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Form 6

Core Mathematics: Paper II

September 2015

Time: 3 hours

Marks: 150

Please read the following instructions carefully:

1. This question paper consists of 19 pages and an Information sheet. Please check that your question paper is complete.
2. Write your examination number in the space provided on this question paper.
3. **Answer all the questions on the question paper and hand this in at the end of the examination.**
4. Read the questions carefully.
5. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.
6. All necessary working details must be clearly shown.
7. Round off answers to **1 decimal digit** where necessary, unless otherwise stated.
8. Ensure that your calculator is in **DEGREE** mode.
9. Diagrams are not drawn to scale.
10. It is in your own interest to present your work neatly.
11. The last page can be used for additional working, if necessary. If this space is used, make sure that you indicate clearly which question is being answered.

EXAMINATION NUMBER:

	SECTION A							SECTION B							
Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mark															
Total	8	12	11	10	12	9	6	22	9	6	11	7	10	8	9
Total								Percentage							
			150									100			

Question 1

- (a) Two points have coordinates $F(6; 2)$ and $H(16, 14)$. If G is the midpoint of FH then determine the coordinates of G .

(2)

- (b) Points $P(2; -3)$, $Q(-3; -3)$ and $R(5; y)$ are given.

1. Determine the lengths of PQ and RQ (in terms of y where necessary).

(2)

2. Calculate the value (s) of y , if the distance from R to Q is twice the distance from P to Q .

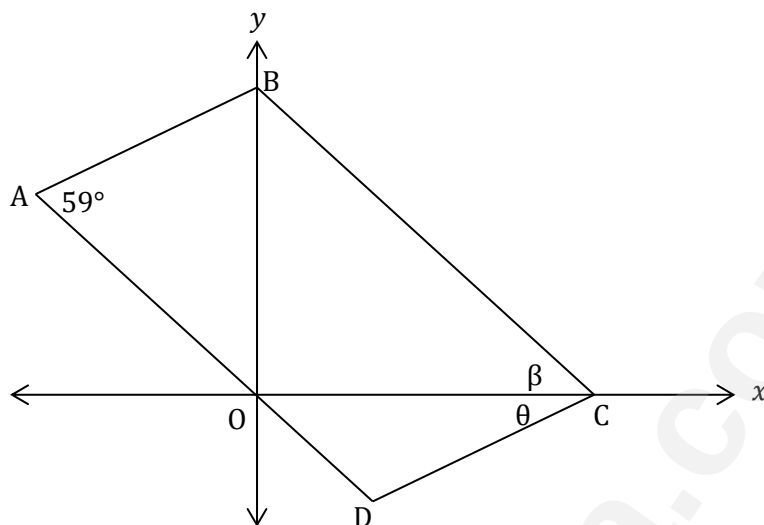
(4)

Question 2

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In the diagram below, ABCD is a parallelogram. The equation of the line passing through A and B is given by $y = \frac{1}{4}x + 6$. The line passing through A and D also passes through the origin.

$\widehat{BAD} = 59^\circ$, $\widehat{BCO} = \beta$ and $\widehat{DCO} = \theta$.



(a) Determine, correct to the nearest degree and with reasons, the size of:

1. θ

(4)

2. β

(2)

(b) Determine the equation of AD.

(2)

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(c) Determine the equation of BC.

