CLUSTER PAPER 2016

MATHEMATICS: PAPER II

Time: 3 hours 150 marks

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This question paper consists of 28 pages and an Information Sheet of 2 pages(i-ii). Please check that your question paper is complete.

2. Read the questions carefully.

3. **Answer ALL the questions on the question paper and hand this in at the end of the examination.**

4. You may use an approved non-programmable and non-graphical calculator, unless otherwise stated.

5. All necessary working details must be clearly shown.

6. Round off your answers to one decimal digit where necessary, unless otherwise stated.

7. Ensure that your calculator is in **DEGREE** mode.

8. It is in your own interest to write legibly and to present your work neatly.

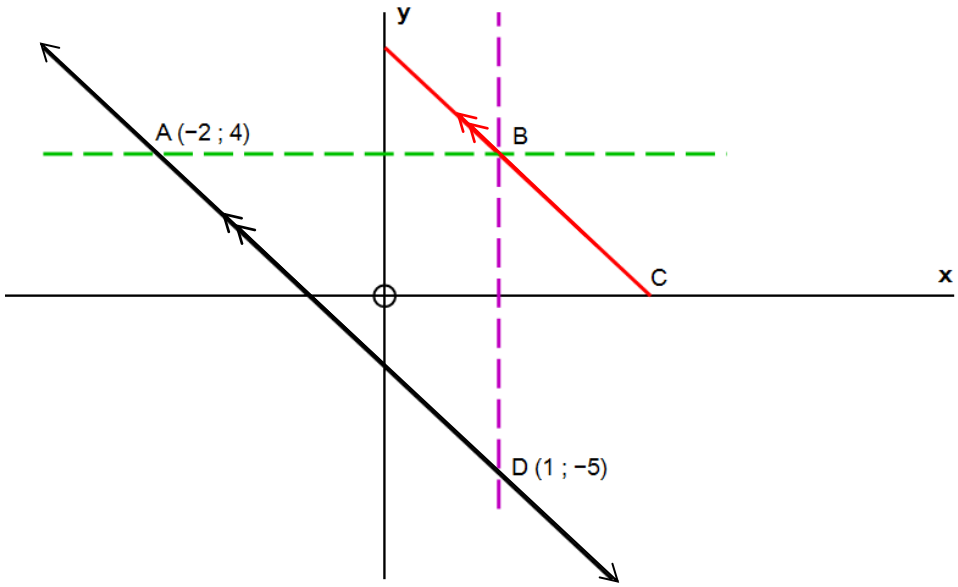
9. The last pages can be used for additional working, if necessary. If this space is used, make sure that you indicate clearly which question is being answered.

SECTION A

QUESTION 1

Refer to the sketch below:

AD//BC. A is the point (–2; 4) and D is the point (1; -5).



Determine:

1.1 the coordinates of B. (2)

1.2 the equation of BC in the form $ax + by + c = 0$. (4)

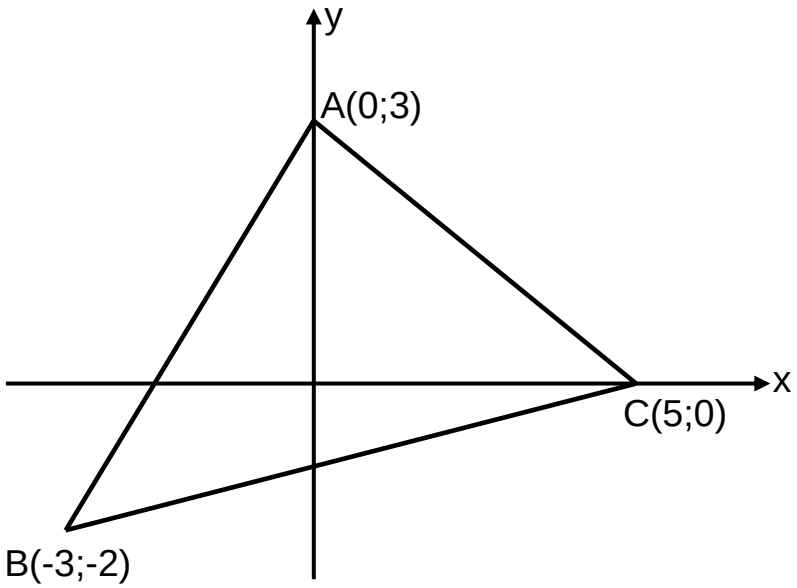
1.3 the coordinates of C. (2)

