements)**



- (a) State the size of \hat{P}_1 . (1)

- (b) Hence, show that BN is the diameter of the smaller circle. (2)

- (c) If $\hat{M} = 70^\circ$, calculate the size of each of the following angles:
 - (1) \hat{A} (1)
 - (2) \hat{P}_6 (1)
 - (3) \hat{B} (2)

- (d) Prove $AM \parallel BN$. (2)

SECTION B

Question 11 [14 marks]

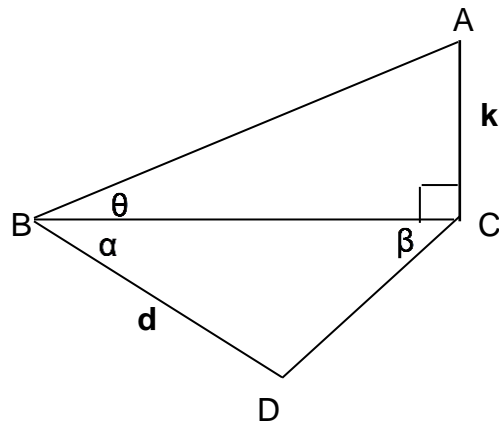
(a) Prove the following identity: $\frac{1}{\sin x + 1} - \frac{2}{\cos^2 x} = \frac{1}{\sin x - 1}$ (4)

(b) Solve for x in the following for $x \in [-90^\circ; 180^\circ]$
 $\sin(x - 15^\circ) = \cos(2x + 10^\circ)$ (5)

- (c) Determine the general solution of $4\cos^2 x - \sin^2 x - 1 = 3\cos x$ (5)

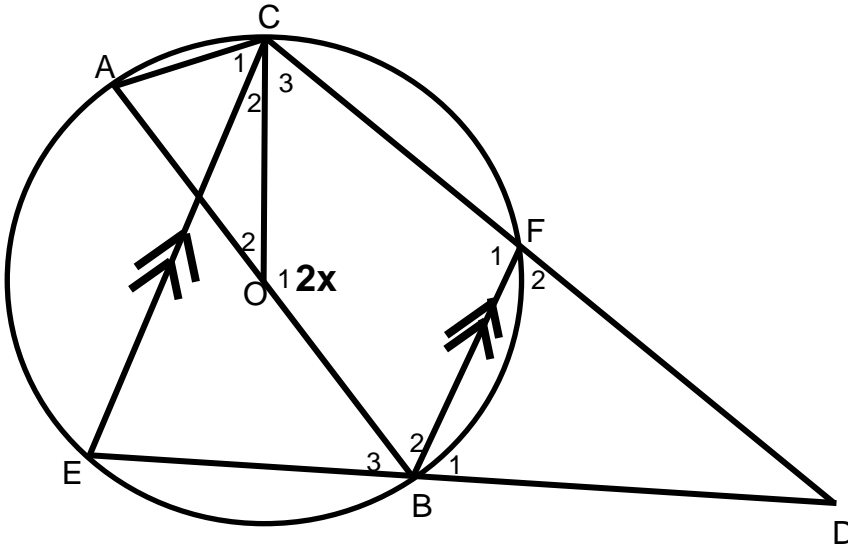
Question 12 [5 marks]

Given the following, show that $d = \frac{k \sin \beta}{\sin(\alpha + \beta) \cdot \tan \theta}$ (5)



Question 13 [17 marks]

In the diagram below, O is the centre of the circle. AOB is the diameter of the circle. Chord CF produced meets chord EB at D. Chord EC is parallel to chord BF. CO and AC are joined. Let $\hat{O}_1 = 2x$.