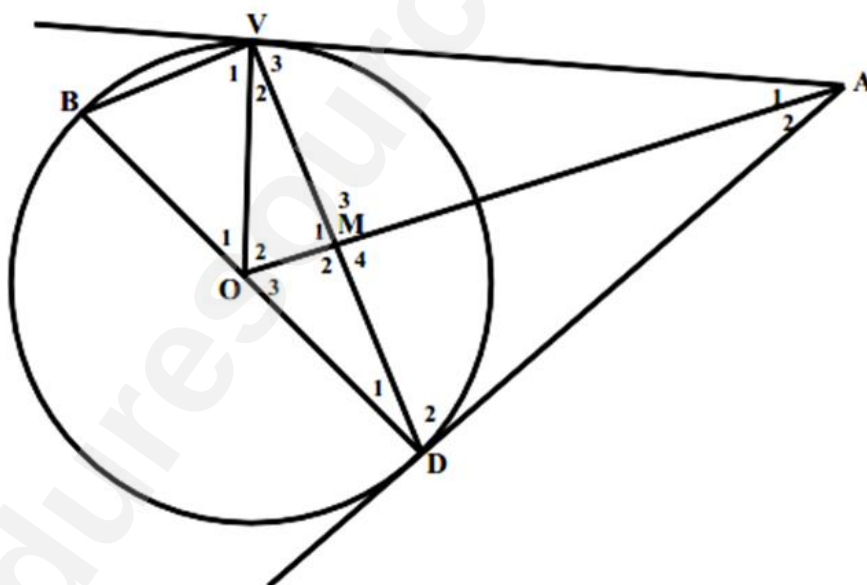
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(d) Determine the co-ordinates of C.

[12]

Question 3

From a point outside the circle, centre O, two tangents AD and AV are drawn. AO and VD meet in M. BOD is a diameter of the circle. BV and VO are drawn and $\hat{A}_1 + \hat{A}_2 = 40^\circ$.



(a) Complete the following table by filling in the reasons:

	Statement	Reason
1.	$\hat{A}DO = 90^\circ$	
2.	$\hat{B}VD = 90^\circ$	

(2)

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(4)

(2)

[illegible]

(3)

[11]

Question 4

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Consider the survey of cell phone calls received by subscribers during one week:

41 ; 5 ; 12 ; 46 ; 39 ; 52 ; 37 ; 38 ; 32 ; 43 ; 18 ; 30 ; 42 ; 41 ; 34 ; 41 ; 43 ; 35

(a) Determine the mean, median and mode of the data.

(4)

(b) Write down the five-number summary for the data.

(2)

(c) Draw a box-and-whisker diagram for the data.

(2)

(d) Describe the skewness of the data. Show your working.

(2)

[10]

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Question 5

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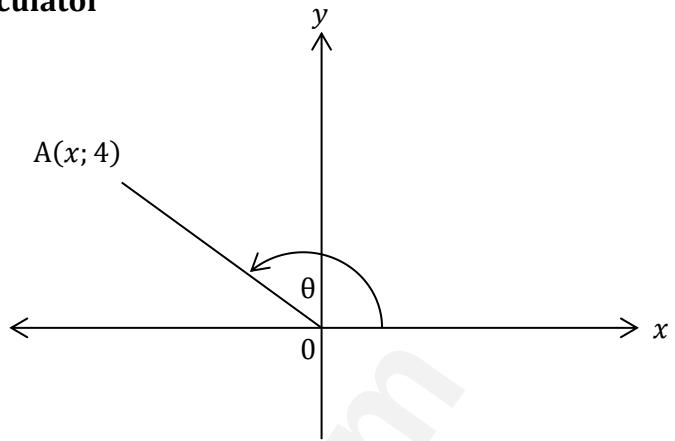
Answer the following without the use of a calculator

(a) Consider the figure alongside.

$A(x; 4)$ is a point on the Cartesian plane.

$\angle XOA = \theta$

$OA = 5$



Determine the value of:

1. x

(2)

2. $\sin(180^\circ + 2\theta)$

(3)

(b) If $\sin 28^\circ = m$, then determine each of the following in terms of m :

1. $\sin 152^\circ$

(2)

2. $\cos 28^\circ$

(2)

3. $\cos 56^\circ$

(3)

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Question 6

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(a) A circle is defined by the equation $x^2 + 6x + y^2 - 4y = 4$

1. Write the above equation in the form $(x - a)^2 + (y - b)^2 = r^2$ and hence write down the coordinates of P, the centre of the circle.