[8]

QUESTION 2

Refer to the sketch below:

ΔABC has vertices of A(0; 3), B(-3;-2) and C(5; 0).



2.1 Calculate the length of: (4)

2.1.1 AB

2.1.2 BC

2.1.3 AC

2.2 Hence, show that ΔABC is a right angled isosceles triangle. (4)

2.3 Determine the area of ΔABC. (2)

2.4 Given that BC is a diameter of the circumscribed circle of ΔABC, show that the centre of this circle is M, the point $(1;-1)$. (2)

[12]

QUESTION 3

Find the equation of the line that is a tangent to the circle

$(x+1)^2+(y+2)^2=20$ at $(3;-4)$. (6)

[6]

QUESTION 4

If $37cos\vartheta + 10 = -2$ and $\vartheta \in [180°; 360°]$, determine, with the use of a diagram, the value of

$$\frac{\frac{1}{4}sin\ 2\vartheta}{cos\ \vartheta}.$$ (4)

[4]

QUESTION 5

5.1 Prove: $1 - \cos(90° - 2\vartheta)\tan(180° + \vartheta) = cos\ 2\vartheta$ (5)

5.2 For which values of ϑ is this identity in 5.1 undefined? (2)

[7]

QUESTION 6

Evaluate without using a calculator:

6.1 $cos\ 3°.cos\ 318° + cos\ 267°.sin\ 42°$ (5)

6.2 $tan^2 210° - (1 + cos\ 120°).sin^2 225°$ (5)

[10]

QUESTION 7

The table gives the Olympic pole vault records for the past 12 games Olympic games.

Year	Height in metres
1968	5,40
1972	5,50
1976	5,50
1980	5,78
1984	5,75
1988	5,90
1992	5,80
1996	5,92
2000	5,90
2004	5,95
2008	5,96
2012	5,97

7.1 Find the equation of the line of best fit for the height (y) against the *year* (x) in the form $y = a + bx$.

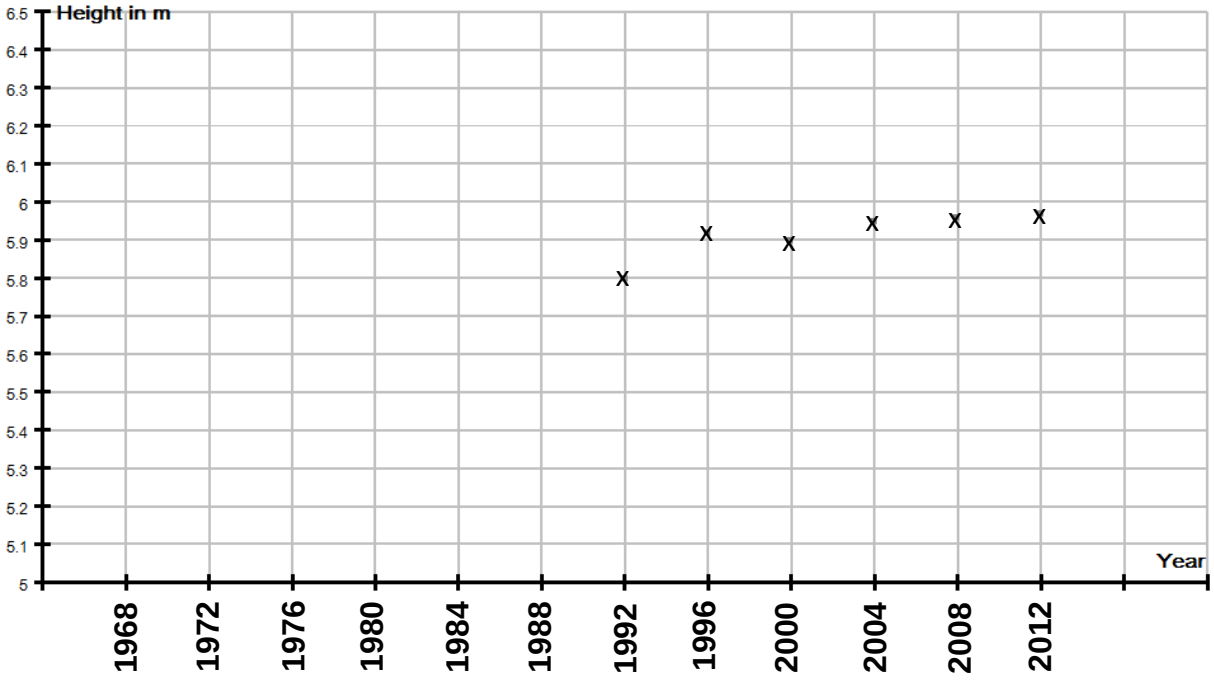
Determine your values for a and b rounded to 2 decimal digits. (2)