(Reasons must be given for all statements)

- (a) Determine, in terms of x , the size of \hat{F}_1 . (4)

- (b) Prove that $DF = DB$. (5)

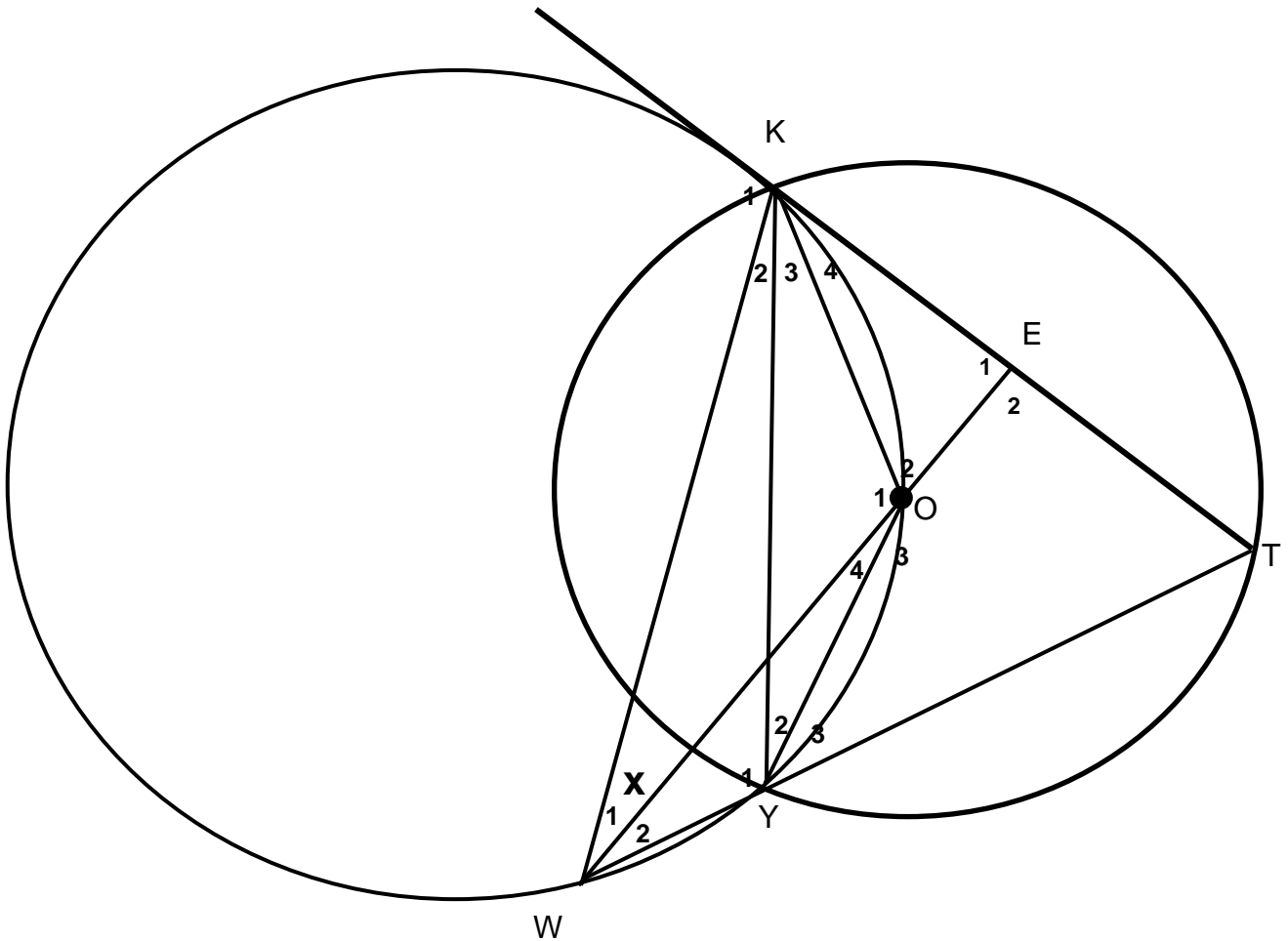
- (c) Show that $\hat{C}_1 = \hat{C}_3$. (5)

(d) Prove OCDB is a cyclic quadrilateral.

(3)

Question 14 [13 marks]

In the diagram below, two circles intersect at K and Y. The larger circle passes through O, the centre of the smaller circle. T is a point on the smaller circle such that KT is a tangent to the larger circle. TY produced meets the larger circle at W. WO produced meets KT at E. Let $\hat{W}_1 = x$



(Reasons must be given for all statements)

(a) Determine FOUR other angles, each equal to x . (8)

(b) Prove that $\hat{T} = 90^\circ - x$ (3)

(c) Hence prove that $KE = ET$. (2)