(4)

2. Determine the equation of the tangent to the circle at the point Q(−4; −2).

(5)

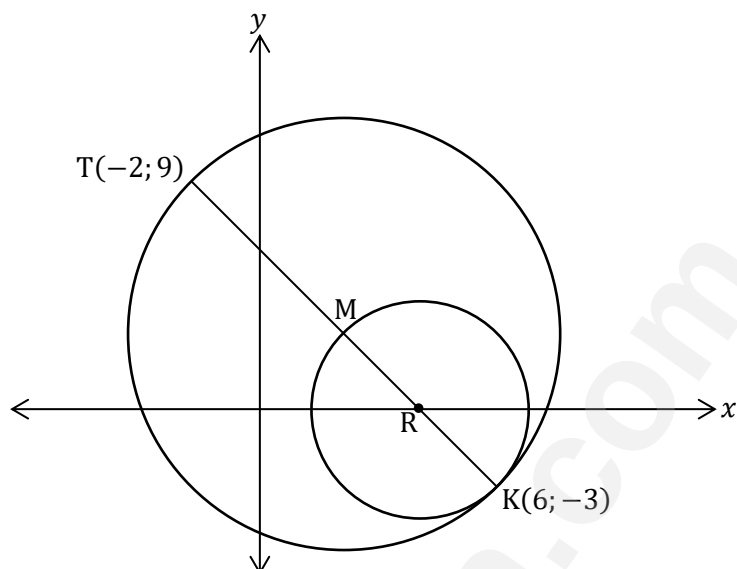
[9]

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Question 7

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In the diagram below, two circles touch each other internally at $K(6; -3)$. The smaller circle has its centre at R . M is the centre of the larger circle. $T(-2; 9)$ and $K(6; -3)$ are the end points of a diameter of the larger circle.



- (a) Determine the coordinates of R .

(3)

- (b) Determine the equation of circle centre R .

(3)

[6]

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Question 8

Answer the following without the use of a calculator

- (a) Simplify, showing all working:

(4)

- (b) Consider the following statement: $\frac{\sin 2x}{1+\cos 2x} = \tan x$

1. Is the statement true for $x = 60^\circ$? Show all working to justify your answer.

(4)

2. Prove the statement holds true for all values of x .

(5)

3. Hence or otherwise, determine the general solution to the equation $\frac{\sin 2x}{1+\cos 2x} = -1$

(3)

- (c) Determine the general solution of: $\sin^2 x + \cos 2x - \cos x = 0$

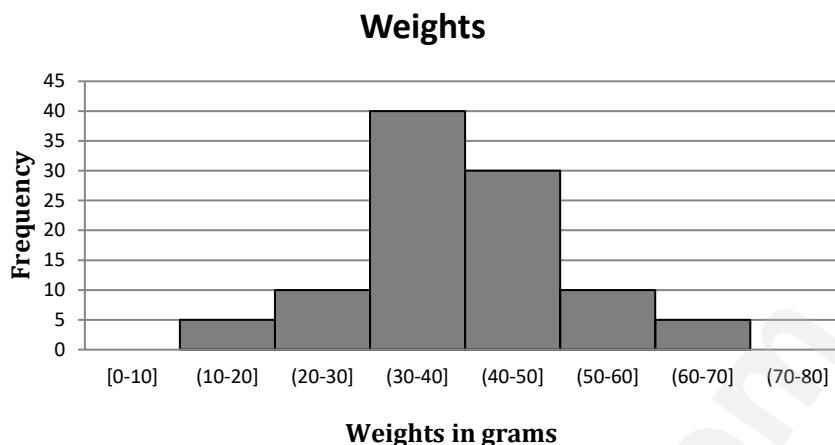
(6)

[22]

Question 9

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The following histogram is of 100 weights in grams



(a) Determine the:

1. estimated mean

_____ (3)

2. If the estimated standard deviation is 11,17, determine the estimated variance

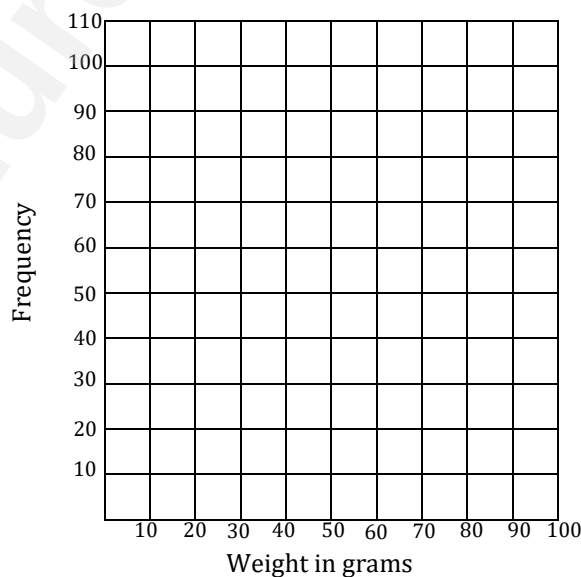
_____ (1)