_____

_____

_____

7.2 Complete the scatter plot and draw the line of best fit on the scatter plot. (3)



7.3 Determine the value of the correlation coefficient rounded to 2 decimal digits and explain clearly what can be deduced from this result. (3)

7.4 Use the model to predict the record pole vault height for the 2016 Olympic Games. (1)

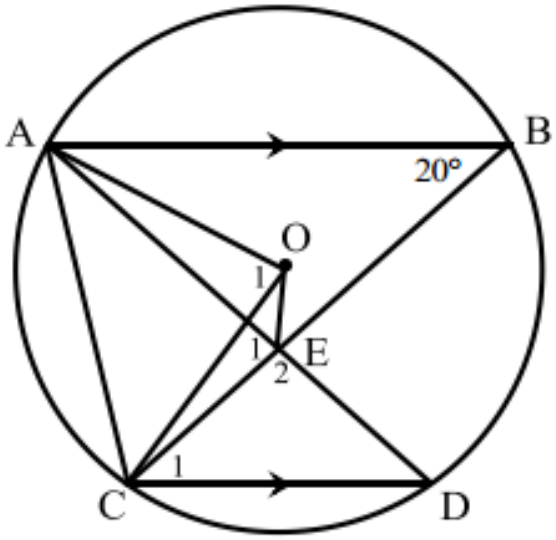
7.5.1 Use the model to predict the record pole vault height for the 2028 Olympic Games. (1)

7.5.2 Do you think the actual record in 2028 will be higher or lower than this prediction? Give a reason for your answer. (2)

[12]

QUESTION 8

In the diagram, O is the centre of the circle passing through A, B, C and D. AB//CD and $\hat{B} = 20°$.



Complete the following statements and reasons to prove that AOEC is a cyclic quadrilateral. No extra steps/calculations are allowed. (5)

STATEMENTS	**REASONS**
$\hat{C}_1 =$	alt. angles ; AB//CD
$\hat{O}_1 = 40°$	……..
$\hat{D} = 20°$	……...
$\hat{E}_1 =$	ext. angle of Δ
$AOEC\ is\ a\ cyclic\ quad$	……...

[5]

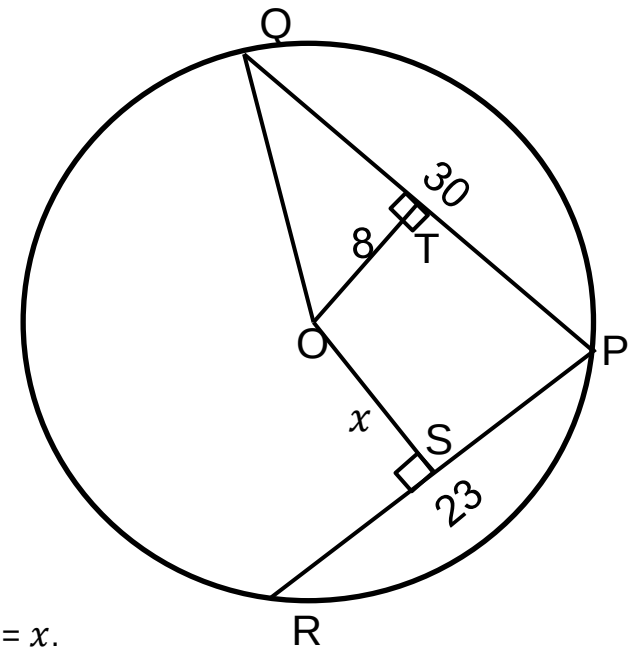
QUESTION 9

9.1 Complete the following statement:

The line from the centre of the circle perpendicular to the chord _____ _____ . (1)

9.2 Refer to the figure below:

In the circle with centre O. OT⊥QP, OS⊥PR, OT = 8 units, PQ = 30 units and PR = 23 units.



Determine OS = x. (5)

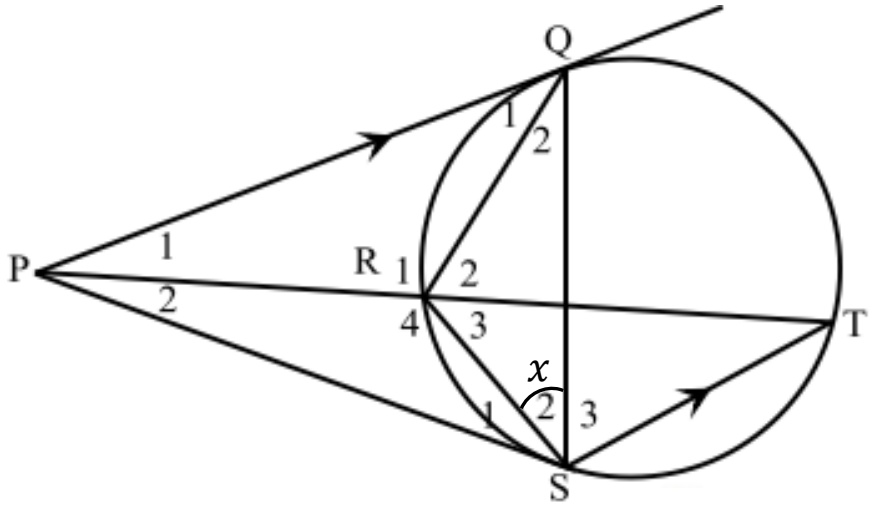
[6]

QUESTION 10

Refer to the figure below:

PQ and PS are tangents to circle QRST. ST, RS and RQ are chords and QS is joined.

PQ//ST. Let $\hat{S}_2 = x$.



10.1 Calculate $\hat{Q}_1$ in terms of x. (1)

10.2 Prove: $\Delta RSQ /// \Delta RQP$ (4)

10.3 Prove: $QR^2 = RS.RP$ (2)

[7]

TOTAL FOR SECTION A = 77 MARKS

SECTION B

QUESTION 11

The circle, with equation $x^2 - 10x + y^2 + 8y - 40 = 0$, is given. A point $P(x; y)$ on the circumference of a NEW circle, is such that it is always 3 units from the circumference of the original circle, and outside the original circle.