3. If 5 weights in the fifties were raised by 10, how would this affect the:

Standard deviation? _____ (1)

Median? _____ (1)

(b) Draw an ogive (cumulative frequency diagram) and then estimate the median.



(2)

Estimated median: _____ (1)

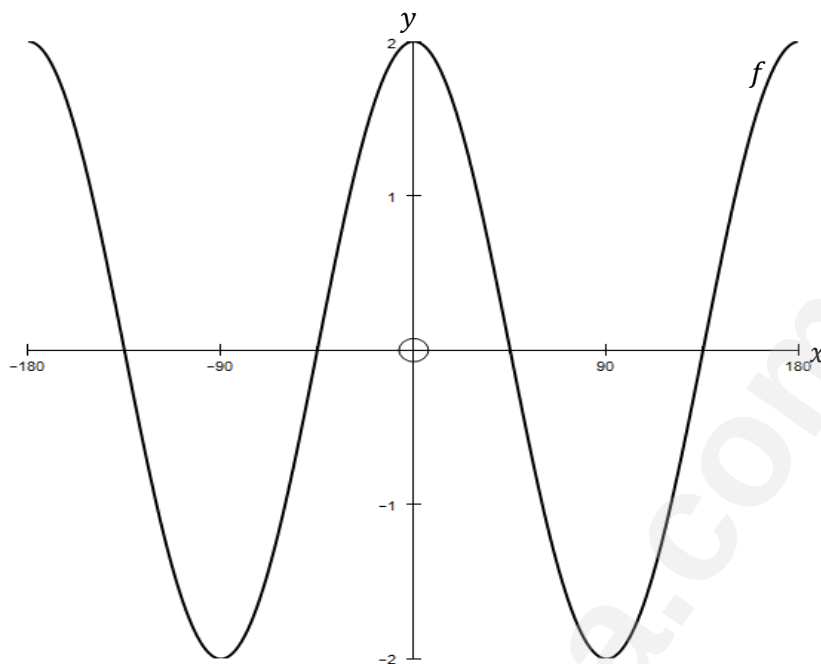
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[9]

Question 10

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The graph $f(x) = 2 \cos 2x$ is drawn below where $x \in [-180^\circ; 180^\circ]$.



- (a) On the **same set of axes**, sketch the graph $g(x) = 1 - \cos x$. Show clearly all the significant points.

(2)

- (b) Determine the value of $f(0) - g(0)$

(1)

- (c) Using your graphs, give the value(s) of x for which $f(x) \cdot g(x) \leq 0$

(3)

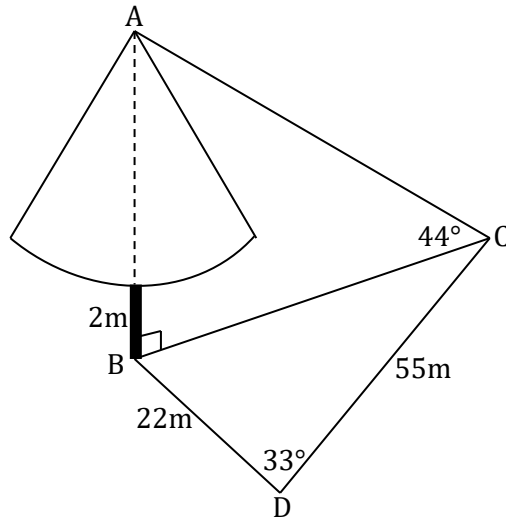
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Question 11

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- (a) The given diagram roughly illustrates a tall tree by using a right cone. The centre of the circular base of the cone is 2 metres above the point B, on the ground.