Determine the equation of this new circle. (6)

[6]

QUESTION 12

Solve for x correct to one decimal digit if $\vartheta \in [-180°; 180°]$

$$sin(2\vartheta - 10°) = -cos\,(\vartheta + 50°).$$ (8)

[8]

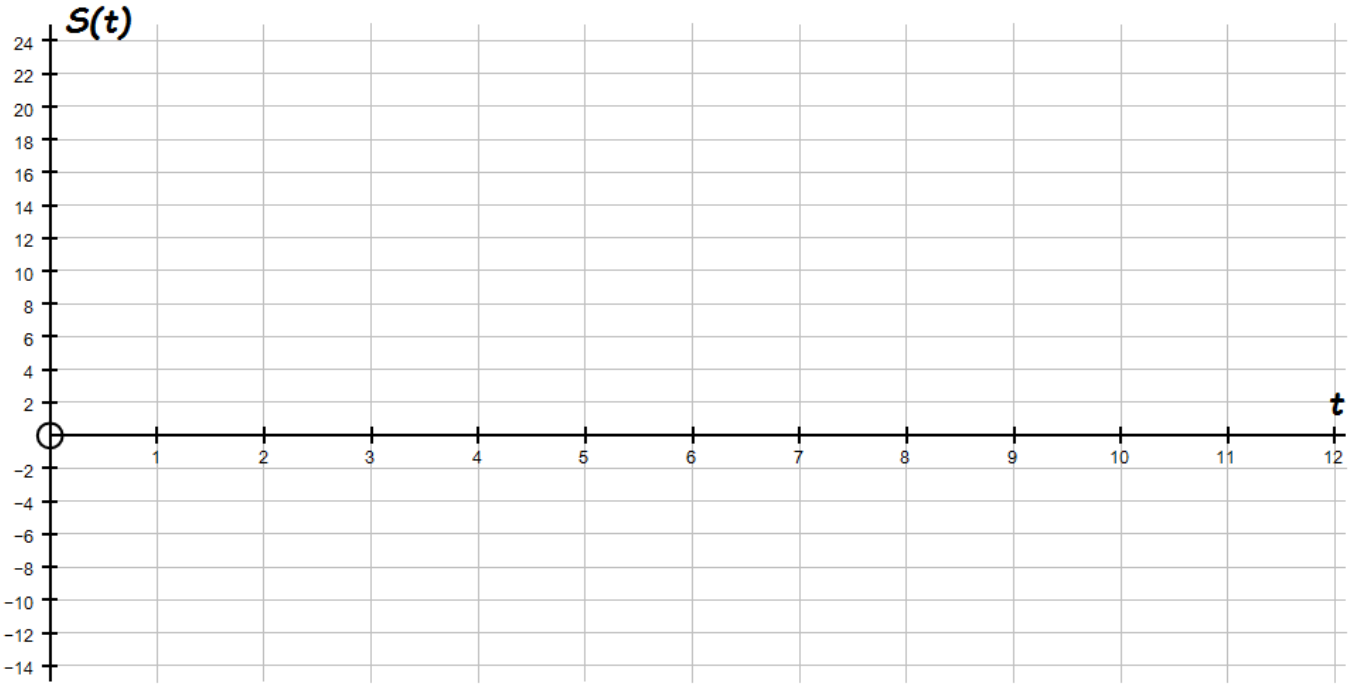
QUESTION 13

The company, Mega Ski, has sales of ski equipment as given by

$$S(t) = 10[1 - cos\ (30°.t)]$$

where t is the time, in months ($t = 0$ corresponds to 1 August 2015), and $S(t)$ is in thousands of Rands.

13.1 Use the given graph paper below to sketch the function of the sales on a 12-month interval $[0; 12]$. (4)



13.2 What is the period of the function? (2)

_____

_____

13.3 What is the minimum amount of sales? (1)

_____

_____

13.4 What is the maximum and when does the maximum amount of sales occur? (3)

_____

_____

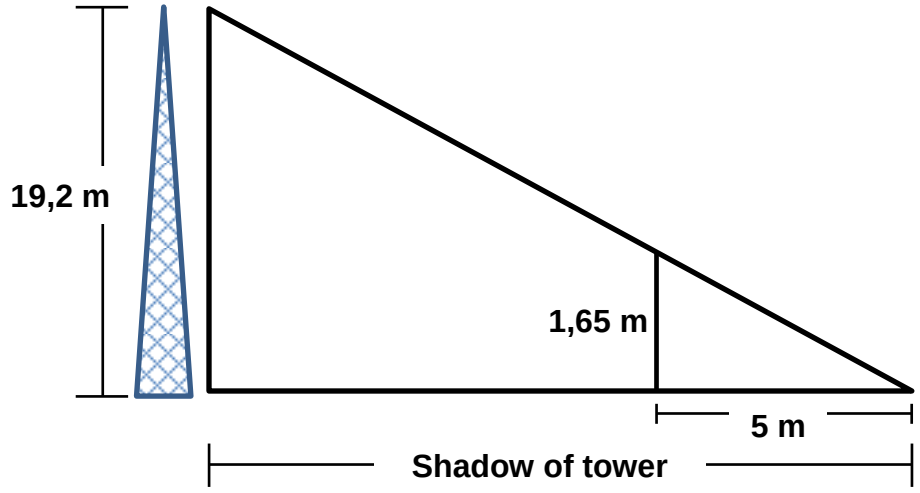
_____

_____

[10]

QUESTION 14

At a particular time during the day, a tower of height 19,2 metres casts a shadow. At the same time, a person who is 1,65 metres tall casts a shadow 5 metres long.

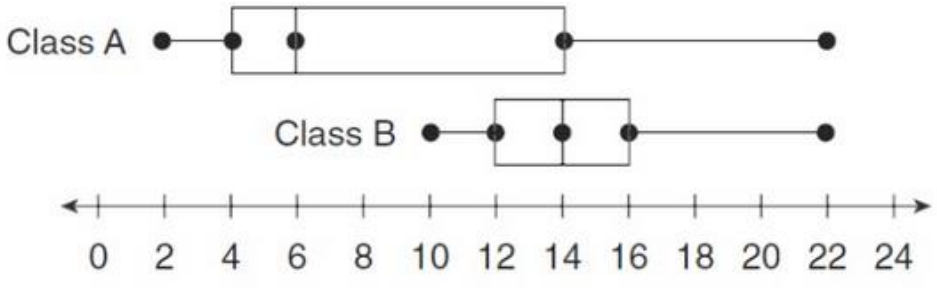


What is the length of the shadow cast by the tower at that time? (6)

[6]

QUESTION 15

A new fitness centre offers two different fitness classes. The attendance for each class for 12 sessions is represented in the box-and-whisker plot.



15.1 Determine the interquartile range of Class A. (1)

_____

_____

15.2 Compare the data from Class A and Class B. How are they alike? (1)

_____

_____

15.3 Compare the data from Class A and Class B. How are they different? (1)

_____

_____

15.4 Which class has more variability? Show calculations to support your answer. (3)

_____

_____

_____

_____

15.5 Which class has a higher mean deviation? Explain your answer. (2)

_____

_____

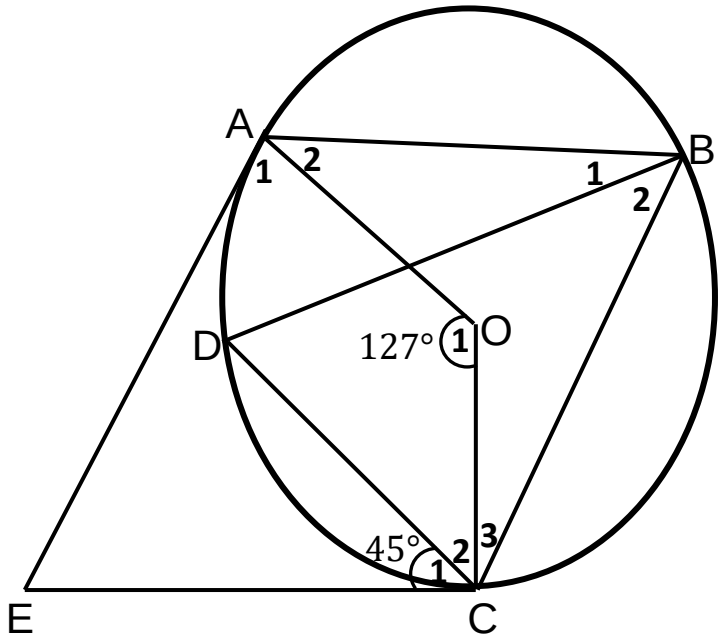
_____

[8]