D and C are points on the ground so that $BD = 22\text{m}$, $DC = 55\text{m}$ and $\widehat{BDC} = 33^\circ$. The angle of elevation of the top of the tree, A, from C is 44° .

1. Determine the height AB of the tree, correct to 2 decimal places.

(5)

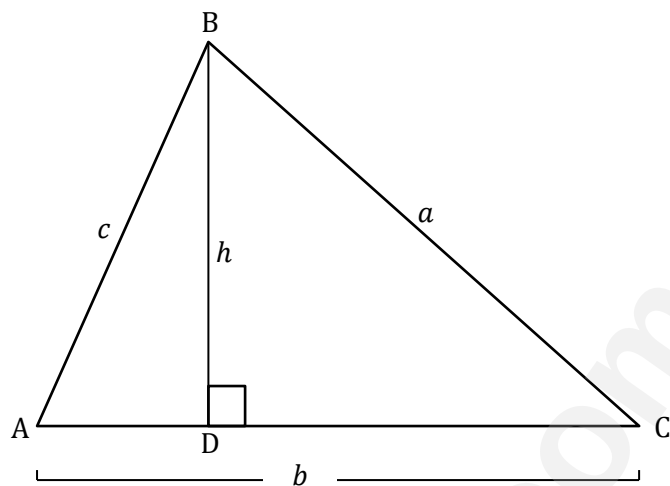
2. If the diameter of the base of the cone is 6m, calculate the volume of the cone depicting the foliage of the tree in the diagram above, correct to 1 decimal place.

Note: Volume of a cone = $\frac{1}{3} \times \text{Area of base} \times \text{height}$.

(2)

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BD ⊥ AC in ΔABC



Proof:

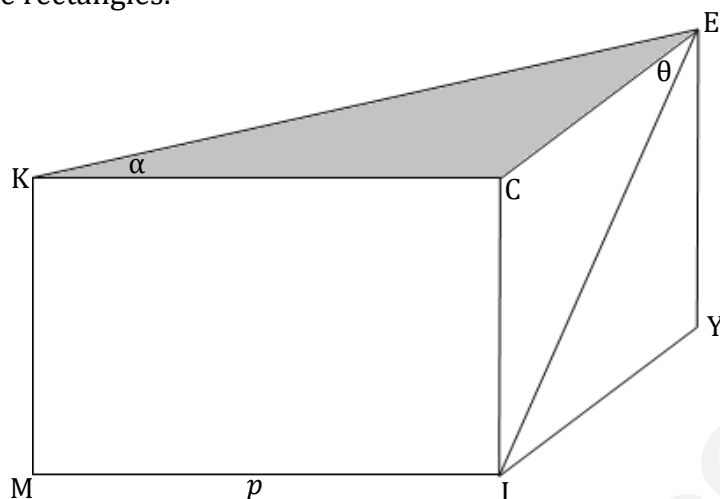
(4)

[11]

Question 12

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Shown alongside is a triangular prism. $\widehat{ECK} = 60^\circ$, $\widehat{EKC} = \alpha$, $\widehat{CEI} = \theta$, $MI = p$ units. MICK and CEYI are rectangles.



Show that the height of the prism CI , is $CI = \frac{2p \sin \alpha \tan \theta}{\sqrt{3} \cos \alpha + \sin \alpha}$

Question 13

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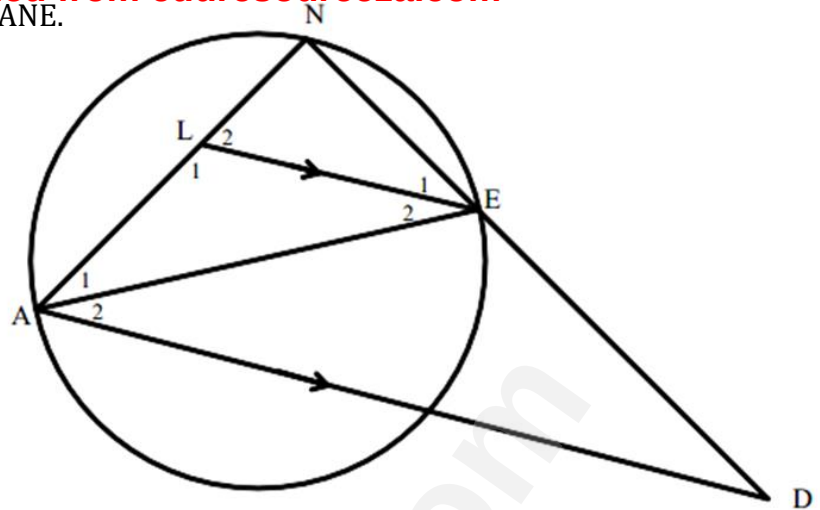
In the figure, AE is a diameter of circle ANE.

L is a point on AN and LE bisects $\widehat{AEN}$.

NE produced meets a line from A at D

so that $LE \parallel AD$.

Let $\widehat{E}_1 = \widehat{E}_2 = x$



(a) Complete the following table by filling in the reasons:

	Statement	Reason
1.	$\widehat{E}_1 = \widehat{D}$	
2.	$\widehat{E}_2 = \widehat{A}_2$	
3.	$AE = ED$	

(3)

(b) If $NE = 12$ units and the diameter of the circle is 20 units, calculate giving reasons:

(a) AN

(3)

(b) AL

(4)

[10]

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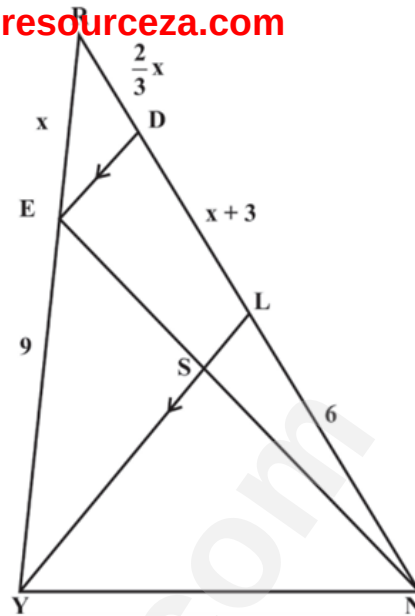
Question 14

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NL = 6units ; RE = x units ; RD = $\frac{2}{3}x$ units ;

EY = 9units and DL = x + 3units.

S is a point on YL and ED || YL.



- (a) Show that L is the midpoint of DN by first solving for x. Give reasons.

(4)

- (b) If SL = 1,4 units, write down the length of DE.

(1)

- (c) If the area of $\triangle RED = 2,7\text{units}^2$, determine the area of $\triangle REN$.

(3)

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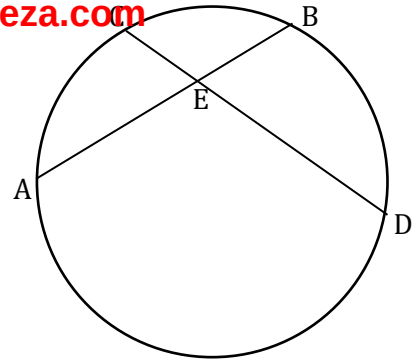
[8]

Question 15

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A theorem you may never have seen before states:

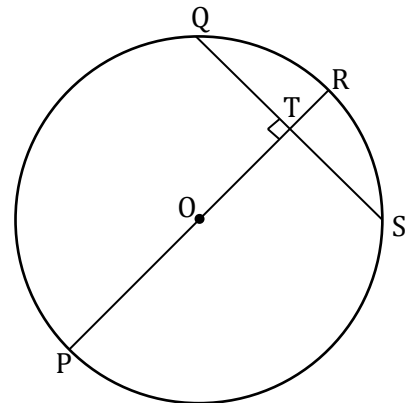
If two chords intersect in the interior of a circle, then the product of the lengths of the segments of one chord is equal to the product of the lengths of the segments of the other chord.



- (a) Given: Chords AB and CD intersect at point E.
By constructing AC and BD, prove $CE \cdot ED = BE \cdot EA$

(4)

- (b) Hence, if $QS = 6$ units, and $PT:TR = 4:1$, determine the length of the diameter of the circle.
P, Q, R and S are points on a circle, centre O, such that PR is perpendicular to QS.



(5)

[9]

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