QUESTION 16

Refer to the sketch below:

In the diagram O is the centre of the circle with AE and CE tangents to the circle.
$\hat{C}_1 = 45°$ and $\hat{O}_1 = 127°$



Calculate the size of $\hat{E}$. (5)

_____

_____

_____

_____

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_____

_____

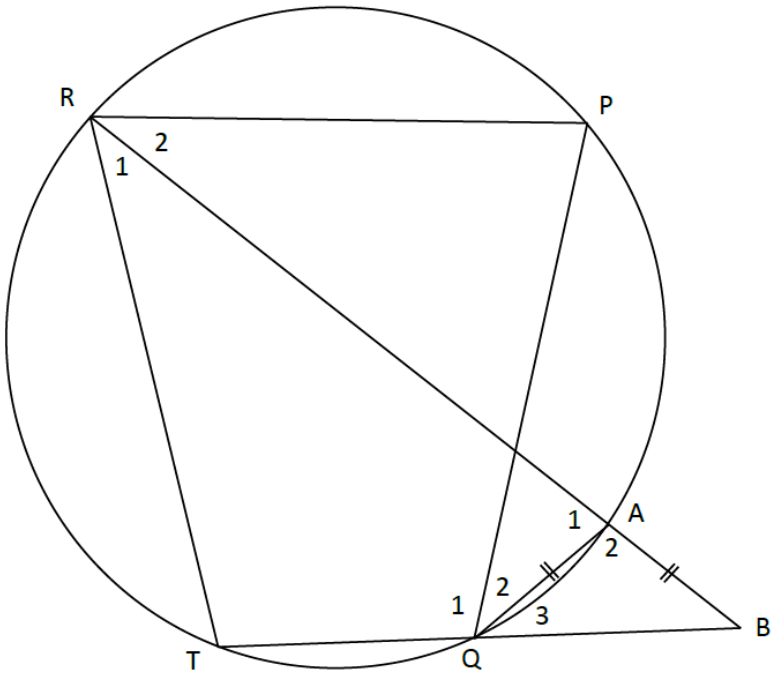
_____

[5]

QUESTION 17

In the diagram below, points R, P, A, Q and T lie on a circle. RA bisects $\hat{R}$ and $AB = AQ$.

RA and TQ produced meet at B.



Prove that:

17.1 AQ bisects $P\hat{Q}B$. (3)

17.2 TR = TB. (2)

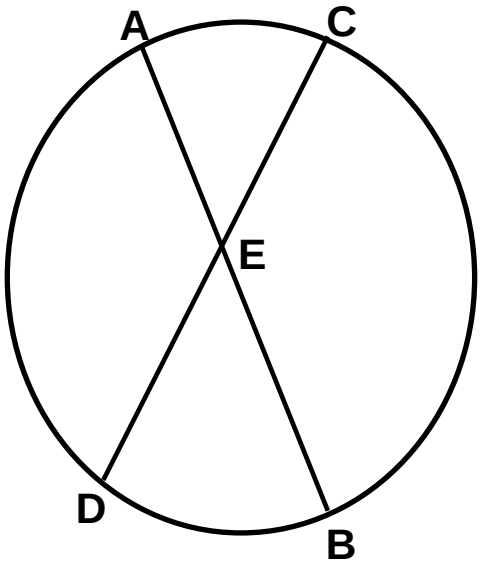
17.3 $\hat{P} = T\hat{R}P$ (3)

[8]

QUESTION 18

Refer to the sketch:

In the circle below, AB and CD are chords intersecting at E.

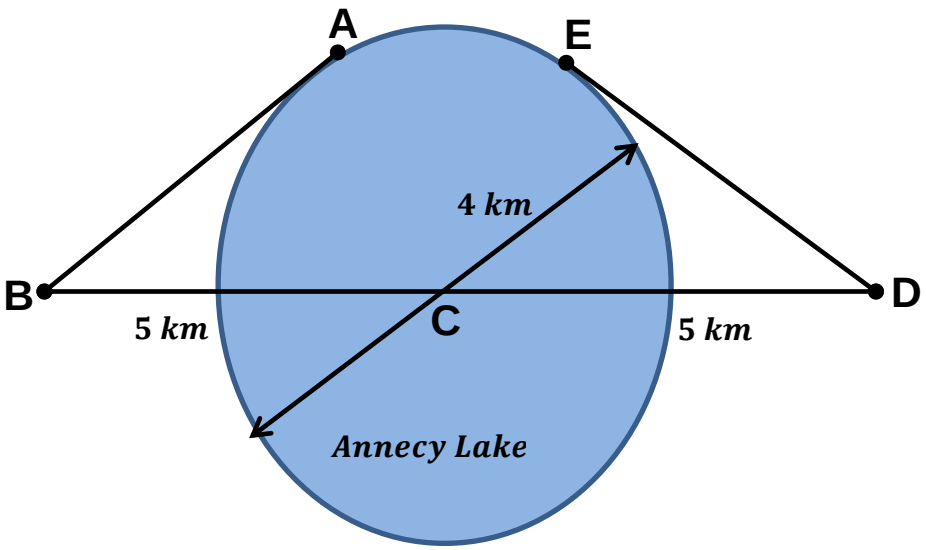


If AE = 5, BE = 12 and CE = 6, what is the length of DE? (6)

[6]

QUESTION 19

Daniel decided to participate in this year's Tour de France bicycle race. One of the routes are around the Annecy Lake which is a circular lake that has a diameter of 4 km, as shown in the diagram below. Points B and D are the opposite sides of Annecy Lake and lie on a straight line through the centre of the lake, with each point 5 km from the centre. The course of the race is ABCDE, where AB and DE are tangents to the lake.

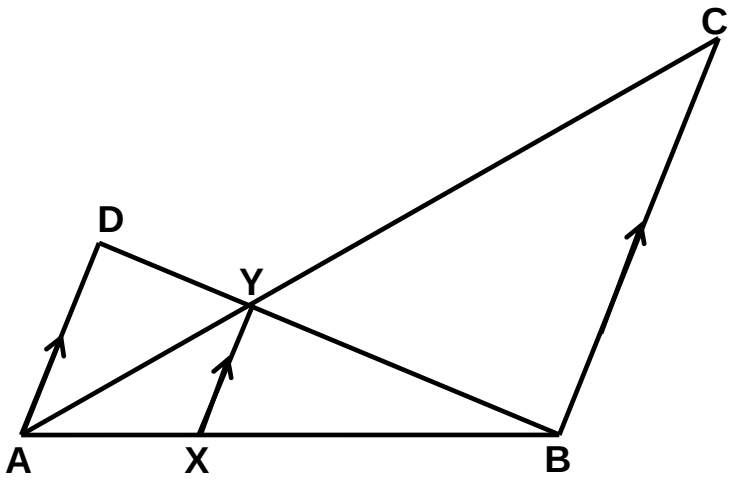


Determine the length of the route. (6)

[6]

QUESTION 20

The diagram shows triangles ABC and ABD with AD parallel to BC. The sides AC and BD intersect at Y. The point X lies on AB such that XY is parallel to AD and BC.



20.1 Prove $\Delta ABC \text{ /// } \Delta AXY$. (4)

20.2 Hence, or otherwise, prove that $\frac{1}{XY} = \frac{1}{AD} + \frac{1}{BD}$ (6)

[10]

TOTAL FOR SECTION B = 73 MARKS

TOTAL: 150 marks